
THESIS DOCUMENT

“GOING OVER THE PARAPET”: THE DEVELOPMENT OF A FRAMEWORK FOR UNDERSTANDING THE TRANSLATION OF EVIDENCE FROM ECONOMIC EVALUATIONS

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ABSTRACT

Objectives

The failure of evidence to translate into policy and practice is one of the most common and disconcerting findings in health services research. Whilst many strategies have been suggested to facilitate translation of evidence-based research, little is known about how these strategies should be adapted for different types of evidence. The principal aim of the thesis is to better understand the factors that determine the translation of evidence from economic evaluation into healthcare policy and practice.

Methods

A literature review of the barriers and facilitators to using evidence from economic evaluations was conducted and mapped to the Consolidated Framework for Implementation Research (CFIR) to develop a framework specific for economic evaluation (CFIR-EE). Decision-makers, including health professionals, healthcare administrators or managers, and health researchers, were surveyed about the factors that determine whether and how they use evidence from economic evaluations. The relative importance of these factors was measured using a discrete choice experiment. Semi-structured interviews were conducted with health economists to explore their experiences translating evidence from economic evaluation into healthcare policy and practice.

Results

The CFIR-EE highlights the multilayered interactions between the economic evaluation, individual decision-makers and the context in which the decision-makers work. The CFIR-EE characterises economic evaluations in terms of accessibility, relevance, and credibility. The discrete choice experiment (N=81) showed that healthcare decision-makers were willing to make trade-offs between these characteristics. Specifically, there were preferences amongst decision-makers for an economic evaluation that is good quality, specifically applicable to the healthcare context and communicated well by an independent researcher. High methodological rigour was valued but did not dominate. The views from the health economists interviewed (N=9) were consistent with the CFIR-EE, but also identified determinants of translation that had not previously been identified. Novel determinants found through the process included the importance of professionalism, the inconvenience of certain methods of presenting evidence in large documents, and the use of inappropriate or ill-defined cost-effectiveness thresholds. The importance of communication and engaging with stakeholders and clinical experts was a common theme for all of the health economists interviewed.

Conclusions

To translate evidence from economic evaluation into healthcare process it is necessary at each stage of the process to find the correct balance between credibility, accessibility, and relevance taking into account the inner and outer setting and knowledge and attitudes of the decision-makers. To increase the impact of economic evaluation on policy, health economists need to actively engage with policymakers, healthcare professionals, and the community.

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ABBREVIATIONS AND TERMS

AusHSI	Australian Centre of Health Services Innovation
CI	Confidence interval
CFIR	Consolidated Framework for Implementation Research
CFIR-EE	Consolidated Framework for Implementation Research adapted for Economic Evidence
CRD	Centre for Reviews and Dissemination
CRE-RHAI	Centre for Research Excellence in Reducing Healthcare Associated Infections
EED	Economic Evaluation Database
HSRAANZ	Health Services Research Association of Australia and New Zealand
HTA	Health technology assessment
ICER	Incremental cost-effectiveness ratio
ISPOR	International Society for Pharmacoeconomics and Outcomes Research
LL	Lower limit
MSAC	Medical Services Advisory Committee
MCDA	Multiple-criteria decision analysis
NA	Not applicable
NICE	National Institute for Health and Clinical Excellence
NHMRC	National Health and Medical Research Council
NHS	National Health Service
PBAC	Pharmaceutical Benefits Advisory Committee
QALY	Quality-adjusted life-year
QPACT	Queensland Policy and Advisory Committee for New Technology
SMART	Specific, measurable, attainable, relevant, and timely
UL	Upper limit

Statement of original authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Signature: [QUT Verified Signature](#)

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1 OVERVIEW OF THESIS

1.1 BACKGROUND

With increasing concerns about health budget constraints, and an ageing population, there is growing pressure to reduce spending on low value healthcare interventions.¹ The decisions made about how healthcare resources are spent have a large and direct impact on the public through government and private expenditure on health and the ability to access care.^{2,3} The process of assessing the economic value of an intervention—economic evaluation—serves an important role in making sure the process of discerning low value healthcare interventions from high value interventions is evidence-based and that the impact of bias and special interests is reduced.

The failure of evidence to translate into policy and practice is one of the most common findings in health services research.⁴ Implementation science, the study of how to narrow the research-practice gap, is a complex, growing and evolving field.⁵⁻⁷ The ultimate aim of implementation science is to reduce the time it takes for healthcare practice to respond to evidence and achieve a meaningful and significant change in clinical and services outcomes.

There are many difficulties encountered in the translation of knowledge in a healthcare setting. Researchers and healthcare decision-makers have differences in incentives and norms, which can manifest as difficulties in communicating with each other and incompatible priorities.^{8,9} The need for researchers, particularly at academic institutions, to publish novel and rigorous research does not always align for healthcare decision-makers' pragmatic needs for making immediate decisions. Complexity of methods and the obscurity of academic language can make translation challenging.

The nature of economic evaluation as a type of evidence results in unique challenges for translating into healthcare policy and practice. Economic evaluation is designed to improve decision-making within the healthcare context. However, economic evaluations include theory and language uncommon in healthcare practice. Translation of evidence from economic evaluations into healthcare practice have not been widely successful,¹⁰ and the health policy impact of economic evaluation remains uncertain.^{11,12}

Some challenges to translating evidence into practice are specific to economic evaluation.¹³ Most healthcare professionals and managers do not have training in producing or interpreting economic evaluations.^{14,15} Specialised terminology and statistical methods can make economic evaluations difficult to understand.¹⁶ The topics addressed in economic evaluations often do not meet the needs of healthcare professionals and policymakers.^{17,18} Sometimes, the time it takes to complete an economic evaluation is longer than the time available to make a decision.¹⁴ Healthcare professionals have reported being uncertain about the methodological quality of economic evaluations^{14,15,19} and

have stressed that equity considerations should be included as well as evidence relating to cost-effectiveness.^{14, 20}

The barriers to translating evidence from economic evaluation into healthcare practice, identified through the literature, were predominantly identified through two methods: (1) qualitative interviews or (2) surveys of health professionals and policymakers.¹³ Whilst insightful the two methods do not provide a measure of trade-off—what the decision-makers would be willing to give up in order to overcome the specific barriers identified. Measuring such trade-offs quantitatively provides a mechanism for identifying strength of preference or priorities in criteria for developing and communicating economic evaluations from a healthcare decision-makers perspective.

The thesis describes multiple approaches to better understand how to get evidence from economic evaluations into healthcare practice. The perspectives of users (decision-makers) and producers (health economists) of economic evaluations were gathered. A literature review was conducted to identify the barriers and facilitators to using evidence from economic evaluations in healthcare decision-making. The findings of the review were mapped to the constructs and domains of the Consolidated Framework for Implementation Science (CFIR), in order to adapt the framework for use in understanding the translation of evidence from economic evaluations. A discrete choice experiment was conducted to measure the healthcare decision-makers' relative importance of the barriers to using evidence from economic evaluations. Lastly, semi-structured interviews were conducted with health economists to explore their experiences translating evidence from economic evaluations into healthcare policy and practice.

1.2 RESEARCH AIM AND CONTRIBUTION OF THESIS

The aim of this research is to understand how to get evidence from economic evaluations into healthcare practice. The following objectives and related research tasks were designed in order to achieve the aim.

1. Identify the barriers to using evidence from economic evaluations in healthcare decision-making.

Study 1a

Systematic identification of the barriers and facilitators to using evidence from economic evaluations in healthcare policy and practice.

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2. Develop a theoretical framework for the translation of evidence from economic evaluation into healthcare decision-making.

Study 1b

Mapping of the barriers and facilitators to using evidence from economic evaluations onto the Consolidated Framework for Implementation Research in order to identify gaps, inconsistencies and emergent relations.

3. Determine the relative importance of these barriers to healthcare decision-makers

Study 2

Discrete choice experiment to examine the relative importance of a range of barriers and facilitators of using economic evaluations in healthcare decision-making.

4. Understand the translation of evidence from economic evaluation from the perspective of health economists who produce the economic evaluations.

Study 3

Semi-structured interviews with health economists to learn from the experiences of health economists translating evidence from economic evaluation into healthcare policy and practice.

This research has been conducted as part of the Centre for Research Excellence in Reducing Healthcare Associated Infections (CRE-RHAI), whose aim is to evaluate infection control programmes. The research outlined herein contributes to the CRE-RHAI's commitment to ensuring that cost-effectiveness research into infection control programmes translates into changes in health services.

1.2.1 Peer reviewed publications arising directly from thesis

Merlo G, Page K, Ratcliffe J, Halton K, Graves N. Bridging the Gap: Exploring the Barriers to Using Economic Evidence in Healthcare Decision-making and Strategies for Improving Uptake. Applied Health Economics and Health Policy. 2014.

Merlo G, Halton K, Graves N, Ratcliffe J, Page K. Understanding The Underutilisation Of Evidence From Economic Evaluations In Healthcare: A Mixed Methods Design. Value Health. 2015;18(7):A527.

Page K, Merlo G, Ratcliffe J, Halton K, Graves N. What factors make Economic Evaluation more valuable as a service? Value Health. 2015;18(3):A85.

Merlo G, Page K, Halton K, Ratcliffe J, Graves N. Healthcare decision-maker preferences for economic evaluation evidence: a discrete choice experiment. Medical Decision Making Policy and Practice (Under review).

2 LITERATURE REVIEW

The literature review describes economic evaluation (**Section 2.1**), the settings in which economic evaluation is used (**Section 2.2**), the barriers and facilitators to using evidence from economic evaluations in healthcare decision-making (**Section 2.3**), and the potential role of implementation science in understanding the translation of evidence from economic evaluation into healthcare policy and practice (**Section 2.3**).

2.1 ECONOMIC EVALUATION

Economic evaluation is a tool of evidence-based decision-making.^{21, 22} For decision-making in healthcare policy and practice to be evidence-based the decisions must be informed by a systematic approach that synthesises the available evidence. The purpose of an economic evaluation is to make informed decisions that recognise opportunity costs—the cost of the next best alternative that is forgone. Economic evaluation supports the fundamental purpose of evidence-based decision-making by focussing on “what works”.²³

The people who produce economic evaluations—health economists*—identify, measure and value the inputs and outcomes of decision alternatives in order to determine which alternative provides the greatest value for money.²⁴ Economic evaluation is based on the notion of marginal analysis—informing decisions by measuring and comparing the additional benefits of an activity (the incremental benefit or effectiveness) to the additional cost of an activity (the incremental cost). Economic evaluations have been produced for a wide range of healthcare interventions—pharmacological, surgical, public health, screening, and diagnostics.²⁴

The simplest type of economic evaluation is the cost analysis.²⁴ Cost analyses identify, measure, and value the resources associated with interventions or diseases. Cost comparison studies are cost analyses of interventions, and cost of illness studies are cost analyses of diseases. Cost comparison studies are used when interventions have equivalent effectiveness and safety, and therefore the relevant aspect of the decision is the relative cost of the interventions. Cost of illness studies measure the economic burden of a disease and they can be useful for priority setting but less useful for making decisions about healthcare delivery.

Cost consequence studies report all of the consequences of the intervention being evaluated, including cost and health consequences, but do not aggregate the results. The reader of the cost consequence study must make the judgement about whether the intervention is cost-effective. The advantage of the cost consequence approach is that it simplifies the evaluation, avoiding some of

* “Health economist” is a commonly used term for the people who produce economic evaluation, although not all health economists produce economic evaluations and many people who produce economic evaluations come from non-economic backgrounds.

the terminology and the assumptions required for the aggregation associated with other approaches.²⁵

For an economic evaluation to say that benefits do or do not outweigh costs, the evaluation must rely on a normative framework. A normative framework attempts to define what public policy should do. The choice of a normative framework has consequences in the methods of evaluation that will be used. **Table 1** presents two common normative frameworks in health economics and the methods of economic evaluation associated with them—welfarism and extra-welfarism.

In order to provide normative guidance for what should be considered cost-effective there needs to be a framework for what should be considered a good decision.

Table 1 Welfarist and extra-welfarist economic evaluations²⁴

Philosophical approach	Analysis type	Measurement/valuation of costs in both alternatives	Identification of consequences	Measurement/valuation of consequences
Welfarist	Cost-benefit	Monetary units	Multiple effects common to both alternatives	Natural units (e.g. life-years gained, points of blood pressured reduction)
Extra-welfarist	Cost-effectiveness	Monetary units	Single effect of interest, common to both alternatives	Natural units (e.g. life-years gained, points of blood pressured reduction)
	Cost-utility	Monetary units	Single or multiple effects, not necessarily common to both alternatives	Healthy years (typically measured as QALYs)

QALY, quality-adjusted life-years

Welfarism is based on two normative assumptions:²⁶⁻²⁹ (1) that the welfare of a society should be judged by the individuals of that society; and (2) that the welfare of a society is improved if the welfare of any individual in that society is improved without making anyone else worse off. The second assumption is sometimes relaxed to say that reallocation is still optimal if the individuals who benefit would still be better off after providing compensation to the individuals made worse off. The welfarist approach to economic evaluation is characterised by the use of cost-benefit analysis, where the cost of the intervention is compared to the monetary value of the benefit of the intervention. Monetary value of benefit is measured by obtaining individuals' willingness to pay for the health gains. It is rarely possible to directly measure an individual's willingness to pay for health gains because it is difficult to distinguish how much an individual values health gains (their willingness to pay) from their financial constraints (ability to pay).³⁰ Contingent valuation techniques are often used to elicit individual's willingness to pay by asking how they think they would behave given a hypothetical scenario.³¹

In contrast to the welfarist approach the objective of an extra-welfarist approach to health policy is not to maximise welfare, but rather has a more limited objective of maximising health gains given a

limited health budget. The type of economic evaluation associated with extra-welfarism—cost-effectiveness analysis—is the most common type seen in the health economics literature.^{32, 33}

Whereas a cost-benefit analysis measures all consequences monetarily, a cost-effectiveness analysis assesses the incremental cost of an intervention in relation to the incremental improvement in health outcomes (the effectiveness).

Any health outcome can be used in a cost-effectiveness analysis as the measure of effectiveness, but a common measure of health benefit is required if the cost-effectiveness of interventions is going to be compared between different population groups. A quality-adjusted life-year (QALY) is often used in economic evaluations for this purpose. QALYs measure survival in years adjusted for quality of life; health consequences are adjusted by utility weights based on relative preferences for particular health states. Utility weights are frequently determined by healthy members of the general public who provide their preferences for various health states, such as blindness³⁴ or diabetes.³⁵ Years living in poor health result in fewer QALYs compared with the same period of time in full health. Cost-effectiveness analyses that use QALYs as the measure of health benefit are sometimes called cost-utility analyses. Incremental change in costs and health benefits associated with the intervention compared with the comparator (the current standard of care).

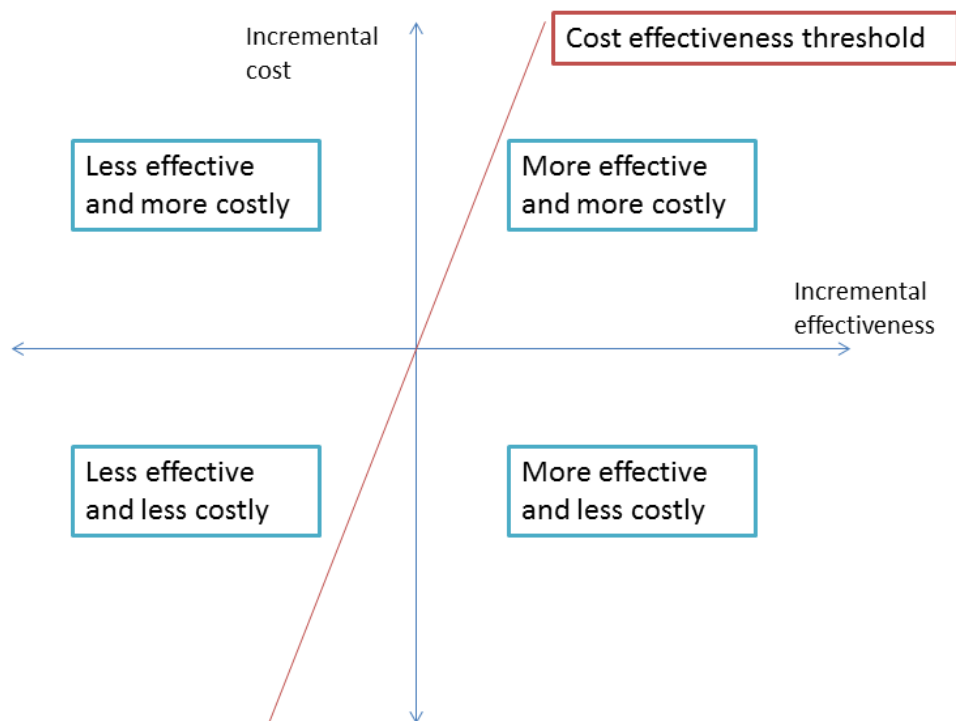
Cost-benefit analyses, cost-effectiveness analyses and cost-utility analyses can all either be measured prospectively or estimated using decision analytical modelling.^{36, 37} A trial based evaluation has the advantage of being internally valid but can lack generalisability if the costs are specific to the trial setting. Furthermore, a trial based economic evaluation can only include costs and health consequences that occur within the trial period, and the trial might not include all the relevant alternatives for treatment.

Some of the limitations of trial-based designs can be addressed through the use of decision analytic modelling. A decision analytic model states the relevant decisions under investigation and estimates the likely costs and consequences associated with these decisions.³⁸ Decision analytic models often use clinical trial data to define model parameters³⁹. Decision analytic models can incorporate multiple sources of uncertainty to assess how responsive the findings are to variations about assumptions in the model.

Cost-effectiveness analyses (including cost-utility analyses) sometimes present results in terms of incremental cost-effectiveness ratios (ICERs).²⁴ The ICER is the ratio of the incremental cost to the incremental benefit—the difference in cost and health benefit between the intervention and the comparator (the current standard of care). If a new healthcare intervention has an ICER of \$30,000 per QALY, it means that there is a cost of \$30,000 for every QALY the new intervention provides to the population.

The ICER can be visually presented on the cost-effectiveness plane (**Figure 1**). The axes on the plane represent incremental cost and incremental effectiveness compared with the current standard, which is located at the intersect. Interventions in the bottom-right quadrant cost less and produce greater health outcomes compared with the current standard of care. Conversely, interventions in the top-left quadrant cost more and produce worse health outcomes compared with the current standard of care. The top-right quadrant represents a common situation for new and effective technologies, where they improve health but at an increased cost. The bottom-left quadrant represents interventions that could save money, but with a worsening of health outcomes. As a society we rarely invest in such interventions or technologies that worsen health at the expense of reduced cost for both political and ethical reasons. However, there is a growing awareness about the importance of disinvestment of low value healthcare in order to gain efficiencies.⁴⁰

Figure 1 Cost-effectiveness plane²⁴



Whether interventions in the top-right and bottom-left quadrants are judged to be cost-effective depends on how much individuals or the health system is willing to pay per QALY; which is known as the cost-effectiveness threshold. The cost-effectiveness threshold represents the willingness to pay for a QALY gain. Interventions with ICERs below the cost-effectiveness threshold are considered cost-effective.

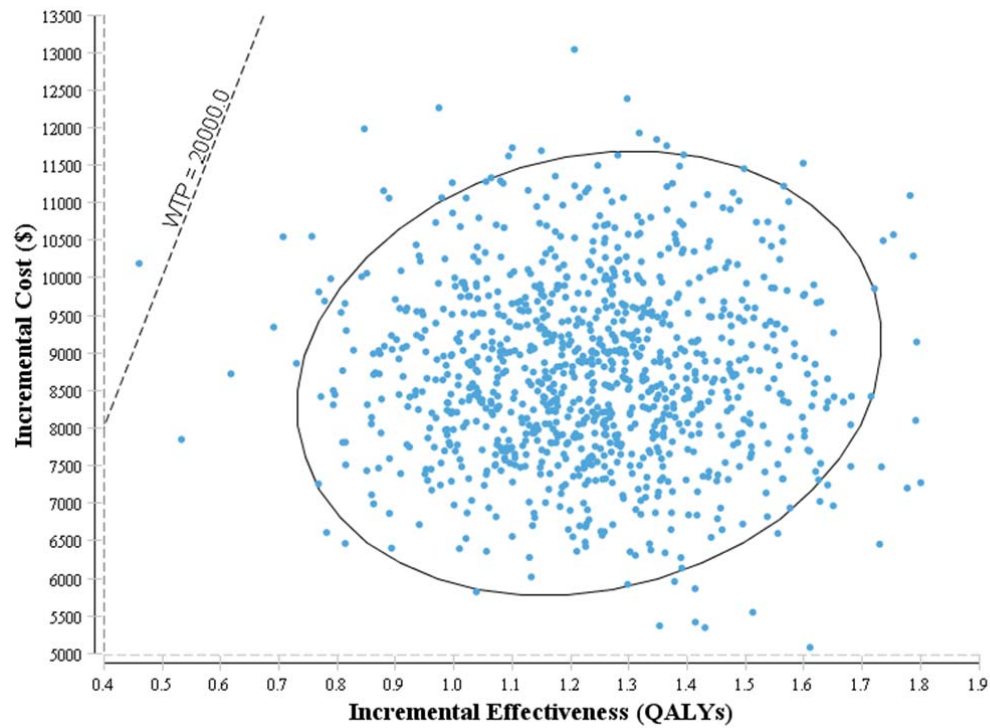
Cost-effectiveness thresholds have often been based on historical decisions. There is no defined threshold within Australia, although the PBAC considers drugs below the threshold of \$30,000/QALY to be cost-effective and above the threshold of \$70,000/QALY to not be cost-

effective.⁴¹ Several authors have argued that the threshold should be lower than what is commonly used in practice in order to accurately represent the opportunity cost of the decision.⁴²⁻⁴⁴ Under the threshold approach it is the change in health outcomes that are relevant, but it has been found that people have a greater willingness to pay per QALY for more severe health states.⁴⁵ The threshold assumes that a QALY gained at a cost of \$30,000 is the equivalent of gaining \$30,000 and losing a QALY. However, this is rarely reflected in practice because of loss aversion (not wanting to lose services that are already provided), public perceptions and resistance to change.

Methods of exploring uncertainty within economic evaluations include sensitivity analysis, scenario analysis, and probabilistic sensitivity analysis.^{24, 38} Sensitivity analysis involves varying model inputs to see how robust the cost-effectiveness estimate is to the changing values. Scenario analysis involves varying overarching assumptions—such as the timeframe or assumptions about models of care—to assess uncertainty in the structure of the decision analytic model. Probabilistic sensitivity analysis is a method used in modelled economic evaluations where the values of the parameters in the model are chosen probabilistically; a process that is repeated in order to get a random sample.

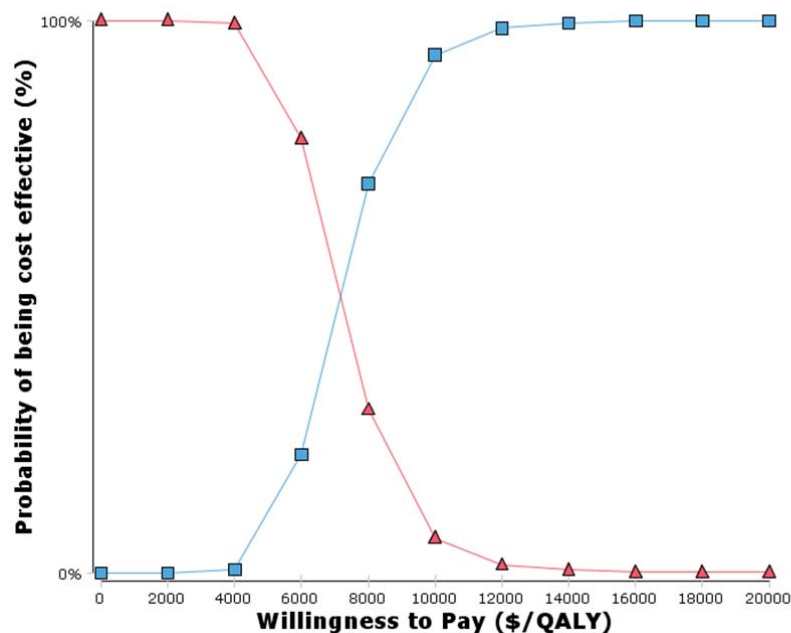
The results of a probabilistic sensitivity analysis can be presented as a scatterplot (see **Figure 2**). Iterations from the probabilistic sensitivity analysis are plotted on the cost-effectiveness plane. The ellipse represents the 95% confidence interval—95% of the iterations are within the ellipse. The dotted diagonal line represents the cost-effectiveness threshold. In this example the cost-effectiveness threshold represents a willingness to pay of \$20,000 per QALY. All values below the threshold are considered cost-effective.

Figure 2 Example uncertainty analysis scatterplots⁴⁶



The results from a probabilistic sensitivity analysis can also be presented graphically as a cost-effectiveness acceptability curve (see **Figure 3**). The cost-effectiveness acceptability curve is a visual display of the probability that an intervention is cost-effective at each of the cost-effectiveness thresholds. The graph presents the probability that the intervention is cost-effective at each willingness to pay per QALY. In this example the drug has close to zero probability of being cost-effective at a willingness to pay of \$2,000/QALY and a close to 100% probability of being cost-effective at a willingness to pay of \$20,000. This example demonstrates the importance as well as the subjectivity of the cost-effectiveness threshold.

Figure 3 Example cost-effectiveness acceptability curve⁴⁷



Cost-effectiveness needs to be balanced with other decision criteria, such as equity and accessibility.²⁴ If an intervention is cost-effective that does not mean that the intervention upholds the principles of equity. Moreover, cost-effectiveness is often balanced with other expectations that people have for the healthcare system in terms of the ability to access care and the nature of the care. One method of balancing the criteria is to incorporate all the decision-making criteria into the cost-effectiveness or cost-benefit estimate. Another method to balance competition decision criteria is multiple-criteria decision analysis (MCDA), which is a mathematical approach for making a decision between a set of alternatives based on criteria that are weighted to reflect the preferences of the decision-maker or population.⁴⁸⁻⁵²

2.2 SETTINGS FOR USE OF ECONOMIC EVALUATION

Organisations that regularly use economic evaluations for decision-making often have established processes for translating evidence from economic evaluations into practice. Australian reimbursement agencies that use economic evaluations for decision-making include the Pharmaceutical Benefits Advisory Committee (PBAC) and the Medical Services Advisory Committee (MSAC).⁵³ The agencies, as well as their subcommittees make recommendations to the Minister for Health about whether pharmaceuticals and medical technologies should be funded nationally.⁵⁴ The recommendations are made based on the cost-effectiveness of the health technologies, so pharmaceutical and medical device companies prepare submissions defending the cost-effectiveness of their products. The submissions follow standard templates, which include instructions for analysing the cost-effectiveness of the product compared with the current standard

of practice and instructions for how to present the results of the evaluation. The Committees have their own evaluators (including health economists) to review and decide whether it is appropriate to fund the intervention. Sometimes the process is used to negotiate price or establish a risk-sharing agreement with the companies. For the organisations, economic evaluations are structurally supported and integrated into the decision-making process at the highest level, so there is minimal need to have additional strategies to ensure that economic evaluation is used in the decision-making process.

At the state level there are health technology assessment (HTA) agencies such as the Queensland Policy and Advisory Committee for New Technology (QPACT). HTA is the process of identifying new medical technologies, evaluating their key dimensions and effects, and monitoring their diffusion into healthcare practice.⁵⁵ Cost-effectiveness is only one of the criteria used for evaluation within health technology assessment, alongside other criteria such as safety, efficacy, and quality and also social impact on equity or innovation.⁵⁵

There are international counterparts to the PBAC and MSAC and the state-based HTA agencies.⁵⁶⁻⁵⁸ In the UK there is the National Institute for Health and Care Excellence (NICE),^{57, 59, 60} which differs from the PBAC in the breadth of responsibilities and the evaluation practices. Unlike the PBAC and MSAC, NICE is not limited to assessing pharmaceutical and medical device, but includes all health technologies and health services within the UK's National Health Service (NHS). In terms of evaluation practice, NICE differs from the PBAC in the proportion of submissions accepted, the willingness to negotiate price, and how study design impacts the decision.⁶¹ However, like the PBAC, the ICER of evaluated interventions has a significant impact on NICE decision-making.⁶² Nevertheless, only about half of the health technologies that NICE have recommended had an associated ICER.⁶³

Other organisations that use economic evaluation for healthcare decision-making—sometimes called HTA agencies—include the Canadian Agency for Drugs and Technologies in Health (CADTH),⁶¹ Germany's Institute for Quality and Efficiency in Health Care (IQWiG),⁶⁴ the Swedish Council on Technology Assessment (SBU),⁶⁵ New Zealand Health Technology Assessment (NZHTA),^{57, 66} and Thailand's Health Intervention and Technology Assessment Program (HITAP).⁶⁷ Economic evaluations are also used for hospital formulary decision-making—where hospitals decide which pharmaceuticals they are going to stock and provide to patients.⁶⁸ Furthermore, economic evaluations sometimes form part of clinical practice guidelines,⁶⁹ including National Health and Medical Research Council (NHMRC) guidelines in Australia.⁷⁰

Even with the existence of HTA agencies, the proportion of healthcare interventions that are validated and based on sound scientific evidence—let alone cost-effectiveness evidence—is small.⁷¹ Use of economic evaluation is mostly limited to decisions at the national level.^{15, 17, 18, 59, 64, 72-75}

Decision-making at the local level tends to be made based on current standards, customs and what has been funded in the past.^{17, 76, 77} Other influencers on healthcare decision-making include the knowledge and experience of the healthcare professional, the characteristics of the patient, financial incentives, fear of malpractice litigation, and awareness of costs.⁷⁸

2.3 BARRIERS AND FACILITATORS TO USING EVIDENCE FROM ECONOMIC EVALUATION

The following section reviews the barriers and facilitators to using evidence from economic evaluation using the Accessibility-Acceptability Framework.⁷⁹ The Accessibility-Acceptability Framework was developed specifically for economic evaluation. According to the framework the use of evidence from economic evaluation in healthcare decision-making depends on whether the economic evaluation is accessible and acceptable. The accessibility of evidence from economic evaluations depends on research being able to be obtained and understood in a timely manner. Acceptability depends of scientific acceptability (“is it accurate?”) and ethical acceptability (“is it the right thing to do?”). The literature review that characterises the barriers and facilitators using the Accessibility-Acceptability Framework is used to define the attributes of the discrete choice experiment in **Section 1**.

The following section describes the findings of a review published as part of the thesis (See Appendix A).¹³ The review investigated the barriers and facilitators to using evidence from economic evaluation using the Accessibility-Acceptability Framework, which was developed specifically for the translation of evidence from economic evaluation into healthcare policy and practice.

2.3.1 Accessibility

An economic evaluation is *accessible* if the policymaker has timely access to relevant research that is understandable.⁷⁹ Identified barriers to accessibility include the absence of relevant available economic evaluations for decision-makers,^{14, 15, 73, 75, 80-87} the time and cost required to conduct economic evaluations,^{14, 19, 87-90} decision-makers’ lack of time to evaluate research,^{8, 17, 90, 91} difficulties translating economic evaluations into different contexts,^{18, 82, 87, 92} and poor awareness of current evaluations.^{14, 15, 17, 18, 80, 93} Economic evaluation is rarely part of academic criteria in graduate medical education.⁹⁴ Barriers to understanding the evidence include poor communication from health economists (including overuse of jargon),^{15, 16, 90} complexity of economic evaluation design,^{16, 19, 82, 87} confusion with methods of presenting results;¹⁹ excessive variation in economic evaluation methodologies and presentation,^{14, 16, 80} and the lack of economic evaluation expertise amongst decision-makers.^{8, 14-17, 19, 80, 90, 91, 93, 95-102}

Healthcare decision-makers, including physicians, pharmacists, hospital administrators, and politicians have recommended that health economists should simplify language and analysis methods,^{16, 82, 90, 101, 102} and use standard brief report formats for presenting economic evaluations.^{8, 14-16, 103} Some decision-makers favour the presentation of results in a disaggregated format (i.e., cost consequence analysis).^{82, 104} Having decision-makers involved who have previous experience using cost-effectiveness analysis in decision-making helps manage the complexity of using the research for decision-making.¹⁹

Sullivan et al (2015)¹⁰⁵ reviewed guidelines and templates for presenting results from economic evaluations. None of the reporting templates specifically targeted policymakers or non-technical audiences. The guidelines recommend economic evaluations to have templates for presenting well-cited tables of data sources, transparent model descriptions and diagrams, disaggregated results, and tabular and graphical displays of sensitivity analysis. Few of the guidelines provide any advice for presenting information to non-economists, but suggestions included minimising excessive jargon and providing a glossary of economic terminology. The review, however, provided several suggestions for presenting economic evaluations to non-economists, including (1) specifying the differences between the societal and healthcare payer perspective, (2) using adequate time horizons, (3) specifying how outcomes such as QALYs and life-years relate to component clinical outcomes, and (4) describing how sensitivity analysis methods were chosen. The authors concluded that best practice and educational resources for communicating results from economic evaluations needs to be further explored, noting the difficulty in presenting results in a way that is both simple and valid.^{9, 105} Policymakers' preferences for being able to deconstruct analyses and for understanding how the results of economic evaluations apply at a practical level do not appear to be reflected in published guidelines for how to present results from economic evaluations.¹⁰⁵ Therefore, there exists considerable scope for further work in the area.

Hoffmann et al.¹⁸ conducted focus group research with decision-makers from UK health authorities to evaluate whether they found the NHS Economic Evaluation Database facilitated the accessibility of evidence from economic evaluations. The NHS Economic Evaluation Database contains structured abstracts of published economic evaluations, and was designed to overcome accessibility barriers. The decision-makers in the focus group reacted positively to the NHS EED, saying that it would aid in the identification of relevant research. The decision-makers identified limitations of the NHS EED including the lack of generalisability the evaluations in the database conducted outside of the UK and the inability to evaluate the quality of the evidence from the economic evaluation given the compressed format of the NHS EED study summaries.

Thurston et al.¹⁰⁶ assessed different summary formats for presenting results from an economic evaluation, using a survey of healthcare decision-makers in the UK who were users of the NHS Economic Evaluation Database. The healthcare decision-makers (n=84), who preferred a

combination of summary formats with a short summary plus a more detailed structured abstract. Decision-makers with economics training preferred a structured abstract that was more detailed compared with the favoured structured abstract of the other decision-makers. The decision-makers seemed to have two needs for the evidence summaries. First, the majority wanted a format that can be rapidly scanned and compared; and second they wanted a more detailed version that they could review for studies they considered relevant. The study highlights the importance of providing multiple formats when presenting information for different purposes to different audiences.

Decision-makers from multiple health contexts suggested training as a method of overcoming the barriers to using economic evaluations,^{8, 14-16, 82} although there are no studies that have assessed the impact of training on decision-makers' attitudes and knowledge of economic evaluation. Training material was provided in the pilot study conducted by Claxton et al.¹⁰⁷ to investigate the potential for decision analysis and value for information analysis to inform the prioritisation process of the NHS's HTA programme. Some members of the HTA programme said that the training material was insufficiently detailed; while others said that the material was too detailed and technical; highlighting the need to tailor the training and dissemination of information to different groups of people.

All told, the accessibility of an economic evaluation is multifaceted and whilst there is research to examine its various components of timeliness, understanding and relevance, the solutions to improving accessibility remain largely poorly understood.

2.3.2 Acceptability

Just because healthcare decision-makers can use evidence from economic evaluations does not mean that they would want to. A decision-maker might not want to use an economic evaluation because it lacks scientific, institutional, or ethical acceptability.⁷⁹

2.3.2.1 Scientific acceptability

Evidence from economic evaluation is scientifically *acceptable* if the methods are valid and the results are unbiased.⁷⁹ Decision-makers have reported concerns about some of the methods used in economic evaluations. Such methodological issues include poor quality of research informing economic evaluations,^{16, 18, 19, 87, 89, 93, 99} use of QALYs to measure health effects,^{14, 16, 100, 108} methods used to estimate indirect and overhead costs,^{87, 109} insufficient description of modelling assumptions,^{14, 15, 18, 94} lack of description of the quality of the data used,⁸⁹ results not representing true uncertainty,¹⁹ and the appropriateness of the cost-effectiveness threshold.^{14, 19, 81, 82, 87}

Decision-makers regard conflicts of interest as a barrier to using economic evaluations.^{14, 16, 82, 91, 100,}

¹¹⁰ Industry funded economic evaluations are prevalent in the academic literature,¹¹¹ raising

concerns that methods are being selected that introduce bias, either in the model design or the selection of parameters. Economic evaluations, like other research, are susceptible to publication bias, as economic evaluations with positive findings are more likely to be published.¹¹²

Another aspect of scientific acceptability is whether economic evaluations are consistent with welfare economics and economic principles more generally. Although the consistency of economic evaluation with welfare economics has been debated in the academic literature,^{26, 113} it was not a concern to the decision-makers surveyed or interviewed about the barriers to using economic evaluations.^{14, 72}

2.3.2.2 Institutional acceptability

Evidence from economic evaluation is institutionally acceptable when it meets the institutional needs of the decision-maker. Policymakers and healthcare practitioners have recommended that health economists need to demonstrate a better understanding of the decision-making process in the healthcare system, particularly with regard to the difficulties in transferring resources between sectors and adjusting budgets for new therapies.^{14, 15, 76, 82, 87, 91, 93, 114} The limited transferability of economic evaluations from other contexts is often identified as a challenge.^{91, 100} Healthcare professionals and policymakers have found that published economic evaluations often address a narrow scope of research questions, and typically ignore concerns that decision-makers often face, including human resource management decisions.^{17, 18} Conversely, economic evaluations of nationwide programs can be too broad to be of relevance to individual hospitals with specific requirements and timeframes.¹⁴ Following guidance from an economic evaluation might not be institutionally acceptable if it advocates disinvestment of an established technology,^{8, 14, 40, 115, 116} or if the findings run contra to the short-term focus of decision-makers.^{117, 118} The relevance of an economic evaluation can be limited by which pharmaceuticals and medical devices have regulatory approval or approval from reimbursement, and which are recommended in clinical practice guidelines.¹¹⁴

Decision-makers have found that potential economic benefits of interventions highlighted in economic evaluations are not being realised in practice.^{14, 15, 82} The lack of benefits in practice might be because of institutional limitations—if individuals in each ward of a hospital are only responsible for the budget of their ward then economic benefits accrued to another ward would be considered relevant for the economic evaluation but less relevant to the individuals within the original ward. Alternatively, if patient behaviour, response to treatment, or any other assumption is not as predicted then that can result in economic benefits highlighted in economic evaluations not being realised in practice.

Approaches that have been suggested to improve the institutional acceptability of economic evaluations include (1) making economic evaluations more relevant to the decision-making

context,^{14, 73}(2) allowing flexibility in decision-making budgets to adopt recommended changes,¹⁵ (3) incorporating budget and resource reallocation constraints in models,^{119, 120} (4) making economic evaluations more sensitive to questions that healthcare decision-makers need answers to,^{14, 73} (5) involving all stakeholders in the economic evaluation process,⁷³ and (6) demonstrating direct benefits to the administrator or department concerned.⁹⁰ Official requirement to demonstrate the cost-effectiveness of interventions for third party funding or reimbursement also promotes the development and use of economic evaluations.¹²¹ The impact of economic evaluations on policy is often related to the level of cooperation between researchers and policymakers,^{14, 110} which explains why the economic evaluations most successful in influencing policy are those that are commissioned by the policymakers themselves.¹²²⁻¹²⁴

2.3.2.3 Ethical acceptability

Ethical acceptability refers to whether the decision-maker and the wider community consider the methods, findings or recommendations from the research to be ethically “right”. A concern that has been raised by decision-makers is that economic evaluations rarely consider or report the impact that an intervention has on equity.^{14, 16, 19, 20, 89, 115, 125} There are many ways to address equity concerns but the methods often depend on the equity criteria of the decision-makers.¹¹³ If policymakers want to know the impact of a policy on equality in health outcomes or access to services then health economists should try to find an effective and meaningful way to present the information.

Explicit rationing itself is ethically unacceptable to some decision-makers¹²⁶. There can be conflict between the individual ethic of the doctor-patient relationship and the population ethic of cost-effectiveness.^{14, 109} The doctor-patient relationship focusses on the effectiveness and safety of treatment, with less concern about the cost of treatment. But economic evaluations take a social or administrative perspective, where between-patient trade-offs in the use of healthcare resources need to be accounted for, which can result in economic evaluation becoming synonymous with cost cutting in the eyes of doctors.^{14, 73, 86} To address the concern of cost-cutting, economic evaluations should highlight to doctors and other health professionals the benefits accrued to all their patients as opposed to any one patient. One study¹¹⁴ found that HTA agencies largely ignored divergent views about economic evaluation, which most likely impacts the acceptability of the findings to a range of stakeholders.

2.3.3 Accessibility and acceptability trade-offs

The constructs of accessibility and acceptability provide a framework to evaluate strategies to increase the usefulness of evidence from economic evaluations or increase the impact that the evidence has on policy. Strategies to increase usefulness of impact can have different effects on

each of components of accessibility and acceptability. The nature of the interactions have not been assessed empirically, but some interactions can be speculated (**Table 1**).

Such interactions can be trade-offs. Sophisticated statistical techniques might improve scientific acceptability but make the research less accessible due to increased time to conduct analysis and difficulty in understanding results. Rapid evaluation methods sacrifice scientific acceptability to improve accessibility.^{49, 127} Decision-makers might find it easier to understand disaggregated results of economic evaluations rather than, say, an incremental cost-effectiveness ratio, but the disaggregated approach provides less support for a scientifically rigorous decision. Industry funding can have a negative impact on perceptions of scientific acceptability, but without industry funding many economic evaluations would not be conducted, limiting accessibility. Involving community members in healthcare priority decisions might improve community attitudes to economic evaluation and healthcare rationing, but their recommendations might not sit well with institutional powerbrokers. Incorporating budget and equity constraints into an economic evaluation might improve institutional and ethical acceptability but also takes time, adds complexity, and opens the door for criticism of methods.

Writing well improves understanding, but at a cost.¹²⁸ It takes time to write clearly and comprehensively. Writing well requires experience, thoughtfulness, and repeated edits. Technical language is a barrier to understanding for non-specialists, but researchers need to demonstrate their understanding of technical language to gain academic credibility.

Decision-makers sometimes like to see economic evaluations include decision making criteria other than cost effectiveness, such as budget impact, resource constraints and equity impact. However, including decision-making criteria other than cost-effectiveness contributes to the complexity of the economic evaluation. Each decision-making criterion introduces new ideas that the reader has to grasp. Each demands knowledge and effort from the researcher to be calculated credibly.^{129, 130}

If cost-effectiveness, budget impact, resource constraints, and equity impact are all reported, another level of complexity is introduced because competing criteria need to be weighed up to make a decision. MCDA can be used to make the weighing up of competing criteria explicit. An MCDA instrument allows for the trade-off between criteria in a way that facilitates the rank ordering of a set of interventions.¹³¹ But MCDA introduces more ideas to be understood and it requires time to develop such a decision tool.

Table 1 Potential accessibility and acceptability interactions

Strategy	Accessibility		Acceptability		
	Availability	Understanding	Scientific	Institutional	Ethical
Rapid evaluation techniques	↑		↓		
Use plain language	↓	↑			
Disaggregated presentation of results (cost consequences analysis)		↑	↓		
Complex modelling techniques to minimise bias	↓	↓	↑		
Conducting economic evaluations with industry funding	↑		↓		
Conducting economic evaluations independent from industry funding	↑		↑		
Clearly stating assumptions and data sources	↓	↑	↑		
Incorporating budget and resource reallocation constraints	↓	↓	↓	↑	
Involving community members in healthcare priority decisions	↓			↓	↑
MCDA to incorporate equity concerns	↓	↓	↓		↑

MCDA, multiple-criteria decision analysis

The upwards arrows indicate that the strategies in the left column have the potential to increase or improve the subcategories of accessibility or acceptability in the top row. The downwards arrows indicate that the strategies have the potential to decrease or diminish the accessibility or acceptability subcategories

The Accessibility-Acceptability Framework was developed specifically to characterise the barriers and facilitators to translating evidence from economic evaluation into healthcare practice. The Accessibility-Acceptability Framework focuses on the characteristics of the economic evaluation rather than the nature of the decision-makers, the context of the decision, or the process of translating evidence into practice. The framework was based on findings from qualitative interviews and surveys of a variety of healthcare decision-makers. Due to the evidence source, any determinants that are not identified in the qualitative studies are not part of the Accessibility-Acceptability Framework.

There are advantages and disadvantages to using a general implementation framework rather than the economic-evaluation specific Accessibility-Acceptability Framework. The primary disadvantage of using a general implementation framework is that it is less specifically relevant for economic evaluation and might use terminology that would not usually be used when discussing the translation of evidence from economic evaluation into healthcare policy and practice. The advantages of using a general implementation framework—as will be used for **Studies 2** and **4**—is that it (1) facilitates identification of determinants of translation not already identified in the current literature; (2) allows comparison with getting other innovations into healthcare policy and practice; and (3) discerns characteristics relevant to the economic evaluation that determine translation from characteristics of the decision-makers and the decision-making context.

To that end, it is worthwhile to consider implementation more broadly as a field of study. The following section describes frameworks and strategies that have been developed for implementation of research findings into practice more generally, with the aim of providing a richer understanding of all of the potential factors at play in the translation process.

2.4 IMPLEMENTATION SCIENCE

The process of getting evidence—such as evidence from economic evaluations—into healthcare practice is slow and high quality evidence is not consistently applied across healthcare practices, resulting in inefficient use of healthcare resources.¹³² It has been estimated that 85% of research is wasted¹³³ and there is a research-to-practice time delay of 17 years.¹³⁴ Gaps between what is recommended and what physicians do and patients receive is common.^{135, 136} One study of the knowledge of a public health workforce in the USA found that all the topics assessed, economic evaluation had the greatest knowledge gap.¹³⁷ Research is needed to understand the reasons for gaps in clinical practice and to identify interventions to address them.^{138, 139} The study of getting evidence into practice is called implementation science.^{138, 140-142} Implementation science has emerged from multiple fields using different terminology, frameworks and strategies.

Implementation science provides frameworks to understand the challenges to getting evidence from economic evaluation into healthcare practice, and provide strategies to overcome those challenges.¹⁴³ One of the aims of implementation science is to reduce waste in research, so that useful research is undertaken and the findings from the research inform decision-making, which is commensurate with the ultimate goals of economic evaluations.

The simplest approach to getting evidence into practice is diffusion and dissemination. Diffusion is the passive spread of information to an audience and dissemination is the active process of spreading a message to defined target groups.¹⁴⁴ Under the traditional academic model the researcher disseminates their finding through publications in academic journals and presentations at conferences. If the research is high quality, and the findings are relevant, then word will diffuse to practitioners who will change their behaviour in response to the research. Dissemination methods depend on the audience and how that audience uses information to make decisions. Different target audiences have different needs for acquiring and interpreting information. Moreover, there are many norms and conventions within the academic system, which mean that some types of research and evidence are disseminated more frequently and successfully than others.

Implementation aims to reduce or eliminate the barriers to the translation of evidence and facilitate behavioural change.¹⁴⁴ There are multiple theoretical frameworks for implementation^{140, 145-148} and a large body of empirical evidence looking at specific implementation interventions.¹⁴⁹⁻¹⁵⁷ Some implementation frameworks are specific to evidence from research; others are broader and relevant

for any innovation where implementation would require some change in the behaviour of individuals or organisations.

Several trials have been conducted to evaluate the effectiveness of individual implementation strategies. There is strong evidence for educational outreach,¹⁵⁸⁻¹⁶¹ including: practice visits by educators, the provision of promotional material, and subsequent reminders or educational follow-up;¹⁵⁸ educational outreach by pharmacists;¹⁵⁹ healthcare visits from outside the organisation.¹⁶⁰ There is moderate evidence for audit and feedback,¹⁵⁸⁻¹⁶⁵ where the change in practice is monitored to inform individuals and managers. There is also moderate evidence for reminders,^{120, 121, 128, 129, 161} including verbal reminders, reminders on paper or digital reminders. There is also moderate evidence for multifaceted interventions,¹⁶¹ where multiple implementation strategies are concurrently implemented. There is mixed evidence for other implementation strategies including mailed dissemination,^{121, 127-129} computerised decision support systems,^{158, 163, 164, 166} educational meetings,^{159, 160, 165, 167} continuing education,^{120, 127, 129} and opinion leaders.^{158, 160, 162}

Tailored implementation interventions are designed to meet specific determinants of practice within the relevant context.¹⁵⁰ A tailored intervention is planned following an assessment of the barriers and facilitators—the determinants—to changing practice. The theory behind the tailored approach is that efforts to change professional practice will have a lower likelihood of success if the determinants of current practice are not taken into account. Methods used to identify determinants include: brainstorming, interviews, or focus groups of health professionals, and questionnaires.^{149, 168} Commonly, interviews with implementation practitioners or health professionals are conducted to identify strategies to address the determinants of practice.^{154, 173, 174} Tailored implementation interventions have been developed for quality and safety improvements and guideline implementation,^{135, 169-171} but there have been no tailored implementation interventions developed specifically for economic evaluations.¹⁵⁰ The effectiveness of tailored implementation strategies are variable, but tend to be small to moderate.¹⁵⁰

2.4.1 Implementation frameworks

Implementation frameworks bring together concepts and provide structure for research into implementation and research utilisation.^{140, 142, 145} Many implementation frameworks have been developed within disciplines, resulting in a variety of terminology and classification concepts.¹⁴⁵ Some frameworks focus on changes at the level of the individual professional, while others focus on changes at the organizational or social level.¹⁷²

Different types of implementation frameworks will be relevant to different aspects of understanding, addressing, and evaluating the research practice gap for economic evaluation. There are five broad types of models (**Table 2**). Process models aim to understand the stages that would

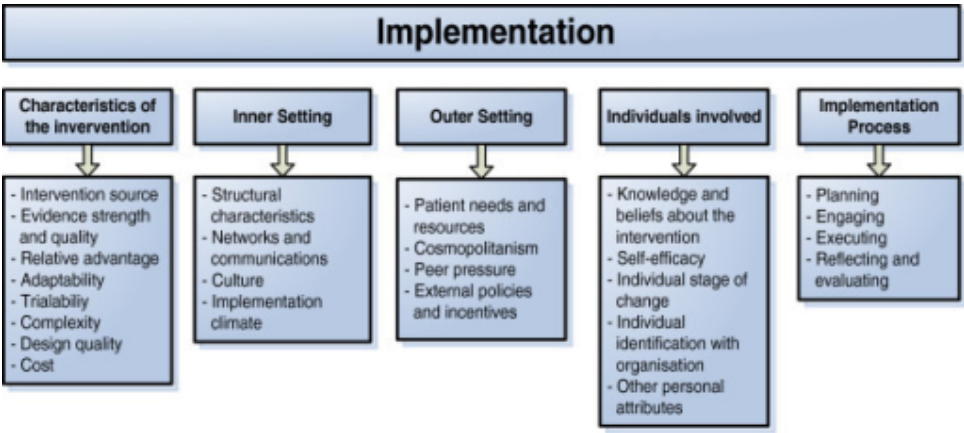
be required to translate research, such as an economic evaluation, into healthcare practice.¹⁷³ Determinant frameworks aim to understand why evidence is or is not used, often using context domains to characterise the determinants.¹⁷³ Determinant frameworks are often informed by classic theories of individual and organisational behaviour and decision-making from outside of the field of implementation research—such as the Theory of Diffusion¹⁷⁴—and theories developed to understand implementation—such as the Normalization Process Theory.¹⁴⁷ valuation frameworks can be used to structure evaluations of implementation programmes, such as strategies to get evidence from economic evaluations into healthcare practice.¹⁷³

Table 2 Five types of implementation frameworks (adapted from Nilsen 2015¹⁷³)

Category	Description	Examples
Process models	Specify the steps of the process of translating research into practice	Model by Huberman, ¹⁷⁵ model by Landry et al., ¹⁷⁶ model by Davies et al., ¹⁷⁷ model by Majdzadeh et al., ¹⁷⁸ the CIHR Model of Knowledge Translation, ¹⁷⁹ the K2A Framework, ¹⁸⁰ the Stetler Model, ¹⁸¹ the ACE Star Model of Knowledge Transformation, ¹⁸² the Knowledge-to-Action Model, ¹³² the Iowa Model, ^{183, 184} the Ottawa Model, ¹⁸⁵ model by Grol and Wensing, ¹⁸⁶ model by Pronovost et al., ¹⁸⁷ the Quality Implementation Framework ¹⁸⁸
Determinant framework	Specify the factors that act as barriers or facilitators and strategies that can be used to influence implementation outcomes.	PARIHS, ^{141, 181} Active Implementation Frameworks, ^{189, 190} Understanding-User-Context Framework, ¹⁹¹ Conceptual Model, ¹⁹² framework by Grol et al., ¹³⁵ framework by Cochrane et al., ⁷ framework by Nutley et al., ¹⁹³ Ecological Framework by Durlak and DuPre, ¹⁹⁴ CFIR, ¹⁴⁰ framework by Gurses et al., ¹⁹⁵ framework by Ferlie and Shortell, ¹⁹¹ Theoretical Domains Framework ¹⁹⁶
Classic theories	Theories originating outside of implementation research	Theory of Diffusion, ¹⁷⁴ social cognitive theories, theories concerning cognitive processes and decision-making, social networks theories, social capital theories, communities of practice, professional theories, organizational theories
Implementation theories	Theories developed within implementation research to understand aspects of implementation	Implementation Climate, ¹⁹⁷ Absorptive Capacity, ¹⁹⁸ Organizational Readiness, ¹⁹⁹ COM-B, ²⁰⁰ Normalization Process Theory ¹⁴⁷
Evaluation frameworks	Specify aspects of implementation that can be evaluated to determine implementation success	RE-AIM, ²⁰¹ PRECEDE-PROCEED, ²⁰² framework by Proctor et al. ²⁰³

The Consolidated Framework for Implementation Research (CFIR) is a widely cited and rigorously developed determinants framework for implementation.²⁰⁴ CFIR was developed through a process of consolidating earlier published literature, including nineteen previously developed frameworks such as the Greenhalgh 2004 model,²⁰⁵ the PARIHS framework,²⁰⁶ and the Ottawa Model of Research Use.²⁰⁷ Common themes were organised into the five CFIR domains of intervention characteristics, outer setting, inner setting, characteristics of the individuals involved, and the process of implementation (**Figure 4**). Each domain is characterised by a set of constructs—for instance the inner setting domain is characterised by four constructs (structural characteristics, networking and communication, culture, and implementation climate).

Figure 4 Domains and constructs within the CFIR Research¹⁴⁰



CFIR, Consolidated Framework for Implementation Research

CFIR was designed for innovations such as changes in clinical practice or new technologies, rather than types of evidence. **Chapter 0** uses the adapted CFIR for framework analysis of interviews with health economists.

2.5 SUMMARY OF EVIDENCE GAPS

There is a strong theoretical rationale for the use of economic evaluation in healthcare decision-making. Empirically there is a positive perception amongst healthcare decision-makers about the value of economic evaluation for making evidence-based decisions based on cost-effectiveness. However, outside the restricted scope of HTA agencies, there is still limited use of economic evaluation, which leads to both the sub-optimal use of healthcare resources and ultimately poorer patient outcomes.

Implementation research is an emerging discipline. Therefore, there has been limited focus on the translation of evidence from economic evaluation into healthcare practice. There are specific challenges that need to be addressed when translating evidence from economic evaluation into healthcare practice. Economic evaluations are specific to the decision-making context that they are designed for, which can lead to problems with adaptation to different clinical contexts. Economic evaluations use language and methods that are unfamiliar to most health professionals and policymakers. Furthermore, the population focus of economic evaluations will sometimes not align with the individual patient focus of healthcare practice. There is therefore a need of a specific tailored framework for the translation of evidence from economic evaluation.

There has been a no attempt to consolidate the research into the barriers and facilitators to using evidence from economic evaluations into existing implementation frameworks such as the CFIR. **Chapter 1** presents an adaptation of CFIR for the transition of evidence from economic evaluations into healthcare policy and practice (CFIR-EE). The adaptation is achieved by mapping the findings of a systematic review of the barriers and facilitators to using evidence from economic evaluations in healthcare policy and practice to the domains of CFIR. The CFIR-EE characterises the determinants of the translation. The CFIR-EE brings together concepts and provides structure to the study of the translation of evidence from economic evaluations.

The factors that prevent or encourage decision-makers using evidence from economic evaluations have been identified, but the relative importance of these factors to decision-makers is uncertain. Without a gauge for relative importance one cannot determine whether sacrificing acceptability for accessibility is worthwhile. Relative importance is likely to depend on the nature of the decision and decision-makers. Trade-offs are inherent in decision-making and that is no different for economic evaluations. Whilst decision-makers can easily state the absolute importance of a multitude of factors for economic evidence, in reality when faced with such a decision they make trade-offs and sacrifice some element of the decision for another. The relative preference for the attributes of an economic evaluation have not captured by any previous research and is essential for better understanding what aspects of the evidence health economists should focus their efforts on in the

production of such evidence. **Chapter 1** details a study of decision-makers' preferences for economic evaluations using discrete choice methodology.

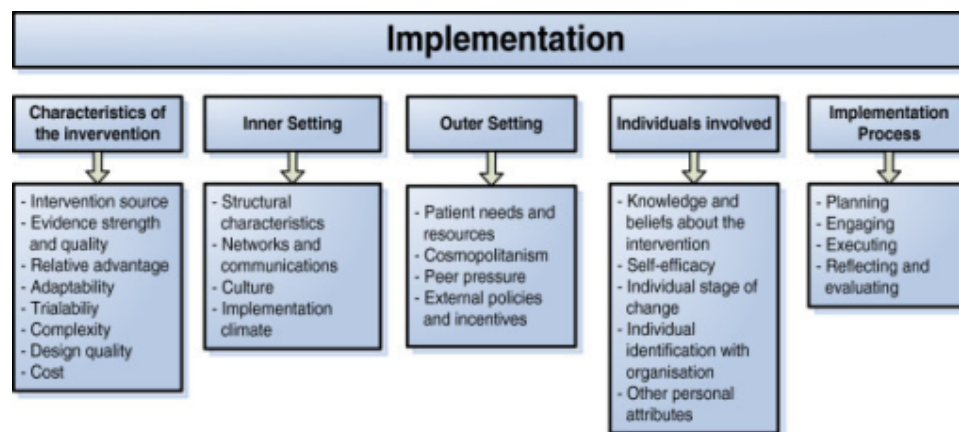
All of the published studies researching the barriers and facilitators to using evidence from economic evaluation in healthcare decision-making have involved interviews with users of economic evaluations rather than the health economists. To develop a prescriptive framework the current body of qualitative data from users of economic evaluation needs to be consolidated with qualitative data from the experiences of health economists trying to get their research into healthcare practice. **Chapter 5** describes the results from a series of in-depth interviews to identify these strategies. Health economists from Australia and the UK were asked about their experiences and attitudes to translating evidence from economic evaluations into practice.

3 ADAPTATION OF CFIR FOR TRANSLATION OF EVIDENCE FROM ECONOMIC EVALUATION INTO HEALTHCARE POLICY AND PRACTICE (CFIR-EE)

3.1 INTRODUCTION

This chapter presents the development of the CFIR-EE (**Figure 5**) for the translation of evidence from economic evaluation into healthcare policy and practice. CFIR is a highly cited theoretical framework that characterises the factors that determine implementation (see **Section 2.4.1**). CFIR was designed for innovations such as changes in clinical practice or new technologies, rather than types of evidence.

Figure 5 Domains and constructs within CFIR



CFIR, Consolidated Framework for Implementation Research

The review used the Accessibility-Acceptability Framework discussed in **Section 2.3**, which had been developed specifically for economic evaluation.⁷⁹ Under the Accessibility-Acceptability Framework evidence from economic evaluation will be used in healthcare decision-making only if it is accessible and acceptable. The advantage of adapting a general implementation framework, such as the CFIR, rather than using the Accessibility-Acceptability Framework are that the adapted CFIR (1) facilitates identification of factors not already identified in the current literature; (2) allows comparison with getting other innovations into healthcare policy and practice; and (3) discerns characteristics relevant to the economic evaluation that determine translation from characteristics of the decision-makers and the decision-making context.

3.2 METHODS

A systematic search strategy was used to identify studies that investigated the translation of evidence from economic evaluation in healthcare decision-making. A literature search was

conducted in EMBASE (1947 to 2016) using a combination of economic (e.g., “economics”, “cost”, “pharmacoeconomics”) and decision-making (e.g., “policy”, “priority”, “decision”) terms (**Table 3**). Articles were included if they were (1) in English; (2) published as a full article in a peer reviewed journal; and (3) reported original research (not a systematic or literature review) of healthcare decision-makers’ attitudes using evidence from economic evaluations. The abstracts of the identified papers were screened for eligibility. Complete versions of all articles that met the eligibility criteria were retrieved. The included articles were reviewed to identify barriers and facilitators to using evidence from economic evaluations in healthcare policy and practice.

Each CFIR construct and domain was defined in terms of how it related to economic evaluation as an innovation. Where there was no available evidence specifically concerning economic evidence the construct is discussed in broader evidence terms. Barriers and facilitators identified in the included studies were mapped across the five CFIR domains and to the constructs within each domain. Gaps, inconsistencies and emergent relations were identified through the mapping process. There were four objectives to the mapping:

1. Identify gaps where there is no evidence of barriers or facilitators relating to the CFIR constructs or domains.
2. Identify barriers and facilitators that do not fit within the CFIR constructs or domains.
3. Identify terminology in the terms used to define the CFIR constructs and domains that could lead to confusion or inconsistency when applied to economic evaluation as an innovation.
4. Observe emergent relationships between the CFIR constructs and domains when applied to economic evaluation as an innovation.

Table 3 Literature review search strategy (July 2016)

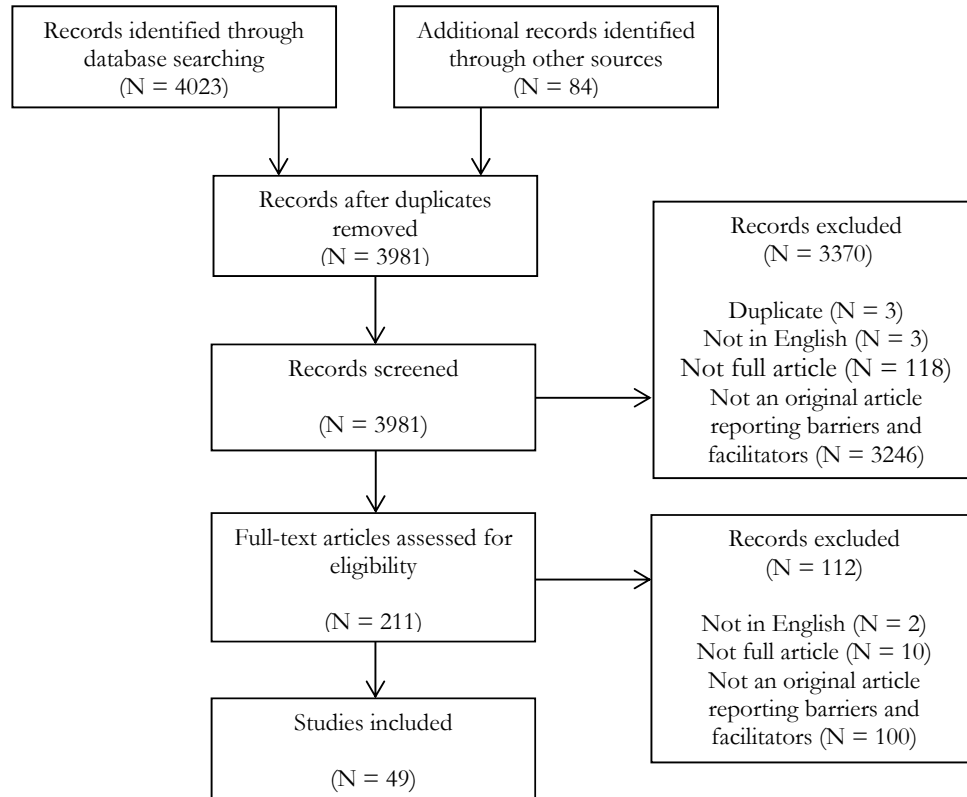
No.	Query	Results
#1	cost*:ti	123886
#2	economic*:ti	46823
#3	polic*:ti	54675
#4	priorit*:ti	13708
#5	decision*:ti	57784
#6	cost*:ti OR economic*:ti	167736
#7	polic*:ti OR priorit*:ti OR decision*:ti	124909
#8	(cost*:ti OR economic*:ti) AND (polic*:ti OR priorit*:ti OR decision*:ti)	4023

3.3 RESULTS

3.3.1 Included studies

A total of 4023 articles were identified through the initial EMBASE search and an additional 83 articles were identified through bibliographic records (**Figure 6**). After initial screening 3370 citations were excluded. Full text articles were assessed for 211 articles, 112 of which were subsequently excluded. A total of 49 studies met eligibility criteria and were included in the review.

Figure 6 Flow diagram of literature search



Qualitative and quantitative research has been conducted across multiple healthcare settings exploring the barriers to using evidence from economic evaluation and the strategies to overcome them. The studies were conducted using surveys,^{15, 75, 80, 81, 85, 87-91, 93, 95, 98, 101-103, 106, 115, 117, 118, 121, 123, 208, 209} interviews,^{16, 17, 19, 73, 76, 82-84, 86, 87, 97, 99, 100, 108, 109, 114, 120, 210-214} focus groups,^{14, 18, 87, 107, 214} and decision-making observations^{14, 17, 19, 82-84, 86, 88, 92, 99, 110, 210, 213-215} of physicians, pharmacists, hospital administrators, HTA groups, and politicians. The studies were conducted in multiple settings, including Australia,^{73, 89, 90} Sweden,^{80, 115, 121} Thailand,^{81, 100} USA,^{16, 75, 98, 102, 121, 209} Canada,^{76, 83-85, 88, 97, 99, 114, 211, 213} Italy,¹¹⁷ UK,^{14, 17-19, 82, 86, 93, 95, 103, 106, 107, 109, 110, 121, 210, 215} France,^{91, 95, 121} Germany,⁹⁵ Netherlands,^{95, 108, 120, 212} South Korea,²⁰⁸ and Saudi Arabia.¹⁰¹ There were also surveys conducted Europe-wide.^{15, 87, 123}

3.3.2 Domain 1: Innovation characteristics

Within CFIR, **innovation characteristics** refer to the characteristics of the “innovation” that is to be implemented, in this case an economic evaluation (**Table 4**).¹⁴⁰

Table 4 Results from mapping the innovation characteristics domain to the barriers and facilitators of using evidence from economic evaluation

Construct	Barriers	Facilitators
Intervention source	Conflicts of interest ^{14, 16, 82, 91, 100, 110}	Reporting conflicts of interest Economic evaluations commissioned by the policymakers themselves ¹²²⁻¹²⁴ Increased collaboration between researchers and policymakers ^{14, 110}
Evidence strength and quality	Poor quality of research informing economic evaluations ^{16, 18, 19, 87, 89, 93, 99} Poor quality methods used to estimate indirect and overhead costs ^{87, 109}	Guidelines for conducting economic evaluations ^{216, 217}
Relative advantage	Absence of relevant available economic evaluations ^{14, 15, 73, 75, 80-87} Conflict between the individual ethic of the doctor-patient relationship and the population ethic of cost-effectiveness ^{14, 109} Difficulties translating economic evaluations into different contexts ^{18, 82, 87, 92} Quality of data ⁸⁹ Economic evaluations rarely analyse the impact that an intervention has on equity ^{14, 16, 19, 20, 89, 115, 125}	Equity analysis ¹¹³
Adaptability	Difficulties translating economic evaluations into different contexts ^{18, 82, 87, 92} Narrow scope of research questions typically addressed in economic evaluations ^{17, 18}	Making economic evaluations more sensitive to questions that healthcare decision-makers need answers to ^{14, 73} Involving all stakeholders in the economic evaluation process ⁷³
Trialability	None identified	None identified
Complexity	Complexity of economic evaluation design ^{16, 19, 82, 87}	Training ^{8, 14-16, 82}
Design quality	Poor communication from health economists (including overuse of jargon) ^{15, 16, 90} Insufficient description of modelling assumptions ^{15, 16, 19, 87} Complex economic evaluation design ^{16, 19, 82, 87} and excessive variation ^{14, 16, 80} Excessive variation in economic evaluation methodologies and presentation, ^{14, 16, 80}	Simplify language and analysis methods ^{16, 82, 90, 101, 102} Appropriately designed summary formats ^{18, 103, 104, 106} Guidelines for presenting economic evaluations ^{216, 217}
Cost	Time and cost required to conduct economic evaluations ^{14, 87-90} Decision-makers' lack of time to evaluate research ^{8, 17, 90, 91}	None identified

The CFIR proposes that there are eight constructs of the innovation characteristics domain that are relevant for implementation:

1. **Intervention source** refers to whether an innovation is externally or internally developed and whether the developers of the innovation have legitimacy. Barriers relating to the intervention source for economic evaluations include conflicts of interest^{14, 16, 82, 110} and lack of collaboration between health economists and healthcare decision-makers.^{14, 110} Whether the evaluation is commissioned by the policymakers is an important factor in determining if the results change policy.¹²²⁻¹²⁴
2. **Evidence strength and quality** refers to the evidence supporting the healthcare decision-makers' beliefs that the use of the economic evaluation will have the desired outcomes. Importantly for economic evaluation, the construct represents the strength of evidence and quality of evidence supporting the use of economic evaluation to improve decision-making rather than the quality of the economic evaluation itself. Although it is a reasonable assumption, it is difficult to assess empirically whether knowing which interventions are more cost-effective would improve the efficiency of decision-making.^{12, 218} It is also a reasonable assumption that an economic evaluation that uses better quality clinical evidence and follows high methodological standards will be more likely to achieve the desired outcome of accurately determining the most cost-effective alternative.
3. **Relative advantage** is the perceived advantage of using the economic evaluation for decision-making versus the alternative solution—whether following clinical norms or using effectiveness analysis alone. Barriers relating to relative advantage include absence of relevant available economic evaluations^{14, 15, 73, 75, 80-87}, conflict between the individual ethic of the doctor-patient relationship and the population ethic of cost-effectiveness,^{13, 117} Difficulties translating economic evaluations into different contexts,^{18, 82, 87, 92} quality of the clinical data,⁸⁹ and economic evaluations failing to incorporate decision-relevant factors other than cost-effectiveness^{14, 16, 19, 20, 89, 115, 125} are also elements that fit within the construct of relative advantage.
4. **Adaptability** is the degree to which an economic evaluation can be tailored to meet local needs. The adaptability of an innovation can be assessed by outlining what are the elements of the innovation that can and cannot be adapted or altered.^{140, 219} A decision analytic model can be adapted by changing parameters; which can be used to adapt models to specific healthcare contexts. Once an economic evaluation is published, that publication itself is not highly adaptable—apart from corrections—but the underlying decision analytic model can be adapted to specific healthcare contexts. The presentation of the results can also be adapted into various summary formats.¹⁰⁶

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5. The **trialability** of an innovation is the ability to test the innovation on a small scale within the organisation. Evidence from an economic evaluation is not highly trialable because information is difficult to contain in a controlled way.²²⁰
 6. **Complexity** refers to the perceived difficulty of an economic evaluation and depends on a number of factors, including the scope of the changes involved, the centrality of the decision-making, and the disruptiveness of those changes.^{140, 205, 221} Difficulty increases with the number of individuals and organisations involved,^{140, 222} and the extent to which the innovation changes standard practice.¹⁴⁰ Using evidence from economic evaluation is particularly difficult to implement if the evidence needs to be generated, for example in the case where an economic evaluation needs to be commissioned or developed internally. The difficulty of implementation will also depend significantly on the nature of the intervention that the economic evaluation is assessing and the scope of the research question.
 7. **Design quality** is the perception of the quality of how the intervention is bundled, presented, and assembled.^{140, 223} An economic evaluation can use appropriate methods, but would have poor design quality if it is poorly communicated with insufficient descriptions of assumptions and data sources. The design quality of a published economic evaluation could be improved by presenting it in a shortened summary form or presenting results visually. The bundling of the economic evaluation within a set of clinical practice guidelines would also be an important aspect of design quality—providing context for how the economic evaluation should be interpreted.
 8. The **cost** of conducting an economic evaluation needs to be offset by the improvement in decision-making associated with knowing the cost-effectiveness of the relevant healthcare interventions in order for the economic evaluation to be worthwhile. A further barrier is the cost for health professionals to spend the time to access and read the economic evaluation.

Domain 1 is highly represented in the literature of the barriers and facilitators to using evidence from economic evaluation. However, some of the terminology requires adaptation because several constructs within the domain are non-intuitive when applied to economic evaluation. Specifically, the construct of **evidence strength** refers to the evidence that using economic evaluation improves healthcare decision-making, while evidence strength is used in reviews of economic evaluation to refer to the quality of methods used in economic evaluation. Similarly, the CFIR construct of design quality has a different interpretation to the usual use of how economic evaluations are defined by quality. It is valid to talk about evidence strength for the use of economic evaluation—although the construct of evidence strength can easily be confused with the evidence strength of the economic evaluation itself. Moreover, the design quality used within CFIR has a different

meaning to how design quality is typically used for defining an economic evaluation. When an economic evaluation is described as good quality it means that the economic evaluation meets certain standards of rigour.

A simplified version of the constructs specific for economic evaluation is presented in **Table 5**. For parsimony and clarity the eight constructs of the CFIR were simplified to three: relevance, accessibility, and credibility. The three constructs were adapted from the Accessibility-Acceptability Framework, providing a link between the generalised CFIR framework and the economic evaluation specific Accessibility-Acceptability framework.

Table 5 Mapping relevance, accessibility, and credibility to the innovation characteristics domain

Adapted construct	CFIR construct
Accessibility	Complexity Design quality Cost
Relevance	Relative advantage Adaptability
Credibility	Evidence strength and quality Intervention source Trialability

CFIR, Consolidated Framework for Implementation Research

Accessibility has the same definition as in the Accessibility-Acceptability Framework (and includes complexity, design quality and costs). By contrast, acceptability had to be defined differently because as originally defined it overlaps with the innovation domain, the characteristics of individuals, and the setting—particularly the inner setting domain. Therefore, the construct of accessibility was separated into the two components of an economic evaluation that determine accessibility: relevance and credibility.

Relevance refers to whether an economic evaluation is applicable to the specific decision-making context. Factors that determine relevance include the research question addressed by the evaluation, the outcomes assessed, the adaptability of the evaluation, the timeframe of the evaluation, and the notion of value (adaptability and relative advantage from CFIR).

Credibility refers to the trustworthiness of the economic evaluation. The credibility depends on the quality of the modelling methods and clinical data, and the intervention source—the expertise of the health economist and any conflicts of interest.

Herein, the first domain is represented only by the three constructs of accessibility, relevance, and credibility.

3.3.3 Domain 2: Outer setting

The outer setting (**Table 6**) is the economic, political, and social context in which the healthcare decision-maker's organisation operates.¹⁴⁰

Table 6 Mapping the outer setting domain to the barriers and facilitators of using evidence from economic evaluation

Construct	Barriers	Facilitators
Patient needs and resources	None identified	None identified
Organisational networks	None identified	None identified
Peer pressure	None identified	None identified
External policies and incentives	Incentives for short-run decision-making ^{117, 118}	None identified
Factors without defined constructs		
Public attitudes and values	Attitudes to rationing by cost-effectiveness ^{14, 73, 86}	

The CFIR defines the outer setting by four constructs:

1. **Patient needs and resources.** An important determinant for whether an innovation is implemented in the healthcare system is the patients' needs for the innovation. Patient needs and resources were not, however, identified as relevant for the use of evidence from economic evaluation in the literature. Economic evaluations are predominantly used to measure patient needs and resources rather than garner inputs from patients, which can explain why patient needs and resources was not identified as a factor relevant for the use of evidence from economic evaluation.
2. **Organisational networks** refers to the networks between the organisation and external organisations. For instance, increased networks between hospitals could facilitate the diffusion of evidence from an economic evaluation.
3. **Peer pressure** has an impact on the implementation of innovations as people change their behaviour in response to their peers changing attitudes and behaviour. Healthcare professionals will be more likely to use evidence from economic evaluations in decision-making if other health professionals are using evidence from economic evaluations.
4. **External policies and incentives** were seen to have a substantial impact on whether evidence from economic evaluation translated into healthcare policy or practice. Decision-makers found that policies and incentives encourage them to focus on short run decision-making—limiting the value of long-term insights from economic evaluations.^{117, 118} Financial incentives and policies play an important role in the uptake of research.^{224, 225}

There are few financial incentives for scientists and policy-makers to take the initiative to build a dialogue with their counterparts.²²⁶

The attitudes and values of the public were identified as a factor that might influence the translation of evidence from economic evaluation.^{14, 73, 86} However, public attitudes and values do not fit within the constructs of the Outer Setting domain as defined. Hostile public opinion particularly about rationing by cost-effectiveness can be a determinant of implementation that has a greater impact on evidence from economic evaluation compared with the innovations typically characterised using the CFIR. Public values for health states and the ability to measure these values also impact implementation, particularly when economic evaluations fail to consider all of society's health objectives.²⁵

3.3.4 Domain 3: Inner Setting

The inner setting is the structural and cultural context of the organisation in which the innovation is to be implemented (**Table 7**)^{140, 227}. In the case of economic evaluations the inner setting might be national advisory committees, such as the PBAC, MSAC, state health departments, hospitals or any organisation that individual healthcare decision-makers are working within.

Table 7 Mapping the inner setting domain to the barriers and facilitators of using evidence from economic evaluation

Construct	Barriers	Facilitators
Structural characteristics	Difficulties in transferring resources between sectors and adjusting budgets for new therapies ^{14, 15, 76, 82, 87, 114} Lack of relevance to local context ^{91, 100} Difficulty with disinvestment ^{8, 14, 40, 115, 116} Potential economic benefits of interventions highlighted in economic evaluations are not being realised in practice ^{14, 15, 82}	Making economic evaluations more relevant to the decision-making context ^{14, 73} Allowing flexibility in decision-making budgets to adopt recommended changes Incorporating budget and resource reallocation constraints in economic models ^{119, 120} Demonstrating direct benefit to the administrator or department ⁹⁰
Networks and communications	None identified	Set routines, established practices, and rules coordinating their relations to stakeholder institutions ¹¹⁴
Culture	Organisational willingness to trade between health gains and cost ^{214, 215} Professional power imbalance ²¹⁵	None identified
Implementation climate	None identified	Reacting to perceived problems ²¹⁵

The inner setting domain is characterised by four constructs:

1. **Structural characteristics** is the construct that defines the inner setting in terms of the level of the capacities, knowledge, and resources available to the organisation and how the

labour, knowledge and resources are coordinated. The structure of an organisation includes the official roles and responsibilities, hierarchy, and procedures. Questions relevant to this construct include: How many individuals in the organisation have training in economic evaluation? How diverse is the organisation? What are the groups of people who make up the organisation? How are the different groups coordinated?

2. **Networks and communications** refer to the nature and quality of formal and informal communications within an organisation. This construct characterises the internal setting of an organisation by the extent to which individuals in the organisation are able to communicate with each other, and the level of cohesiveness within organisations.
3. **Culture** refers to the norms, values, and assumptions of an organisation.²²⁸ One explanation of failure of implementation is that the initiatives failed to understand the culture and the cultural changes required for the implementation to be successful.^{140, 229} Andrew Pettigrew defines culture as the system of “publicly and collectively accepted meanings operating for a given group at a given time”.²³⁰ Pettigrew emphasised the central role of symbols to understanding organisational culture through the processes of character formation and organisational sagas; how narratives define the organisations’ culture.
4. **Implementation climate** refers to how the receptivity of a culture to change can be in flux. Characteristics of an organisation receptive to change include¹⁴⁰ the perception that current situation is seen as intolerable;^{205, 231} compatibility with organisational values, workflows and systems;^{197, 205} relative priority of the innovation within the organization;^{197, 223, 232} and organisational incentives for change.^{223, 233}

The current literature on the barriers and facilitators to using evidence from economic evaluation in healthcare decision-making neglects the inner context relative to the Innovation Characteristics domain. This relative neglect of the inner context might be because of the nature of the research studies where decision-makers were asked to consider their use of economic evaluations. Under the circumstances, the salient factors might be the characteristics of the evaluation rather than the structure and culture of the organisation they work for.

3.3.5 Domain 4: Characteristics of individuals

One way of thinking about the process of evidence from economic evaluation changing healthcare practice can be as a series of individuals deciding whether to use the evidence to change their own behaviour (**Table 8**).

Table 8 Mapping the characteristics of individuals domain to the barriers and facilitators of using evidence from economic evaluation

Construct	Barriers	Facilitators
Knowledge and beliefs about the intervention	<p>Poor awareness of current evaluations^{13, 14, 16, 17, 86, 100, 214}</p> <p>Lack of economic evaluation expertise amongst decision-makers^{8, 14-17, 19, 80, 90, 91, 93, 95-102, 214}</p> <p>Negative opinion about economic evaluation, including use of QALYs,^{14, 16, 108} methods used to estimate indirect and overhead costs^{87, 109}, cost-effectiveness threshold,^{14, 19, 81, 82, 87} or explicit rationing^{126 14, 73, 86}</p> <p>Conflict between the individual ethic of the doctor-patient relationship and the population ethic of cost-effectiveness^{14, 109}</p>	Training decision-makers in how to use economic evaluations ^{8, 14-16, 82}
Self-efficacy	Decision-makers' lack of time to evaluate research ^{8, 17, 90}	None identified
Individual stage of change	None identified	None identified
Individual identification with organisation	None identified	None identified

QALYs, quality-adjusted life-years

The four constructs in the CFIR that constitute the characteristics of individuals domain are:

1. **Knowledge and beliefs about the intervention.** An individual making the decision to use evidence from an economic evaluation will do so based on their knowledge of economic evaluation and their beliefs about using economic evaluation in healthcare decision-making. A lack of understanding of economic evaluation is a barrier to use. Positive attitudes about an innovation, for instance economic evaluation or the interventions assessed in an economic evaluation, promotes use of that innovation. Positive attitudes help shape the intention to change behaviour. The converse is also true, negative attitudes about economic evaluation or rationing by cost-effectiveness is a barrier to the use of evidence from economic evaluations, resulting in negative attitudes, resulting in little or no behaviour change from the status quo.
2. **Self-efficacy.** The individual's beliefs in their own capacity to execute a course of action is an important determinant of implementation.^{140, 234} With regards to using economic evaluation for healthcare decision-making, self-efficacy means more than being able to understand the economic evaluation, the individuals need to have the belief that they can enact the changes required to make the decision that is guided by the economic evaluation. Individuals with high self-efficacy are more likely to make changes in behaviour, such as responding to evidence from economic evaluations, and more likely to sustain changes in behaviour.¹⁴⁰

3. **Individual stage of change.** The stage of change of individuals trying to implement an intervention impacts on the success of the implementation. The individual stage refers to the point they are at in their readiness for change. There are a number of theoretical models for an individual's stage of change.^{174, 221, 223, 235} The more individuals at later stages of change the greater the likelihood of successful implementation. The individual's stage of change is linked to the organisations readiness to change (CFIR inner setting domain).

Even when evidence from economic evaluations does not change policy decisions, notions of costs and benefits have become pervasive.¹⁷ Decision-makers might not be using formal economic evaluations to inform decision-making, but they still use notions of efficiency and opportunity costs in decision-making.

4. **Individual identification with an organisation** defines the individual in terms of how they perceive the organisation and their role within the organisation.

Both of the constructs of individual stage of change and individual identification with organisation were not identified in the literature review of the barriers and facilitators to using evidence from economic evaluation. There is scope for greater attention to the impact of individual stage of change and identification with organisation in the translation of evidence from economic evaluations.

3.3.6 Domain 5: Process

The process domain encompasses the stages involved in the development, implementation and evaluation of an innovation (Table 9).

Table 9 Mapping the process Domain to the barriers and facilitators of using evidence from economic evaluation

Construct	Barriers	Facilitators
Scoping	Training decision-makers in how to use economic evaluations ^{8, 14-16, 82} Narrow scope of research questions typically addressed in economic evaluations ^{17, 18}	Involving all stakeholders in the economic evaluation process ⁷³
Development	Absence of relevant available economic evaluations for decision-makers ^{14, 15, 73, 75, 80-87}	None identified
Diffusion and dissemination	None identified	None identified
Deliberation	None identified	None identified
Monitoring and reflection	None identified	None identified

Stages adapted from other implementation frameworks^{145, 236, 237}

Here the stages within CFIR have been augmented to include the stage of pre-implementation (development) as included in other frameworks^{132, 145, 205}—which is a stage particularly relevant to

the implementation of evidence from economic evaluation because considerations about implementation should influence development. Altogether there are five stages in the process:

1. **Scoping** involves determining the research question and the scope of the research to be addressed in the economic evaluation.
2. **Development** involves doing the economic evaluation and includes any supporting materials, refining and creating different versions of the economic evaluation to be appropriate for various audiences, and determining the likely impact that the results of the evaluation could have on healthcare practice.^{132, 145}
3. **Diffusion and dissemination** are the ways the evidence from the economic evaluation are communicated. Diffusion and dissemination does not include the active process of addressing the barriers to using evidence from economic evaluations.
4. **Deliberation** is the point where the decision that is to be informed by the economic evaluation is made.
5. **Monitoring and reflection** is the final stage in the implementation process. Monitoring and reflection can take the form of feedback through standardised surveys, telephone interviews, and focus groups. Standardised surveys are the most common method of evaluation for HTA agencies.⁸ The objectives to be evaluated should be specific, measurable, attainable, relevant and timely (SMART).^{140, 238} Key outcomes for evaluations include level of awareness and knowledge of target groups, changes in clinical health practices, changes in institutional policies, and changes in government policies.¹⁴⁴

Several of the stages in the process domain did not have barriers or facilitators identified with them. It is unknown whether the absence of barriers and facilitators relating to the stages is due to the limitations of the qualitative literature investigating the determinants of translation of evidence from economic evaluation.

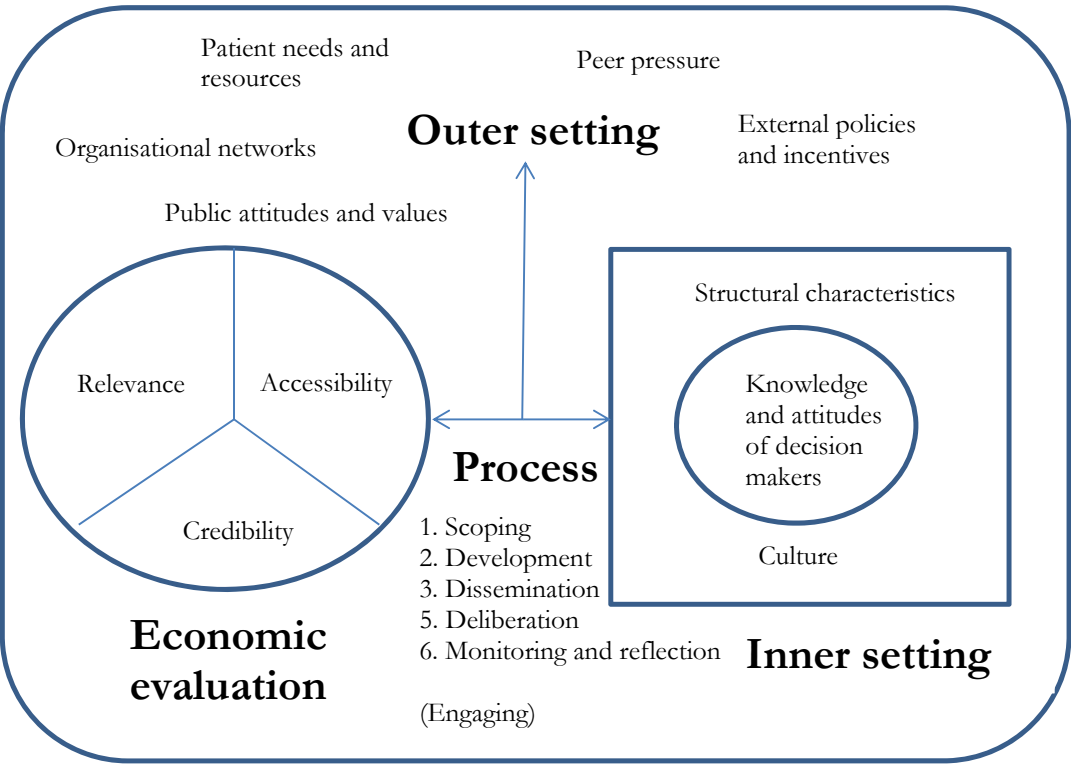
3.3.7 CFIR adapted for Economic Evidence (CFIR-EE)

Each of the CFIR domains is represented by barriers and facilitators identified in the literature review, although not all of the constructs are represented because there is a paucity of research in certain areas. In some cases the constructs might not be represented because of the nature of the qualitative research that identified the barriers, where healthcare decision-makers were asked about their attitudes to using evidence from economic evaluation. The nature of the research question makes the characteristics of the economic evaluation more salient than other domains; the domains of inner setting, outer setting, individual decision-maker, and process all had fewer identified barriers and facilitators than the characteristics of the innovation domain. Only one of the barriers

or facilitators identified—public attitudes to rationing by cost-effectiveness—did not fit within any of the CFIR constructs. Public attitudes did, however, fit within the outer setting domain, so public attitudes represents a unique construct relevant to using evidence from economic evaluation.

The CFIR-EE differs from the original CFIR in four ways (Figure 7).

Figure 7 CFIR-EE



CFIR, Consolidated Framework for Implementation Research adapted for Economic Evidence

The first difference is that the innovation domain now consists of only three constructs (Section 3.3.2)—accessibility, credibility, and relevance. The three constructs represent the overarching factors that must be balanced in the development of the economic evaluation at each stage of the process in consideration of the characteristics of the individuals involved and the context in terms of the inner and outer setting.

The second difference is the inclusion of public attitudes as a construct within the outer setting domain. The public attitudes construct characterises the outer setting in terms of the perceptions in the community about rationing by cost-effectiveness.

The third difference is that the characteristics of the economic evaluation interact with the inner setting domain, the characteristics of individual decision-makers domain, and the outer setting domain. If the economic evaluation is highly relevant, accessible and credible then it can have an

impact on the attitudes and knowledge of the decision-makers and lead to changes in the inner and outer setting domains. The interactions between the domains are represented in a graphical change from the original framework. The process as a domain links (with arrows) the characteristics of the economic evaluation domain with the individual decision-makers and the inner and outer settings. The individual decision-maker domain is graphically represented within the inner setting domain.

The final difference is that the stages in the process domain have been redefined to be more relevant for economic evaluations (**Section 3.3.6**). Stages of scoping and development were included in the CFIR-EE because the production of the economic evaluation itself is a crucial stage in translating evidence from economic evaluations into healthcare policy and practice.

The adaptations were predominantly driven by the mapping of the evidence of the barriers and facilitators review but were supplemented by expert knowledge and the nature of the innovation. It should be noted here that the mapping represents the first stage of the adaptation of the framework for economic evidence and it is likely that future research and development will result in later changes to the framework.

3.4 DISCUSSION

The CFIR-EE provides a theoretical framework to understand the translation of evidence from economic evaluations into healthcare policy and practice. The CFIR-EE represents the translation of evidence from economic evaluation within a broader implementation context. The adaptation of the CFIR was informed by the Accessibility-Acceptability framework; specifically, in the definition of the constructs within the characteristics of the economic evaluation domain.

The CFIR-EE highlights the multilayered interactions between the economic evaluation, individual decision-makers and the context that the decision-makers work in. The CFIR-EE has a number of strengths as a framework for understanding the factors that determine the translation of evidence from economic evaluation into healthcare policy and practice. The CFIR-EE makes explicit that the implementation process begins with the conception and development of the economic evaluation, includes multiple stages of diffusion, dissemination and active implementation strategies, and finally an evaluation of the success of the implementation strategy.

The eight constructs within the characteristics of the economic evaluation domain were simplified into three constructs. The terminology of some of the constructs in the CFIR is misleading when the innovation under scrutiny is a type of evidence. The evidence strength and quality of the medical device refers to the strength of the evidence that supports the use of the medical device, the equivalent for an economic evaluation is not the quality of the evaluation but the strength of evidence that supports the use of economic evaluations generally. Similarly, design quality has a

different meaning when applied to evidence from economic evaluation to when applied to another innovation, such as a medical device.

Some of the terminology and concepts within the CFIR constructs and domains needed to be adapted when relating to the implementation of a type of evidence and a method of evidence synthesis such as economic evaluation. CFIR characterises innovations by their evidence base. However, evidence itself, such as evidence from economic evaluations, can also be an innovation. CFIR remains valid when the innovation is evidence, but some of the terminology within the framework requires clarification. Furthermore, evidence from economic evaluation, as an innovation, affects the relationship between the domains

The nature of the qualitative studies from the literature review might have had an impact on which domains were well represented in the identified barriers and facilitators to using evidence from economic evaluations in healthcare decision-making. The most well represented CFIR-EE domain was the characteristics of the evaluation—which is likely to include the most salient factors for healthcare decision-makers asked specifically about why they do or do not use evidence from economic evaluations. However, and importantly, it should not be concluded that the greater representation implies that the characteristics of the evaluation have a greater impact on the success of the translation process than the other determinants. The relative influence on successful implementation of each domain is a question for future research.

The mapping process conducted to develop the CFIR-EE only incorporated the barriers and facilitators for getting evidence specific to economic evaluations into practice, rather than other types of evidence. However, the original CFIR was based on findings from a wide range of implementation settings within health and healthcare. How the CFIR should be applied or adapted to other types of evidence remains a topic for further research.

The CFIR-EE represents a comprehensive and relevant framework in which to better understand, structure and implement the translation of economic evidence.

4 MEASURING DECISION MAKER'S PREFERENCES FOR THE ATTRIBUTES OF ECONOMIC EVALUATIONS

4.1 INTRODUCTION

Preferences for a good can be revealed through behaviour. Consumer preferences can often be understood through a close analysis of purchasing behaviour and how the behaviour responds to factors such as price, or distance, or other attributes that define the good. Revealed preference methods, however, require an existing market for the good under investigation.

An alternative approach in the absence of a market is stated preference analysis. Stated preference analysis is a family of survey techniques designed to elicit people's preferences for goods. Contingent valuation and choice analysis are two common types of stated preference techniques.

In contingent valuation, people are told to consider a hypothetical opportunity and directly asked how much they would be willing to pay.^{31, 239} Often the outcome of a contingent valuation is the respondents' willingness to pay measured in monetary terms. Contingent valuation can also be used to elicit other valuation preferences such as willingness to wait or willingness to travel.

Choice analysis also provides a method of eliciting willingness to pay, wait or travel.^{240, 241} However, in choice analysis respondents are not asked to directly value a good. Rather they are provided with alternative options. The choices between the options provide information about preferences and how much the people value the goods.

Discrete choice experiments are a common and well studied choice analytic technique. Discrete choice experiments allow for the measurement of preferences for individual attributes of a good or service (such as an economic evaluation).^{215, 242, 243} It is a method that has been used to value preferences for healthcare services and the healthcare system more widely.^{244, 245} A discrete choice experiment is more realistic than simply asking respondents what they prefer as it forces the respondents to make a choice.¹³¹ As a method it is consistent with economic demand theory, specifically Lancaster's theory of value²⁴⁶—that it is the characteristics or attributes of a good that determines the good's value. Unlike other stated preference techniques, discrete choice experiments allow for scale comparisons.²⁴⁷ There is growing evidence that the nature of the decisions made in discrete choice experiments can be more intuitive compared with other stated choice methods.²⁴⁸ Studies have found that respondents answer discrete choice experiments in a way that is internally valid and consistent.²⁴⁹⁻²⁵¹

Previous work using discrete choice experiments include measuring patient preferences for health services and health outcomes, professional preferences for occupation factors and nature of

treatments, preferences for which patients should receive priority, and what factors should be considered in healthcare decision-making.^{244, 252, 253} Discrete choice experiments have also measured preferences for decision-making criteria for use in HTA.^{20, 49, 125, 254-258} Decision-making criteria assessed in these studies included incremental cost-effectiveness,^{49, 125, 254-258} uncertainty of the cost-effectiveness,^{49, 125, 258} distributional or equity impact,^{20, 125, 259} absolute health benefit of treatment,^{20, 49, 256-258} number of potential beneficiaries and their characteristics,^{49, 256-258} severity of the disease before treatment,^{256, 257} budget impact and affordability,⁴⁹ and accessibility in terms of waiting times and travel distance.²⁰ Although discrete choice experiments have measured preferences for cost-effectiveness as a decision criterion and have been used to estimate parameters for economic evaluations, none to date have assessed the factors that make economic evaluation valuable for decision-making.

This is the first study to apply quantitative discrete choice experiment methods to value preferences for the design and conduct of an economic evaluation. The results demonstrate the trade-offs that healthcare decision-makers are prepared to make when choosing an economic evaluation. By understanding the preferences of healthcare decision-makers for the design and conduct of an economic evaluation, health economists can better meet healthcare decision-makers' needs and facilitate the translation of their research into healthcare policy and practice.

4.2 METHODS

4.2.1 Participants

The eligible population included healthcare professionals, health administrators, health managers, and health researchers. Multiple methods were used to recruit participants during a five month time period from February to June 2015. Emails were sent through professional mailing lists including those of the Australian Centre of Health Services Innovation (AusHSI) and Health Services Research Association of Australia and New Zealand (HSRAANZ). Nationality was not an eligibility criterion, although the recipients of these mailing lists are predominantly from Australia and New Zealand. Participants attending AusHSI economic evaluation workshops were informed of the survey. Flyers for the survey were posted at International Society for Pharmacoeconomics and Outcomes Research (ISPOR) and HSRAANZ conference. The recruitment involved snowballing; where respondents were asked to forward the link of the survey to people they thought would be interested.

4.2.2 Design of the discrete choice experiment

A discrete choice experiment was designed, following best practice guidelines,^{227, 230, 241} to elicit preferences for the design and conduct of an economic evaluation. Attributes were identified through a literature review of barriers to using evidence from economic evaluation in healthcare

decision-making¹³ and the framework developed by Williams et al.,²¹⁰ and represent features of an economic evaluation that effect the relevance, accessibility, and credibility of an economic evaluation. A convenience sample of healthcare professionals were surveyed to confirm the attributes and was used to select the subset used in the final discrete choice experiment (see Appendix B). The survey assessed importance of the attributes using five-point Likert scales, and asking respondents to rank their two most and least important attributes. The responses to the questions were used to select the seven attributes, with each attribute having three levels.

The discrete choice experiment design software package NGENE was used to develop the orthogonal fractional factorial design.²⁴⁶ There were no combinations of levels for the attributes that were considered implausible. The experimental design resulted in 18 binary choice sets for presentation. Respondents were randomised to receive one of two blocks each consisting of nine choice sets to reduce the cognitive burden of answering the questionnaire. There was also a repeat choice set that was not included in the statistical analysis but was used as a consistency check—respondents who were not consistent between the duplicate choice sets were excluded from the analysis.^{248, 260}

Respondents were asked to consider a hypothetical scenario where two health economists are available to provide supporting evidence to make a decision on whether a hospital should fund a new piece of equipment. The scenario was chosen to be a situation where it would be feasible that an economic evaluation would be used for a concrete, easy to understand decision. The equipment was not defined, because it would need to be relevant across specialties. Respondents were asked which health economist they would choose. The attributes of the discrete choice experiment were the distinguishing features of the economic evaluations. A forced choice design was used^{248, 261}—in each choice the respondent had to select one of the health economists, without the choice of picking neither. The health economists were labelled “Economist A” and “Economist B”, giving no additional information beyond the attributes and levels. All other factors were assumed to be constant.

4.2.3 Administering the questionnaire

The questionnaire was conducted online (see Appendix C). The front section of the questionnaire provided participant information and confirmed consent to participate. The questionnaire was piloted with 15 respondents. Findings from the pilot questionnaire were used to clarify the scenario and definitions of attribute levels. Some minor changes to the questionnaire layout and phraseology relating to one of the attribute levels were made as a result of the pilot survey to facilitate respondent understanding and completion. The descriptions of the final attributes and levels included in the discrete choice experiment are presented in **Table 10**.

In addition to the discrete choice experiment, the questionnaire included a series of demographic and attitudinal questions. Demographic questions included profession, gender, and previous experience with economic evaluation. The respondents were asked to rank on five-point Likert scales how useful they thought cost-effectiveness information is to decision-making, and how difficult they found the questionnaire to complete. An example choice set was provided at the beginning of the survey along with pre-test questions so that respondents could habituate to the nature of the task and confirm their understanding.

4.2.4 Data analysis

Preferences were analysed using conditional (fixed-effects) logistic regression in STATA.²⁴² Time was continuously coded (in months) after it was confirmed that the level effects were linear. Other attributes were effects coded.²⁶² The coefficients in the model indicate the relevance of those attributes to the choice of economist. A positive coefficient indicates that the attribute makes the economic evaluation more valuable while a negative coefficient indicates that the attribute detracts from the value of the economic evaluation. Willingness to wait was calculated by dividing the regression coefficient attached to the respective attribute level by the coefficient attached to time (treated as a continuous variable).

4.3 RESULTS

4.3.1 Preliminary survey

A convenience sample of 35 health professionals completed the preliminary survey. The difference in the mean rankings was similar between the attributes, indicated that all the attributes were considered important. The attributes from most to least important were quality of clinical evidence ($m = 4.49$; $SD = 0.65$), clearly stating assumptions ($m = 4.30$; $SD = 0.62$), making cost-effectiveness studies easier to understand ($m = 4.30$; $SD = 0.85$), using the simplest valid approach to measuring cost-effectiveness ($m = 4.22$; $SD = 0.89$), rigour of methods used to estimate cost-effectiveness ($m = 4.14$; $SD = 0.72$), avoiding conflicts of interest ($m = 4.08$; $SD = 0.89$), budget impact analysis ($m = 4.00$; $SD = 0.68$), professional training in interpreting and evaluating cost-effectiveness studies ($m = 3.97$; $SD = 0.76$), considering equity effects of healthcare intervention in cost-effectiveness studies ($m = 3.78$; $SD = 0.85$), considering clinical need ($m = 3.76$; $SD = 0.80$), and length of time required to conduct the cost-effectiveness study ($m = 3.69$; $SD = 1.00$).

When the respondents were asked which two attributes they would rank as most important the attributes that were chosen most often were quality of clinical evidence (48.7%), using the simplest, valid approach to measuring cost-effectiveness (32.4%), and avoiding conflicts of interest (18.9%). When the respondents were asked which two attributes were least important the attributes that were chosen most often were “length of time required to conduct the cost-effectiveness study”

(62.9%), “considering clinical need of healthcare interventions in cost-effectiveness studies” (28.6%), “avoiding conflicts of interest” (25.7%), “considering budget impact of healthcare interventions” (22.9%).

Time was not one of the most preferred attributes, but it was included within the discrete choice experiment because it is a factor with established relevance for real-world decision-making. As an attribute time is context specific so its value is likely to be greater when a scenario is provided, such as with a discrete choice experiment. The other advantage of using time as a variable is that it can be used to calculate willingness to wait. Conflict of interest was included because it was “very important” to a subset of the respondents. All of the attributes related to communication, training, and parsimony were viewed as roughly equal in importance, so the attributes were collapsed into a single communication attribute with training and parsimony included in the definition.

Respondents were asked to describe other characteristics of an economic evaluation that are important. The most common response was making sure that the economic evaluation was relevant to the specific clinical setting. Therefore the ‘applicability’ attribute was included in the discrete choice experiment.

Table 10 **Attributes and levels**

Attribute	Definition	Levels
Quality of clinical evidence	Level of bias in the clinical evidence informing the cost-effectiveness study.	<p><u>Good quality</u> – Multinational randomised controlled trial with large sample size or systematic review of multiple randomised controlled trials. Low risk that bias, confounding or chance may have influenced the results. Conducted in relevant population and generalisable.</p> <p><u>Fair quality</u> – A small randomised controlled trial or a good quality observational study. Moderate risk that bias, confounding or chance may have influenced the results.</p> <p><u>Poor quality</u> – Observational study with high risk that bias, confounding or chance may have influenced the results.</p>
Quality of economic modelling	Level of bias in the economic modelling techniques.	<p><u>Good quality</u> – Most accurate measure of cost-effectiveness given quality of clinical evidence; all relevant economic consequences identified, measured, and valued accurately.</p> <p><u>Fair quality</u> – Reasonably accurate measure cost-effectiveness given quality of clinical evidence; most relevant economic consequences identified, measured, and valued accurately.</p> <p><u>Poor quality</u> – Inaccurate measure of cost-effectiveness given quality of clinical evidence; economic consequences not accurately identified, measured, or valued.</p>
Length of time	Time to produce the cost-effectiveness study between first contact with the health economist and completion of study.	<p><u>1 month</u></p> <p><u>6 months</u></p> <p><u>12 months</u></p>
Communication	How easy is it to understand the cost-effectiveness study?	<p><u>Good</u> – Easy to understand. Avoids unnecessarily complex methods or jargon.</p> <p><u>Fair</u> – Mostly understandable. Some unnecessary complexity of methods and some jargon.</p> <p><u>Poor</u> – Difficult to understand. Unnecessarily complex methods with heavy use of jargon.</p>
Equity	How is the fairness (equity) impact of the piece of equipment assessed?	<p><u>Thorough analysis</u> – Potential costs and consequences across socioeconomic and cultural groups analysed in detail.</p> <p><u>Mentioned</u> – Discussion of potential costs and consequences across socioeconomic and cultural groups.</p> <p><u>No consideration</u> – No discussion of costs and consequences across socioeconomic and cultural groups.</p>
Applicability	How applicable are the results to the decision-making context?	<p><u>Specifically applied to context</u>– Applied to specific hospital, department, or other healthcare context. Includes thorough budget impact analysis.</p> <p><u>Generally applied to context</u>– Applied to general decision-making context (Australian healthcare setting). Budget impact estimated.</p> <p><u>Not applied to context</u>– Not specifically applicable to the decision-making context. Conducted in a different context (e.g. in another country). No budget impact analysis.</p>
Conflict of interest	Whether the health economist is employed by or receives funding from a company with financial interests in the results of the cost-effectiveness study.	<p><u>No conflict</u> – Health economist is not employed by or has received any funding by a company with financial interests.</p> <p><u>Independent with industry funding</u> – Health economist works at a university but has received research funding from industry.</p> <p><u>Employed by industry</u> – Health economist is an employer of a company with direct financial interests.</p>

4.3.2 Characteristics of respondents

Ninety respondents completed the main survey and answered all ten choice comparisons. Nine failed the consistency check and were removed from the analysis, leaving a final sample of eighty-one. **Table 11** presents the demographic details of the respondents. A total of 37 (46%) respondents were health professionals, 33 (41%) health researchers, and 18 (22%) were health managers and administrators (7 respondents were health professionals who also had either a managerial or research role). The majority of the respondents (91%) lived and worked in Australia and the majority were female (70%).

Many of the respondents indicated that they had a pre-existing interest in economic evaluation. Thirty-five (43%) respondents had received previous training in cost-effectiveness, mostly in the form of workshops or individual lectures. The majority of respondents thought that cost-effectiveness evidence was “useful” or “very useful” for healthcare decision-making (65%) and had at least sometimes used cost-effectiveness evidence for healthcare decision-making (62%). Several respondents had been involved in developing (20%) or commissioning (14%) economic evaluations or had worked with a health economist (37%). When asked how difficult they found the survey 31% found it “not difficult”, 53% “slightly difficult”, 13% “difficult”, and 2% “very difficult”.

Table 11 Characteristics of respondents and their experiences with economic evaluation (N=81)

Characteristics	Categories	N (%)
Gender	Female	57 (70.4%)
	Male	21 (25.9%)
	Other/Not answered	2 (2.5%)
Profession category	Health professional	37 (45.7%)
	Health manager/administrator	18 (22.2%)
	Health researcher	33 (40.7%)
Previous training in economic evaluation	Yes	35 (43.2%)
	No	46 (56.8%)
Previous worked on economic evaluation	Yes	16 (19.8%)
	No	65 (80.2%)
Previous commission of economic evaluation	Yes	11 (13.6%)
	No	70 (86.4%)
Previous worked with health economist	Yes	30 (37.0%)
	No	51 (30.0%)
How often do you use cost-effectiveness information for healthcare decisions?	Never	16 (19.8%)
	Seldom	15 (18.5%)
	Sometimes	35 (43.2%)
	Often	12 (14.8%)
	Almost always	3 (4.3%)
How often do you think you should use cost-effectiveness information for healthcare decision-making?	Never	3 (3.7%)
	Seldom	4 (4.9%)
	Sometimes	17 (21.0%)
	Often	38 (46.9%)
	Almost always	19 (23.5%)
How useful do you think cost-effectiveness information is for	Slightly useful	5 (6.2%)

healthcare decision-making?	Fairly useful	13 (16.0%)
	Useful	30 (37.0%)
	Very useful	23 (28.4%)

4.3.3 Analysis of preferences

The conditional logistic regression model revealed a good model fit (McFadden's pseudo- $R^2=0.267$). The β -coefficients of the model, representing the preference weights associated with the attributes are presented in **Table 12** and **Figure 8**. Respondents exhibited statistically significant ($p<0.05$) preferences for fair and good quality clinical evidence, good quality economic modelling, having a shorter time to wait (in months) for the completion of the economic evaluation, good quality communication, thorough analysis of equity impact applicability (general or specific), and having no conflicts of interests. The greatest willingness to wait was for good quality economic modelling (19.8 months), good communication (14.9 months), avoiding conflicts of interest (12.9 months), and good quality evidence (11.3 months). Respondents were also willing to wait almost a year to make sure that the evidence is generally (8.3 months) or specifically (10.1 months) applicable to their clinical context. The respondents were willing to wait almost a third of a year (3.7 months) to have at least fair quality clinical evidence.

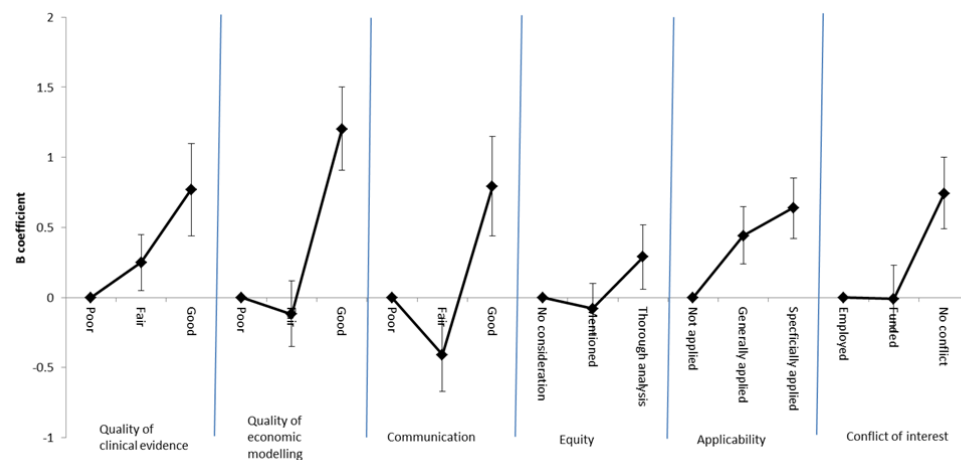
Table 12 Results of conditional (fixed-effects) logistic regression of respondent choices

Attribute	Excluding inconsistent responses				
	Level	Mean parameter	95% CI	<i>p</i>	Willingness to wait (months)
Quality of clinical evidence	Fair	0.25	[0.05, 0.45]	0.02	4.9
	Good	0.77	[0.44, 1.10]	<0.01	14.9
Quality of economic modelling	Fair	-0.12	[-0.35, 0.12]	0.33	-2.2
	Good	1.20	[0.91, 1.50]	<0.01	23.2
Length of time	Per 1 month*	0.05	[0.02, 0.09]	<0.01	1.0
Communication	Fair	-0.41	[-0.67, -0.15]	<0.01	-7.8
	Good	0.79	[0.44, 1.15]	<0.01	15.3
Equity	Mentioned	-0.08	[-0.27, 0.10]	0.38	-1.6
	Thorough analysis	0.29	[0.06, 0.52]	0.02	5.6
Applicability	Generally applied to context	0.44	[0.24, 0.65]	<0.01	8.5
	Specifically applied to context	0.64	[0.42, 0.85]	<0.01	12.2
Conflict of interest	Independent with industry funding	-0.01	[-0.24, 0.23]	0.97	-0.1
	No conflict	0.74	[0.49, 1.00]	<0.01	14.4

CI, confidence interval; LL, lower limit; NA, not applicable; UL, upper limit

* Based on attribute levels 1 month, 6 months, 12 months

Figure 8 Pattern of healthcare decision-maker preferences for the design and conduct of an economic evaluation by attribute



4.4 DISCUSSION

Whilst previous discrete choice experiments have included preferences for cost-effectiveness as a decision-making criterion, this is the first study to assess the aspects of an economic evaluation that make it valuable for decision-making. There is a clear preference for a good quality economic evaluation that is specifically applicable and communicated well by an independent researcher. High methodological rigour was valued, but did not dominate; methodological rigour alone does not determine the value of an economic evaluation. The healthcare decision-makers valued timeliness, but were willing to wait for an economic evaluation that was high quality in terms of modelling, clinical evidence used, and communication.

Preferences of the respondents were not sensitive to all changes in attribute levels. There was a strong preference for good quality economic modelling but no significant difference in preference between fair and poor quality economic modelling. The lack of preference for fair quality economic modelling could be because the respondents are less familiar with economic evidence than clinical evidence – respondents might believe that they can adapt to clinical evidence with moderate level of bias but not to economic modelling with moderate risk of bias. The unintuitive findings for communication might have a similar explanation; if the evaluation is not completely understandable then there is the risk that a crucial element to interpreting the evaluation will not be understood by the decision-makers. There was little difference in preference between having a conflict of interest through being employed or through being funded by industry. Similarly, although there was a preference for a thorough equity impact analysis, respondents did not prefer mentioning potential equity impacts over no consideration of equity. The preference for being generally applicable was similar to the preference for being specifically applicable.

The complexity of the discrete choice experiment task was mitigated by the high levels of education of the study population and the design of the survey instrument. Most of the respondents (84%) found the survey “Not difficult” or only “Slightly difficult”. Only 10% of the respondents failed the consistency check. The blocked nature of the design might have reduced complexity, as the respondents only needed to answer ten choice comparisons. The pre-test example choice comparison and self-test questions provided further opportunity to understand the nature of the choice task.

An important question with regard to any discrete choice experiment is whose preference should be measured. In the case of this study a broad definition of “healthcare decision-maker” was used to include not only health professionals but also health administrators and health researchers.

Subgroup analysis was consistent over the divergent groups indicating that preferences were not highly determined by the population whose preferences are assessed. The sample size was moderate but in line with studies using discrete choice methods in a similar context, and the sample size was sufficient to support the level of analysis conducted. Moreover, the variety of backgrounds that the decision-makers were from, and the consistency of their responses increases the generalisability of the results.

The attributes within the discrete choice experiment were limited to factors associated with the design of the economic evaluation as these are the most easily modifiable factors, particularly for health economists. Potentially, this may make economic evaluation design factors appear to have greater importance than factors associated with context, process, or the individuals involved.

The respondents had greater experience with economic evaluation than would be expected in a random sample of health professionals, administrators, and researchers. The greater experience with economic evaluation is likely a result of self-selection, where people with an interest in economic evaluation were more likely to respond to a request to complete a survey about the use of evidence from economic evaluation in decision-making. However, the respondents’ interest in economic evaluation is not a limitation, as the sample represents the people who are more likely to be using evidence from economic evaluation for decision-making at the margin—and so most likely to respond to efforts to make economic evaluations more useful and better quality.

This is the first study to quantitatively measure what determines the value of economic evaluation as a service. The discrete choice experiment is a useful tool for discerning which attributes matter most and what trade-offs are possible. The attributes and levels were designed to reflect the constraints of producing an economic evaluation and the factors that need to be balanced to translate results into healthcare practice. The willingness to wait for the factors that are important to healthcare decision-makers—quality of modelling and clinical evidence, good communication,

avoidance of conflicts of interest, applicability—supports a pragmatic approach to the trade-off of time and quality.

The findings provide guidance for producing, explaining, and communicating economic evaluations to decision-makers. Health economists should aim for high quality methods whilst also ensuring that the findings of an economic evaluation are communicated in a manner that demonstrates applicability to the healthcare context. This work also suggests that decision-makers prefer to wait for good quality research they can understand and trust.

5 EXPERIENCES OF HEALTH ECONOMISTS TRANSLATING EVIDENCE FROM ECONOMIC EVALUATION INTO HEALTHCARE POLICY AND PRACTICE

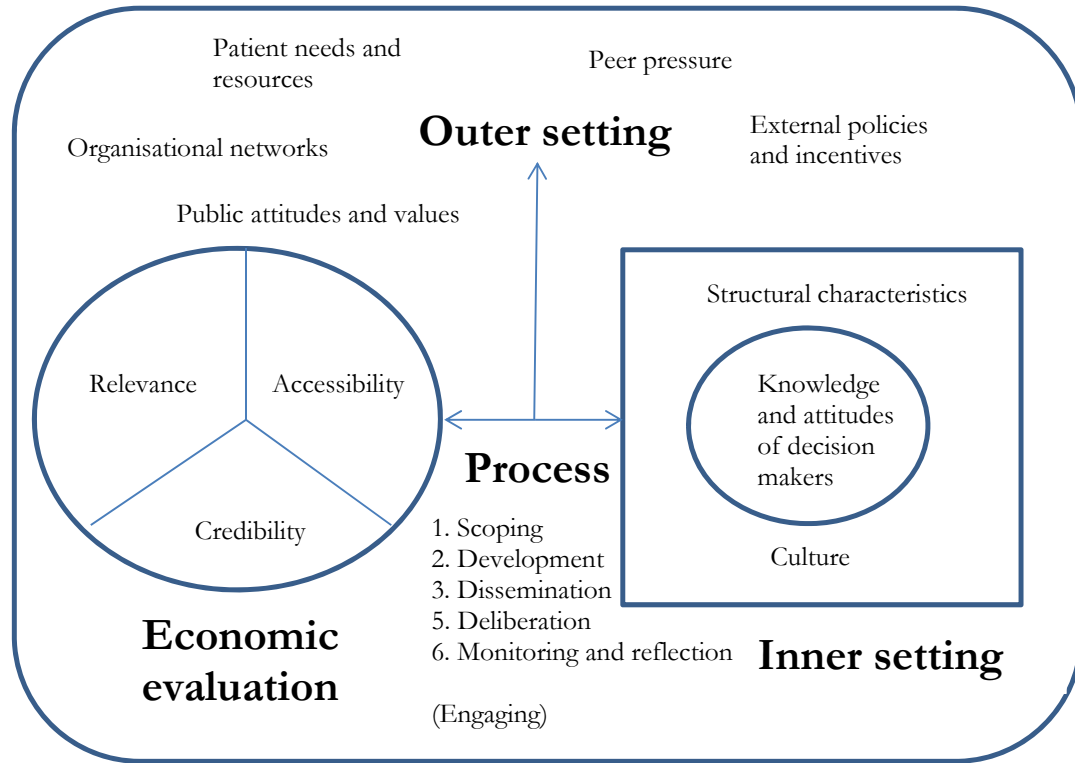
5.1 INTRODUCTION

Several studies have investigated the translation of evidence into healthcare policy and practice from the perspective of researchers from a variety of fields including clinical practice guidelines,²⁶³⁻²⁶⁵ and research on health inequality,²⁶⁶ and the research translation priorities of health research funding agencies.²⁶⁷ Determinants of practice have been identified in the studies that were not identified when only users of evidence were interviewed. The researchers have more detailed understanding and have more experience implementing strategies to facilitate the use of evidence.

Qualitative studies that have investigated the barriers and facilitators to using evidence from economic evaluation in healthcare policy and practice have not gathered the perspectives of health economists. The objective of this study was to learn from the experiences of health economists translating evidence from economic evaluation into healthcare policy and practice, which was achieved through semi-structured interviews with health economists.

The CFIR-EE provides the theoretical framework used in this study (**Figure 9**; see **Chapter 1**). The CFIR-EE consists of five domains: (1) the characteristics of the economic evaluation; (2) the individual decision-makers who use evidence from economic evaluations in healthcare decision-making; (3) the inner setting where the healthcare decision-making occurs; (4) the outer setting representing the wider political, cultural and economic context; and (5) the process of implementation.

Figure 9 CFIR-EE



CFIR, Consolidated Framework for Implementation Research adapted for Economic Evidence

5.2 METHODS

5.2.1 Data collection

In-depth interviews were conducted in person with a purposive sample²⁶⁸ of health economists recruited from Australia and the UK—two of the world’s leading countries for economic evaluation and HTA.⁶¹ The health economists were chosen based on their high level of expertise, and experience and to reflect a variety of decision-making settings and a variety of economic evaluation types. The variety in backgrounds was chosen to allow for the identification of factors relating to the setting or the nature of the economic evaluation that influence translation. All of the health economists provided consent for the interviews.

The interviews were organised around three questions:

1. *I would like you to think of an economic evaluation that you have worked on in the past couple of years. Preferably one that is now finished. Can you explain the process from the very beginning to the end?*
2. *In what ways can the process of producing economic evaluations be improved?*
3. *What do you think are the most important things you as a researcher can do to translate evidence from economic evaluation into healthcare practice?*

Further questions pursued and clarified emerging themes. An interview guide was developed (Appendix D), and was revised during the study. The most significant change was in the manner that the questions were asked—the protocol was revised so that at the beginning of the interview the health economist would be informed of all three questions that were to be addressed. Informing the health economists of all of the questions upfront allowed the health economists to focus on the issues that they thought were most important. The interviews were between half an hour to an hour long with most being over 45 minutes long. The interviews were audio recorded and transcribed non-verbatim by GM.

5.2.2 Research ethics

The study was approved by the Queensland University of Technology Office of Research Ethics and Integrity (Ethics Clearance Number: 1500000245). Written informed consent was obtained from participants prior to commencing the interview. All data were protected and available only to the authors. Every effort has been made to ensure that the participants are not identifiable. In order to maintain confidentiality, the health economists were given labels (HE1, HE2 etc.). The academic titles were organised as either Lecturer or Professor/Associate Professor.

5.2.3 Data analysis

Deductive thematic analysis was conducted²⁶⁹ using the CFIR-EE as a theoretical framework. There were two steps in the analysis. In the first step the interview transcripts were read and participants' responses on how to translate evidence from economic evaluation into healthcare practice were identified and openly coded—identifying elements relating to the translation of evidence from economic evaluation into healthcare policy and practice. In the second stage this coded content was compared with the constructs and domains of the CFIR-EE to identify where the content fit within the domains and constructs of the CFIR-EE and to identify coded content that does not fit. Codes were continuously compared between transcripts to ensure consistency and comprehensiveness. Quotes from the participants were used to highlight the themes.

5.3 RESULTS

5.3.1 Participants

Nine health economists participated in the semi-structured interviews (**Table 13**). Four were from Australia and five were from the UK. The economic evaluations discussed as examples were a range of types including trial-based economic evaluations, modelled economic evaluation, MCDA, and one health economist who focussed on methodological rather than applied economic evaluation research. The transcriptions of the interviews can be found in Appendix E.

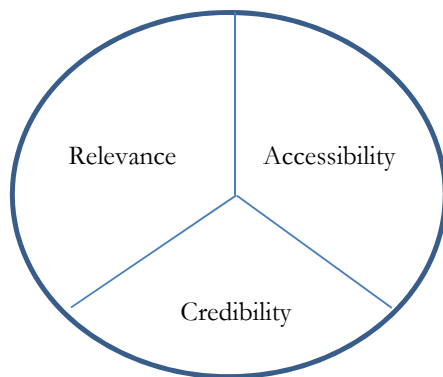
Table 13 Participant characteristics

ID	Country	Nature of economic evaluation	Position
HE1	Australia	Trial-based	Professor/associate professor
HE2	Australia	Modelled	Lecturer
HE3	Australia	Modelled	Professor/associate professor
HE4	UK	MCDA	Professor/associate professor
HE5	UK	MCDA/modelled	Lecturer
HE6	UK	Trial-based	Lecturer
HE7	UK	Modelled	Lecturer
HE8	UK	Methodology	Professor/associate professor
HE9	Australia	Modelled	Professor/associate professor

MCDA, multiple-criteria decision analysis

5.3.2 Domain 1: Characteristics of the economic evaluation

The characteristics of the economic evaluation are the features in the design, methods, and presentation of the economic evaluation that are relevant in terms of translation in healthcare policy or practice. The domain can be described using three constructs of relevance, accessibility, and credibility (**Figure 10**). As described in **Section 2.3.1**, an economic evaluation is relevant if it is applicable to the specific decision-making context. Accessibility depends on the economic evaluation being obtainable, understandable and timely. An evaluation is credible if it is perceived as trustworthy, which depends on several factors including the rigour of the methods, the source of the evaluation, and expectations of results.

Figure 10 Characteristics of the economic evaluation

5.3.2.1 Relevance

Relevance was an implicit factor discussed in all of the interviews, and was explicitly discussed by three of the nine participants. Each of the three participants mentioned relevance on more than three separate occasions.

HE7 found that in most cases the research from the economic evaluations did not translate into healthcare practice.

You mean like research going into the ether? You just publish and that's it, and you don't know if it's going to be used or not? I think that's the majority. HE7

The aspects of an economic evaluation that determine its relevance include the **research question** addressed by the evaluation, the need to consider **criteria other than cost-effectiveness**, and the **time dependence** of the evaluation.

HE3 discussed the relevance of the **research question**.

Make sure that you're researching a practice relevant question. You really want your question to be driven by people in practice addressing a relevant problem. ... You could research lots of things, but it's the ones that address real world problems for people in practice or in clinical areas that are likely to be driven ahead and taken up by people in clinical practice and that are likely to make a difference. HE3

HE5 noted the importance of decision-making criteria other than cost-effectiveness, particularly budget impact, which was seen as more important than cost-effectiveness by health policymakers at the local government level. As pointed out by several of the health economists, sometimes there are things that are **valued** where we cannot put a monetary value on them.

...we shouldn't just have a cost-effectiveness health system because that would be a strange thing. We wouldn't save premature babies; we wouldn't prolong life for terminal cancer when maybe we should prolong their life for a year. HE1

I would probably be one of the first to say cost-effectiveness is important but it's not the be all and end all. To be honest I'd be concerned if we lived in a world where cost-effectiveness was seen as the be all and end all. HE3

HE2 recommended doing economic evaluation within “a broader evaluation framework, considering the value of that service to the community and to society and bringing in other principles that are founded in economics—like rule of rescue and equity issues—but do not fit nicely into a traditional economic evaluation.” Otherwise, “it can be misleading in the same way that just looking at effectiveness without the economic evaluation is misleading.” HE3, HE4, and HE5 all discussed the potential use of MCDA to aid decisions in situations where decision making criteria other than cost-effectiveness should be considered. HE5 discussed the use of MCDA to factor innovation in healthcare decision-making.

...a lot of people thought about how innovation should be captured within economic evaluation. And MCDA was initially one of the methods that captured that... HE5

HE2 discussed the impact of **time dependence** on the relevance of economic evaluations:

I tend to evaluate things within a very short timeframe, which is also challenging because if your programme will probably become more efficient over time as you get slicker at doing things and you create more demand for your programme. But quite often they are doing it earlier on in the piece. So you get this massive set up costs and only a handful of patients in the first few months. HE2

An implication of these upfront costs is that it can make programs seem less cost-effective than they would be in the long term—but perhaps the long term measure of cost-effectiveness is the more relevant measure.

5.3.2.2 Accessibility

The construct of accessibility refers to whether the economic evaluation is affordable, understandable and available in a timely manner. All of the participants discussed accessibility in some form; the most common issue was related to the importance of **communication**. Characteristics of communication discussed included **choice of language, clear descriptions of assumptions, level of detail, precision, explaining concepts, tailoring to mode of communication, evidence summaries**, and the **presentation of results**. Other determinants of accessibility include **cost, timeliness, and complexity of study design**. Five of the participants referred to some aspect of accessibility at least five times.

HE3 discussed the importance of explaining research in a way that people understand.

It's important that the people who are interested in the answer to the question can understand what you've done; otherwise they are not going to believe what you say. But that's about having them on board and ensuring that it is reported in a way that can be understood. HE3

The **language** used must be appropriate for the intended audience.

You need to use the language that makes sense to people from a health background. HE3

There's barriers for the reader—the end user—to say “what does this all mean?” It's got to be in a format and language so that they can understand. HE9

HE3 and HE6 discussed the importance of providing a **clear description of assumptions** to ensure transparency.

I think it's about clarity. You've got to report in a clear way so that people should be able to understand what you have done and it should be clear what assumptions are based on. HE3

One thing we learn is that at every step to make clear what we are doing is consistent with their research plan and research question; making the economic evaluation design transparent. HE6

Several of the health economists discussed their approaches to deciding the **level of detail**, how much or how little to show. The suggestions include finding a compromise between quality and relevance, minimising unnecessary details, and not necessarily presenting every analysis that has been conducted.

It was actually a bit of a compromise in a way between what we actually had good data to show and what was meaningful in terms of their decision. HE2

But I wouldn't have gone into extreme detail... in the manuscript of course and in the report I would have reported but in clear language without dwelling too much on distributions. HE3

Part of the communication and presentation of results requires **conveying concepts** of cost-effectiveness. HE8 discussed how they go about conveying difficult concepts.

I don't think there is one way to present things and I'm constantly thinking if somebody doesn't get it there's a reason. It's your fault. If people don't understand what you've done then it's your fault. HE8

The presentation should be **tailored to the mode of communication** and the understanding of the audience. HE3 produced a more detailed evaluation to be presented to a HTA organisation, but that was then shortened to a simplified presentation for a wider clinical audience at conferences.

If you've got a more technical audience you need to give enough of an indication of the technical rigour that underlies what you are doing. But that doesn't necessarily mean you have to report it in a complex way. It's about how you explain things and the level of knowledge that you expect your audience to have. You are better off explaining things in less technical language and assume a lower level of knowledge as a general rule. If you are talking to a health audience you largely need to focus on the consequences in terms of health and clinical aspects and explain and interpret what has happened underneath. And you generally need to keep things quite quick and precise. If you are talking to an economic audience you need to provide more detail on the exact type of modelling that has been used and more technical detail generally—which would be completely lost on a health audience. HE3

HE1 recommended developing **evidence summaries**.

So we have a really nice, easy to read five page summary of the literature and the take home messages... So we say this is what we think the literature is saying here are the weaknesses and strengths. This is what it would mean for health services. ... Taking the difficult evidence and turning it into a simple story. HE1

HE4 also recommended summaries, but in a video format.

I would say the prime output of a cost-effectiveness analysis should be a ninety second video. That should be your goal, your prime deliverable. Explaining what happened, why. But you can't think that's possible when you've got a problem. Forget the paper, nobody will read the paper. H4

Sometimes there are practical issues where **presentation formats** become unmanageable when presented many times for subgroup analyses and intervention comparisons. HE8 criticised the overuse of cost-effectiveness acceptability curves—a way of presenting the uncertainty of whether an intervention is cost-effective at different cost-effectiveness thresholds.

They're a nightmare. Doing an appraisal when you've got 15 bloody scenarios and you are looking at curves. I mean, they're not helpful for a decision-making process. What's much more helpful is to just see a table. HE8

HE8 also preferred summary tables compared with the use of networks of evidence.

I think networks of evidence is another example. I personally don't like the diagrams. I understand them but I don't particularly like them. What I want to see as a decision-maker is a table. And you can put a lot of information in a very simple summary table. HE8

HE1 and HE2 stressed the need to minimise the complexity of study design. Complex design can have the same effect as poor communication—lack of transparency to the decision-maker and increased difficulty to understand and use in decision-making.

When it's complicated then a decision-maker is not confident enough to change their service around something they can't defend. HE1

...you want to keep things simple. You don't want to go into overkill. Because people need to be able to understand what you've done. HE2

For HE5, cost of conducting economic evaluations was identified as a barrier at the Local Health Authority level but not for the centralised decision-making at NICE. MCDA was successfully used as a low cost alternative to conducting a full economic evaluation.

At the local level—or even in low or middle income countries where there is not enough time and resources to do the same things that people do in the UK or in Australia or Canada—MCDA is useful. HE5

HE4 advocated the use of MCDA for the same purpose; allowing decision-makers to trade between timeliness and rigour, whether it is done “...within five minutes, ten minutes, or ten weeks”.

You choose how much time you are willing to engage with this. MCDA is the only way we can open up the decision-making to the ordinary person. So the language and competence is pretty much already there and if you make it more complex you are losing them straight away. HE4

HE3 did not think the clinician's time to access an economic evaluation was a major factor in whether evidence would be used in practice.

...my general feeling is that if a clinician is interested in something they will access it... My general experience is that clinicians working in particular fields are very good at being up to date. HE3

5.3.2.3 Credibility

All of the interviewees mentioned the rigour of the economic evaluation in some form; either obtaining good quality clinical data, the appropriate methods for economic modelling, or some other factor. Seven of the nine participants discussed elements relating to some other aspect of credibility, such as the source of the economic evaluation.

Credibility is necessary in order for the evidence to be “*defendable and justifiable*”[†], and is needed in order to make “*good, accountable, evidence-based decisions*”[‡]. Credibility depends on the **rigour of the methods** used; the **robustness of the results**; **expectations** about the results; **publication** in academic journals; the level of **engagement** with clinical experts, decision-makers and other stakeholders; the **personal characteristics and affiliations of the health economist**.

HE3 described the process of ensuring **rigour of the methods** for conducting the economic evaluation.

It's about choosing the appropriate method to address a research question. HE3

HE7 emphasised the importance of good quality data to ensure rigour.

It's about having robust data using large data sets if possible or models that consider all types of evidence to avoid selection bias. HE7

Rigour is required in order to demonstrate cost-effectiveness in a robust manner. HE3 found that **robust results** increase translation into practice.

I'd think if you've got robust results that it's not cost-effective it would change opinions about whether it should be implemented more broadly or supported or extended. Or question why it's not cost-effective. Or reevaluate, again. HE3

[†] HE3

[‡] HE8

HE3 found that if the results of an economic evaluation are **consistent with expectations** the findings are more likely to be perceived as credible.

If findings are against what everyone else expects then everyone else will immediately say “well, is that right?” HE3

HE1 discussed how the credibility of health economists depends on publication in high impact journals and receiving large research grants. However, it was noted by HE7 that published evaluations, particularly models are more likely to be cost-effective; particularly if they were funded by the pharmaceutical or medical device companies.

We have all these studies coming up of particular things, if it is a model it’s more likely to be cost-effective... and if its sponsor led then it’s really cost-effective. HE7

Engagement with clinical experts, decision-makers, and other stakeholders is an important to ensure that the right methods are selected.

Try to involve other experts if needed so that you choose the right method not just one that you would like. I often work in teams which brings more than one perspective. HE3

Personal characteristics of the health economist, including even-handedness, professionalism, expertise, and stage of career, can all influence credibility. HE2 advised even-handedness, “I think it gains a bit of trust from the different parties that you’ve actually done it from both points of view.” HE2 also discussed the importance of the health economist’s professionalism.

I think being professional about how you deal with people. ... I think people get this sense of “oh, is that all we are doing?” sometimes. I think they want to feel that they are doing something rigorously and not necessarily complicated. ...going in with a data collection tool which might just be an excel spreadsheet that I have knocked up which breaks things down into categories—as opposed to just sitting and having a chat and scribbling in my scruffy notebook and going “oh, is there anything else you can think of”. I think it’s about having a process. HE2

Project management skills are part of professionalism.

I think the criticisms that come back about the universities are if you think about it more about the manner of working than what you are doing. So I think failing to get back to people promptly not sending things through when you said you’d send them through. Poor project management, so no one has a clue what is going on and when. HE2.

Another aspect of professionalism is the health economist’s ability to explain their choice of methods. When the health economist is able to explain their choices of methods decisions-makers

get the sense that they are “...*actually working with someone who can add additional expertise and theory to their problem that they wouldn’t have necessarily had themselves.*”

HE2 and HE3 discussed the importance of the health economist’s expertise and knowledge of the clinical area for building credibility.

I think it’s good to have done a bit of background reading so that you are not asking really stupid questions. HE2

...Keeping up with the literature in the area. Or doing a literature review in the area to ensure that you are working appropriately in the area. HE3

HE1 wondered whether health economists at later stages in their career might focus more on relevance and accessibility rather than pure credibility.

Ambitious researchers who want to build a CV will be attracted by Lancet. But maybe that’s a stage of career thing. Maybe after you’ve built a CV with a hundred papers in in and you’ve got grants then maybe you’re not so ambitious to make a name. Then you might want to actually get credit in other ways—trying to actually improve health. HE1

HE1 described an experience where a simple and accessible economic evaluation was seen as not credible by a journal reviewer because it was too simple.

We got a paper back from a journal and one of the reviewer’s comments was this is a rather simple analysis as if that was a bad thing and I thought that was a strength. HE1

Affiliation was a potential source of credibility.

You need to have a logo that people think is cool. That’s why the consulting firms do well. Because people think their logos are cool. They’d say “look, you need to get to this answer and you need to put a logo on the report, then we will show it to other people”. HE1

HE2 discussed how economic evaluations are more likely to have traction if developed as part of guidelines or as part of a large report—partly because of increased credibility but also increased accessibility. However, HE2 was not sure university affiliation carried weight.

Because quite often I think there’s this sense of “god you take ages, you’re really slow, you’re really pedantic, you communicate things in a way we can’t understand”. There are people who prefer working with a more commercial consultancy firm because what they get is more straightforward. And some of them do a good job as well. And I think there is also sometimes a sense that you might just go off and do your own thing and actually we just want you to do this. HE2

5.3.2.4 Summary

All of the health economists discussed relevance, accessibility, and credibility. Relevance depends on the research question, the adaptability of the economic evaluation to specific contexts, and the need to consider criteria other than cost-effectiveness. Accessibility depends on the choice of language, the complexity of the design, the transparency of the methods and assumptions, the level of detail, and whether the communication is tailored to the audience and the mode of delivery. Cost and time can also be barriers to accessibility. Credibility depends on methodological rigour, robust results that meet expectations, professionalism, external approval through publication or affiliations, and engagement with decision-makers, clinical experts, and other stakeholders. Several of the health economists pointed out that sometimes trade-offs are required between relevance, accessibility and credibility.

5.3.3 Domain 2: Inner setting

The inner setting is the structural and cultural context of the organisations the individual decision-makers work within.¹⁴⁰ The structural characteristics are what make up the organisation—how centralised the decision-making is in the organisation, the number of individuals in the organisation, what groups of individuals are there in the organisation. The cultural characteristics are the norms, values, and assumptions of an organisation.²²⁸ The networks and communications are the nature and quality of the social networks and communications within the organisation and with the health economists. Economic evaluations are most likely to have an impact in a culture that values efficient use of resources, has evidence-based medicine and the importance of cost-effectiveness as assumptions, or has norms regarding use of evidence from economic evaluations. The choice of cost-effectiveness threshold was a relevant factor associated with the inner setting that depends on both structural characteristics and culture.

5.3.3.1 Structural characteristics

Six of the health economists discussed how structural characteristics of the decision-making organisation affect how and whether the organisation will use evidence from economic evaluations. Four of the health economists mentioned the structural characteristics on three or more occasions during the interview. Five of the health economists explicitly discussed the impact of having a centralised decision-making group, such as NICE or the PBAC.

When the decision-making is centralised there can be a direct link between the economic evaluation and the decision. If the target audience of an economic evaluation is outside of a group such as NICE or the PBAC then translation of evidence from economic evaluations can be more challenging. Divided budgets can mean that cost savings are only valued if they are accrued within

the internal budget. The societal benefits in health measured by QALYs are not highly relevant to organisations such as hospitals in Australia where the focus is more on the business case.

I don't think the driver for this one was can we optimise a service. You know, it wasn't about can we improve life and we are prepared to pay more to get better patient outcomes. It was about can we afford to do this. [GM: Is it more like a business case?] Yeah. That's how it was. HE2

Communication of findings from the economic evaluations is more challenging when the decisions are not centralised.

Because now each of them is their own entity, has their own thing, they don't really communicate with the one down the road, which is very sad. And now some Hospital and Health Services undertake economic evaluations—or cost analyses—for certain interventions but the evidence doesn't get to anywhere else. No one else knows. HE9

There is a distinction between what is useful to an external funding group and what is useful to individuals making decisions in healthcare practice.

... Evaluation adds this extra layer of monitoring and analysis and reporting on top of that which is really valuable for people externally but might actually not very important for people who can just see if it is working or not working. I think you see it with funding bodies like aid agencies and things when they are giving out money to people to implement community disease control programmes and then they are insisting on very stringent evaluations of those but the people who are actually doing it there, they are trying to put a programme to address a need, and monitor for their own purposes to make sure it is running properly. And the evaluation is kind of useful for them but it is more useful for the donor agency for deciding which projects they will choose to fund or not.

There is often not the funding to do economic evaluations at the local level and in low-to-middle income countries,

I was involved in looking at local trusts and whether they considered cost-effectiveness evidence, and we asked which ones they were implementing and which ones they were not, and we plotted to see if there was a trend. And there wasn't a trend; they were not considering any cost-effectiveness evidence. Because I think at the local level, first you don't have the resources, and then you have to implement it somehow, lack of understanding of the cost-effectiveness evidence so lack of reliability of a lot of the cost-effectiveness evidence. HE2

Although MCDA might provide an alternate, cheaper method of incorporating measures of cost and effectiveness for decision-making.

At the local level—or even in low or middle income countries where there is not enough time and resources to do the same things that people do in the UK or in Australia or Canada—MCDA is useful. Thailand uses it, and Malaysia, and South Africa. HE5

5.3.3.2 Culture

Six of the health economists mentioned the role of culture within the decision-making context. One of the health economists explicitly discussed culture on more than two separate occasions.

Some organisations have cultures that are designed around economic evaluation for decision-making, such as the PBAC and NICE.

It's always quoted that there are some areas where the culture is not amenable to value for money as evidence. HE3

The amenability of cultures using economic evaluation in decision-making differs between different clinical areas and evaluation programmes.

There are some areas where it's about trying to produce the same patient outcomes but at a low investment and other areas where they are much more open to the findings where you actually have to invest more but you'll achieve better outcomes with patients. HE2

HE9 found that the PBAC was resistant to using probabilistic sensitivity analysis.

I asked that question of NICE and they said, "Well, we'll look at that in three years' time." The whole apparatus is ossified. HE4

5.3.3.3 Cost-effectiveness threshold

Four of the health economists identified the cost-effectiveness threshold of decision-makers as an important factor. In the Australian context the problem was a lack of a well-defined threshold.

The big Achilles heel is our floppy threshold. Because the threshold is almost anything you want it to be. It's from zero, which is how the state was running business for a few years. They wouldn't spend any more money to improve health. So their threshold was effectively zero. Only cost saving programs... up to \$400,000 or \$500,000 if you are going to help a child with cancer. So the threshold makes everything a bit of a joke because there is no threshold. HE1

HE4 argued with NICE against using different cost-effectiveness thresholds for different health conditions

We are simply saying that if you are claiming to be equitable you have to use the same number, whether it is about cancer or heart disease. If you change that number—the whole purpose of setting up NICE is to be consistent. HE4

But even if the cost-effectiveness threshold is defined it will result in suboptimal decision-making if the threshold is too high, as was argued by HE5 and HE8.

In some ways there is no point in trying to get the best evidence into practice if you know that the threshold is three times higher than it is meant to be. HE5

It's also helpful in terms of thinking about whether NICE is doing more harm than good, and what the consequences of NICE being pushed to say yes when it should be saying no are. HE8

The perception of the movable cost-effectiveness threshold was highlighted in discussion of the Cancer Drugs Fund in the UK. The Cancer Drugs Fund was singled out by HE8 as a particularly inefficient use of resources from a cost-effectiveness perspective, raising the bar for the cost-effectiveness threshold for cancer drugs.

The Cancer Drugs Fund is like a blank check and what it demonstrates beyond any shadow of a doubt is that there isn't a blank cheque big enough to fill this hole. HE8

5.3.3.4 Summary

The inner setting can be defined by its structural and cultural characteristics. Structural characteristics includes the centralisation of decision-making, whether there is funding for producing economic evaluations. Cultural characteristics include whether the organisations are designed around economic evaluation for decision-making and level of resistance to change. Whether an organisation uses a cost-effectiveness threshold and how high a threshold they use can be a mix of structural and cultural factors. The nature of the cost-effectiveness threshold affects the quality of the decision and the credibility of using evidence from economic evaluations in decision-making.

5.3.4 Domain 3: Characteristics of decision-makers

The third domain of the CFIR-EE is the individual decision-makers who are within the inner setting.

5.3.4.1 Attitudes

Seven of the health economists discussed decision-makers' attitudes to economic evaluation. The health economists generally found that healthcare decision-makers had some interest in economic evaluation.

I've never had anyone say to look at cost-effectiveness is not good. HE3

HE3 had heard negative comments from healthcare decision-makers about the hypothetical nature of the evaluations.

I think if people have been trained strongly in evidence-based medicine and levels of clinical evidence, sometimes excepting that you might model something not based on randomised controlled trial evidence or that you might use preference data based on hypothetical decisions. Those sorts of things, sometimes people feel uncomfortable with. HE3

Individuals will approach evidence—such as evidence from economic evaluations—with their own sets of biases, preconceptions and self-interest.

People don't respond to evidence rationally. HE1

HE1 and HE4 found that sometimes evidence from economic evaluation was used to substantiate decisions that had already been made.

If somebody has got to a position based on gut instinct and a bad back of the envelope type of approach, which is how most of these things are done and they find a paper that supports that view then they will stand squarely behind the paper because it validates their pre-existing position. What I'm trying to say is I haven't actually seen people switch based on a cost-effectiveness study that they weren't doing. HE1

At the moment I think NICE are used to saying "we've done a thorough economic analysis, here the result." But in most cases I think the decision is taken and it's judged on whether it supports the case. If it doesn't support the case then it will be rejected. ... HE4

Economic evaluation can be useful for price negotiation, rather than simply a decision-making tool.

I think the work that we did – we've been told at least, the work that we did – helped them in their negotiations – the pharmaceutical renegotiations, pharmaceutical price regulation – in some respects underpinned the fact that they were able to negotiate a cap on pharmaceutical pricing, so I'm very happy with that. HE8

A factor identified as relevant to positive attitudes about an economic evaluation is the sense of ownership. Ownership depends on understanding, credibility, and engagement in the evaluation process.

It's not ok for them to say "I read this abstract and it seemed like a good idea". They need to own that research and defend their decision. Unless you have done the research yourself it's really hard to have that understanding of the paper. So I think it's about ownership and it's about credibility. HE1

But I think with the evidence it's tricky because in some ways the policymakers have to buy in. I think the main thing will be to get the policymakers to understand the value of what you are doing and then it will come... HE5

Negative attitudes about outcomes used in economic evaluations can be a barrier. HE6 found that clinicians preferred functional outcomes rather than the use of QALYs.

... They tend to have more confidence in clinical based measures, which are generally validated in their real setting. That's why perhaps quality of life is still a bit controversial or at least less accepted as a meaningful. HE6

If it is something that is outside their familiarity they just frown at it. The functional measures rely more on clinical judgement, when confronted with patient reported outcomes they are like "yeah, yeah, yeah... The patient only knows so much." Obviously the patient knows how they feel, but when it comes to reflecting any gains the clinicians think the patients aren't in the best position to know them. HE6

HE3 identified the risk that decision-makers might have too high an opinion of economic evaluation and not be sufficiently critical.

I think one of the risks of people not understanding all the things underlying cost-effectiveness is that they don't understand weaknesses and limitations and then they are at risk of thinking "well, if something is not cost-effective we shouldn't do it". HE3

5.3.4.2 Knowledge

Four of the health economists discussed decision-makers' knowledge of economic evaluation as a factor.

Knowledge about economic evaluation and familiarity with methods of economic evaluation amongst healthcare decision-makers was seen as variable. Knowledge was highest for centralised decision-making groups that explicitly included economic evaluation as part of the decision-making process such as NICE and the PBAC.

They were a group of people who were quite immersed in evidence-based medicine and decision-making already. And some of them would have been involved at a state level for different processes. So it would be variable. But I'd imagine that the concepts would be understood but the technical details would not as a general rule. HE3

Sometimes there was awareness of terminology but not necessarily detail.

Sometimes you have to do a lot of interpretation. Often people they want an economic aspect to their study, but they often don't know the best way to do the economics. It's so variable because some clinicians have done economic evaluations in some way and you'll meet people who have done none. HE3

[At NICE] Everyone knows and understands so there is no explanation around what a cost-effectiveness acceptability curve is and what a plane is and what a relevant measurement is. They already understood. It's more checking whether the assumptions are valid, and the choice of states in the model, and whether anything needs to be done. At the local level there is no... they do lots of other things so they can't have the same level of rigour. They don't have the same level of process measures or guidelines. HE5

5.3.5 Domain 4: Outer setting

The outer setting refers to the economic, political, and social context around the decision to use evidence from economic evaluations in healthcare decision-making.¹⁴⁰ Factors in the outer setting that relate to the use of evidence from economic evaluations in healthcare decision-making include funding and healthcare budgets, the incentives of health economists, political influence, current practice and the problem of disinvestment, and the media.

5.3.5.1 Funding and healthcare budgets

Four of the health economists discussed healthcare budgets and funding for economic evaluations. As healthcare budgets tighten there is greater pressure to identify and cease funding for futile interventions. HE2 discussed the nature of healthcare budgets with greater constraints on resources with the focus of economic evaluation as a way of monitoring and measuring the performance of new initiatives.

On the other hand, economic evaluations require funding. HE7 described the high quality data and professional expertise required for a rigorous economic evaluation, but that was only possible because their group had “*very good funding*”. Countries with more funding for conducting economic evaluation are also likely to build capacity and specialisation in evaluation.

I think UK is ahead partly because of methodology. On the MCDA taskforce three of the people from the UK run it. So they're more aware of MCDA in terms of whether they are actually using it or not, I think hard to know. There are more discussions around the method. Whether they actually use it it's hard to say. HE4

A further challenge is the separation between the funding process for healthcare decisions and healthcare research decisions.

So we have approval decisions that don't take account of the impact on evidence and research, and research decisions, which aren't linked to the decisions that need to be made. HE8

5.3.5.2 Incentives of health economists

Four of the health economists mentioned the incentives of health economists.

The reward structure for conducting economic evaluations within academia was identified by HE1 as a potential barrier to the development of relevant and accessible evaluations.

The way we reward researchers is by numbers of publications and impact factor in journals. If researchers were rewarded based on change to health outcomes then I think there'd be quite different research. But I think at the moment you get a fellowship if you get into big journals and the route to big journals is not necessarily doing useful research; research that can make a huge difference to lots of people. When we moan about cost-effectiveness not being used maybe we should look a little bit inwards as well as outwards. HE1

The reward structure can result in what HE8 described as a “competition of geekiness”.

We've competed ourselves into a geek-hole. “Oh, you've missed a bit, and I've put that bit in!” Collectively, through academic competition, we've dived into a completely pointless hole, and missed the real value, which is making sure we communicate those principles of what assessments are needed really clearly. HE8

HE1 observed the same phenomenon.

We sometimes fall victim to having the fanciest possible modelling approach; booking on to some big trial; tackling an unanswered question so that we can get a really important publication out of it. And we can boost our own standing in the community and strengthen our CV have a better chance of getting a fellowship; a better chance of getting grants. So maybe we're selfish in the way we generate research evidence.

HE1

Economic evaluations with certain outcomes are more likely to receive publicity. HE7 found that the economic burden of disease studies that showed the greatest burden of disease were more likely to be picked up and publicly endorsed by advocacy groups. The advocacy groups then prepare reports, publish press releases, do media interviews, and engage with politicians.

HE1 described doing an economic evaluation where the funders were not pleased with the results. Before initiating the study, HE1 told the funders, “Please don't ask us to do a cost-effectiveness study, because you won't like the answer. There's no way in the world it will be a good answer”. The funders persisted even as HE1 told them “We won't do what you tell us to. We'll interpret the information as we see it. And it won't be a good story.” After the economic evaluation was produced HE1 told them that “it's not looking good”.

And they were “how dare you?” They were gobsmacked. The naivety was incredible. I think people see health economics as simply something they can control and they've just got to get it down, get the right

answer and move on. They don't see us as an objective evaluator. Because cost-effectiveness studies are modelling studies, which are in some way discretionary—what evidence you put in, what states you include, how you deal with uncertainty—we are so vulnerable to that game being played. HE1

HE2 had a similar experience working with researchers who were passionate about a healthcare intervention that was effective but not necessarily cost-effective.

I think they are worried that it undermines the evidence that they've produced about whether it's effective. It's still seen as a negative result and not as publishable and not as palatable. A lot of the things that I get asked to evaluate have been put in as novel things to meet a perceived demand. So the problem is that you turn around and say it wasn't cost-effective. There's still a demand, there's still a need and there is this sense of well if we don't do that what would we do? HE2

5.3.5.3 Political influence

Four of the health economists discussed the role of political influence on getting evidence from economic evaluations into healthcare practice. HE8 found that political influence was not always apparent from the beginning.

Having spent a long time going to meetings, workshops, explaining and realising that the problem wasn't the fact that people didn't understand, the problem was a political one. HE8

HE8 found that NICE were uninterested when the research “wasn't giving them an answer they felt was politically convenient.” When asked what it would take for a minister to take notice of work from a health economist:

A minister will take notice of our work if a minister thinks that by not taking notice it will create a political problem. HE8

HE8 provided a description of the role of the health economist in relation to organisations such as NICE.

My position has always been that they are the ones who are going to have to stand up and go on the radio and take responsibility for what NICE does. And that means that I have to give them the ammunition as to why this is right. And I have to do that, not just in a way that I think is academically correct I have to do that in a way that they truly buy and own and secondly I have to do it in a way that gives them the way of communicating that to a much wider audience. And if as an academic I can't do that then I can't possibly expect them to go over the parapet into a hail of machine gun fire with no weapons. So it's not enough to have a good idea. That's not enough. HE8

HE8 continued.

Now if you give them a perfectly good weapon and they still don't want to go over the top then you have to go over the top or find someone else who is willing to go over the top. Then have them shot for cowardice.

HE8

5.3.5.4 Current practice and the problem of disinvestment

Three of the health economists discussed the problem of disinvestment. Politically it is more difficult to disinvest than to invest in healthcare services. Often the initial investment required an upfront sunk cost. Disinvestment rather than not investing in the first place is also more likely to lead to negative public perceptions as people are losing what they already had.

If it was not cost-effective it's really hard to think whether it [the economic evaluation] would change practice in places at all really. Because then you are in the position where you have to pull out something which is in. HE3

5.3.5.5 Media and public perception

Three of the health economists discussed the role of the media.

HE8 had used engagement with the media to make the case of lowering the cost-effectiveness threshold.

Engaging with the media requires preparation and requires the health economist to develop a new skillset.

I'm much more comfortable doing media stuff. But I have to say I don't like it, there is huge opportunity cost. It is exhausting. The most important thing is that journalists understand your position and your work and are using that to ask the questions. HE8

H8 discussed the type of arguments to make

I go straight to what are the benefits, what is the scale of the benefits, what type of benefits, what do we lose elsewhere? What are the opportunity costs—I don't use the word opportunity cost. What do you get, what are you going to have to give up? These are resources that could have been used for other effective interventions. And then people say it's a difficult decision and I say, absolutely, but the key question is the discrepancy between the price that's charged and how much we can afford to pay for the benefits. HE8

HE8 discussed a potential approach to raising awareness of the opportunity cost of an inappropriately high cost-effectiveness threshold through creating a website called “NICE body count”.

We'll keep track of the number of patients that NICE decisions have killed in the NHS... It's a good threat. You don't want to take notice of it but we will. HE8

5.3.6 Domain 5: Process

The process of translating evidence from economic evaluation into healthcare practice involves multiple stages and the stages are not always linear. Roughly, the process of translating evidence from economic evaluation into practice consists of the following six stages.

5.3.6.1 Scoping and development

The scoping phase is where the research question is determined and the scope of the study is determined. Scoping and development is the earliest stage to determine what trade-offs are required in terms of credibility, relevance, and accessibility of the economic evaluation.

The development stage involves the preparation of the economic evaluation itself. The factor that was repeatedly noted as important during scoping and development was the level of engagement the health economist had with decision-makers and clinical experts. Many of the elements in **Section 5.3.2** refer to scoping and development in translating evidence from economic evaluation into healthcare practice.

5.3.6.2 Dissemination

All of the health economists disseminated their research. There were internal dissemination strategies for within the decision-making organisation and external dissemination strategies for a wider audience.

For those working with a centralised decision-making body or HTA organisation, the primary methods of internal dissemination—direct to the organisation—were through written reports and presentations in person. A few of the health economists had additionally prepared simple summary documents. In one case there was two separate reports for the same intervention, one on cost-effectiveness and the other on budget impact. For some organisations such as NICE and the PBAC the format of the reports is standardised.

They have established guidelines on how to do different things. There are methods on pretty much everything, from reviewing, searching through to statistical analysis and sample modelling, mapping and so on. All of it has good practice recommendations you need to follow. HE5

Publication in academic journals was less of a priority for the funders or decision-making groups than it was for the health economists. The health economists often had approval for publishing the results as part of the contract with these funding organisations. Sometimes the individuals of the funding or decision-making groups would also be authors on the paper. Often presentation at the

clinical conferences was not done by the health economists themselves but by clinicians involved in the study. In one case the economic evaluation was used by a professional organisation to policy change at the parliamentary level; it was the professional organisation not the health economist who was doing the direct advocacy. One of the evaluations described by the health economists was developed for inclusion in a set of clinical practice guidelines, but the economic evaluation was published as a separate journal article. The health economist described the attitude of the organisation to publishing the findings.

They didn't really care if it was published or not. Though I suppose the people doing the guidelines because then it backs up the evidence for the evidence base. But in terms of what was going to go into the guidelines—yeah they would have gone ahead with or without it with the same recommendations and suggestions. I didn't feel their drive to publish it. ...HE2

HE7 discussed how results from a cost of illness study was publicised and disseminated through media channels, and that it lead to a large impact in the attention that the manuscript received compared with another cost of illness study that the health economist had written that did not receive the same attention. None of the health economists mentioned social media as a dissemination strategy.

5.3.6.3 Deliberation

For the evaluations developed for centralised decision-making groups the deliberative process in each of the cases involved a meeting. For a few of the health economists the role of the economic evaluation within these meetings appeared more political than scientific. Sometimes the political influence came from the pharmaceutical or medical device companies producing the economic evaluation.

You see this game being played all the time. So a submission comes in, it gets reviewed by the group. They pull it to pieces, and then the drug company goes and fiddles with some things and changes it a little bit so that it looks better. They just play this stupid game. And then the committee is so bored of it they just say yeah go on then. HE1

Sometimes to HE2 the decisions seemed to be made for the symbolic impact of substantiating decisions made for other reasons or conferring legitimacy to the decision-makers themselves.

Unfortunately I sometimes feel that it's used to justify a decision rather than make a decision. But I suppose that is somewhere on the spectrum of decision-making. HE2

It's as much about evaluating a particular thing as about showing that they are an institutional department that engages in reflection and evaluation of their own practices and procedures. That seems to mean that they are more willing to take on board the findings. HE2

5.3.6.4 Monitoring and reflection

In nearly all of the economic evaluations discussed by the health economists there was no formal process to evaluate the impact of the economic evaluation. In some of the instances it was not apparently necessarily as the economic evaluation was used directly within a centralised decision-making process. Otherwise, impact was mostly observed through academic measures, such as citations and manuscript views. HE5 developed a web-based cost-effectiveness model that could be adapted to local contexts through adapting the parameters to specific contexts. One of the advantages of the web-based design was that it allowed observation how many individuals have accessed the model.

5.3.6.5 Engaging

All of the health economists said that engagement was an important aspect of getting evidence from economic evaluation into healthcare practice. Benefits of engagement include improving the **quality of the economic evaluation**, building a **relationship with decision-makers**, changing the **attitudes and knowledge of decision-makers**, keeping individuals **informed of progress** of the economic evaluation, and an increased sense of **ownership** leading to a greater likelihood that the individuals will become **champions** of the research.

Engagement with decision-makers, clinical experts, and stakeholders improves the rigour, accessibility, and credibility of the economic evaluation.

Try to involve other experts if needed so that you choose the right method not just one that you would like. I often work in teams, which brings more than one perspective. HE3

HE1 found that training clinicians to economic evaluations themselves leads to simpler and more accessible evaluations.

So you actually feel like it is a tailored evaluation and not just a churn it out type of evaluation. HE2

HE3 believes that it is important to involve people who know the current trends in the clinical area—people who are on the edge of clinical practice “so that they know how things are changing over time... what you do now might be completely irrelevant in two years’ time.”

HE1 described the necessity of engaging with decision-makers in order to build a relationship with them.

You really need to have that relationship and that understanding in place. You can’t just turn up to some strangers and say this is what you should do. HE1

Without engagement with decision-makers the health economists can seem indifferent or careless.

Appearing engaged, like bothering to actually have a proper meeting where you sit down with somebody and if it's a service that they are evaluating just understand what that service is and then you can actually ask smart questions about it. Rather than thinking what it is and doing something then coming back and saying well we didn't do that. Oh but we've also got this person who comes in two days a week and does that. Or not knowing where the patients go afterwards and whether it's supposed to change that or not.

HE2

HE1 described how clinicians being engaged in the process can change their attitudes and knowledge about economic evaluation.

You can imagine a clinician learning a lot from that kind of approach and changing the way they think about things. So it's useful to change the way people think about making these decisions. HE1

Engagement with decision-makers, clinical experts and stakeholders should be maintained throughout the process of developing and implementing the economic evaluation so that everyone is informed of any progress.

The way we conducted the research, we had an initial workshop, which included stakeholders and academics, we wanted to keep everybody informed as it developed, so over time as we had initial drafts, those were circulated to—if you like—this working group. HE8

When individuals are engaged in developing the economic evaluation they are more likely to feel a sense of ownership of the research.

I drove the writing of the manuscript and all the clinicians at the sites were on the manuscript. So that engaged them on the research. And the people from the state government who had been involved in the project were also on the manuscript. HE3

That engagement, understanding and sense of ownership are all required in order to have individuals who will champion the research.

You want to have people on board—crucial to have people on board from practice. So that you've got people that are interested in that research and champions of that research within the relevant practice or clinical area that would be responsible for implementing findings of the research. HE3

Try to take them on board. Ask them for suggestions, or at least reassure ourselves on what we are doing and that they understand. In the end if you try to impose anything from a health economics perspective it will be more difficult for them to understand and to encourage any use there. HE6

The other audience that HE8 engaged with was with pharmaceutical and medical device companies (“manufacturers”).

Because at the end of the day, actually I don't think this is a threat. The alternative to this is an unsustainable business plan where if you don't get real about figuring out ways to offer differential pricing globally the alternative is much worse. The alternative is that people are basically going to tear up patent protection. People are going to reference price, competitive tendering, and we already see it. Middle income countries are saying, "Hold on a minute, we're not so bothered about your intellectual property, we're going to licence a generic manufacturer for your branded product. And if you don't like it, what are you going to get us through the WTO? Well, the world has changed. You're the ones with the begging bowl and asking us to lend you money to sustain your budget deficit not the other way around. So I think manufacturers, there's some manufacturers I know realise that getting real and having predictable evidence-based prices is in the long haul a much better option. HE8

5.4 DISCUSSION

The views from the health economists interviewed were consistent with the CFIR-EE. The health economists addressed each of the domains within the framework. The most frequently addressed and most detailed domain was the characteristics of the economic evaluation. The economic evaluation needs to be answering a practice relevant question using data that is high quality and applicable to the decision-making setting. Communicating the evidence from economic evaluations was seen as a challenge of finding the correct choice of language and level of detail for the target audience. The credibility of the economic evaluation does not only depend on the quality of the methods used and whether it is published in a prestigious journal, but was also seen to depend on the health economist themselves and their affiliations, personality, and relationship to the decision-maker.

The health economists interviewed were rarely the people who would publicise and advocate change in practice based on the results of the economic evaluation. Rather, advocacy was primarily the responsibility of the funder of the economic evaluation. Funder-led advocacy was successful when the results of the economic evaluations aligned with the interests of the funder. However, in cases where a large scale intervention programme was shown to not be cost-effective or the economic burden of a disease of interest was shown to be less than previously established then the funder did not actively publicise, advocate or otherwise implement the research. Although, in the examples discussed the funders did not interfere with publishing the results as publication was stipulated in the contract between the funder and the health economist.

In the absence of an alternative funding model for economic evaluations, the health economist needs to become their own advocate. They need to, as one health economist said, "Go over the parapet" and argue the case for change in the media and with stakeholders. Health economists recommended bringing clinical experts on board and giving the clinical experts a sense of

understanding or ownership of the research such that the clinical experts become advocates for the research.

The health economists identified determinants of translation that were not identified in earlier studies. Such as the importance of professionalism, the inconvenience of certain methods of presenting evidence in large documents, and the use of inappropriate or ill-defined cost-effectiveness threshold. The importance of communication and engaging with stakeholders and clinical experts was a common theme for all of the health economists interviewed as had been emphasised previously in published interviews and surveys of healthcare decision-makers.

The less centralised the decision-making process, the harder it was for the health economists to translate evidence from economic evaluation into healthcare practice. In a less centralised context there are greater gains to be had in engaging with clinicians at all stages of the process, thoughtful dissemination, and implementation targeted at barriers to behavioural change.

The experiences of the health economists interviewed will differ from health economists of other backgrounds. Health economists from the North America, Europe or Asia would have very different experiences, as would health economists working in developing countries. All of the health economists interviewed were academic rather than from consultancies or from the pharmaceutical or medical device companies. Further research into the experiences of health economists from the pharmaceutical or medical device industry would provide greater insight into the many challenges of translating evidence from economic evaluation into healthcare practice.

The inner setting was particularly identified as a relevant factor in the interviews with health economists. It has been less of a focus in the published interviews and surveys of healthcare decision-makers because the inner setting was framed as a constant. The most relevant structural characteristic of the inner setting determining the use of evidence from economic evaluations is the level of centralisation. Translating evidence from economic evaluations into healthcare practice can be straightforward for a centralised decision-making group with an established culture of using evidence from economic evaluations in decision-making, although some of the health economists interviewed found it hard to change suboptimal process within centralised inner settings.

Within the inner setting, the attitudes and knowledge about economic evaluation of individual decision-makers influences how likely they are to use evidence from economic evaluations in decision-making. The influence of decision-maker knowledge of economic evaluation on translation is why the health economists and the healthcare decision-makers considered engaging with all relevant stakeholders from an early stage in the economic evaluation to be crucial. Engaging early can provide a sense of ownership of the research, so decision-makers feel more confident of the methods and more likely to champion the findings.

The health economists and the healthcare decision-makers identified many of the same features of the outer setting relevant for translating evidence from economic evaluation into healthcare practice. Outer setting determinants of translation included funding for healthcare budgets and health service research funding, political and media influence, and challenges with disinvesting in current practice. Additionally, the health economists identified the academic incentives that they face and how the incentives are misaligned the needs of healthcare professionals and policymakers.

The approach to economic evaluation of using a single figure to inform a decision—whether an ICER or net monetary benefits—is challenged by alternative approaches such as MCDA. There were several cases described by the health economists of healthcare decision makers valuing being able to consider multiple decision criteria. How the challenges of translating MCDA compare with economic evaluation is not known.

Further research should empirically assess the strategies identified by the health economists. The CFIR-EE provides a method of categorising strategies for facilitating translation. Methods will need to be developed to measure factors such as engagement, communication, and advocacy when applied to economic evaluation.

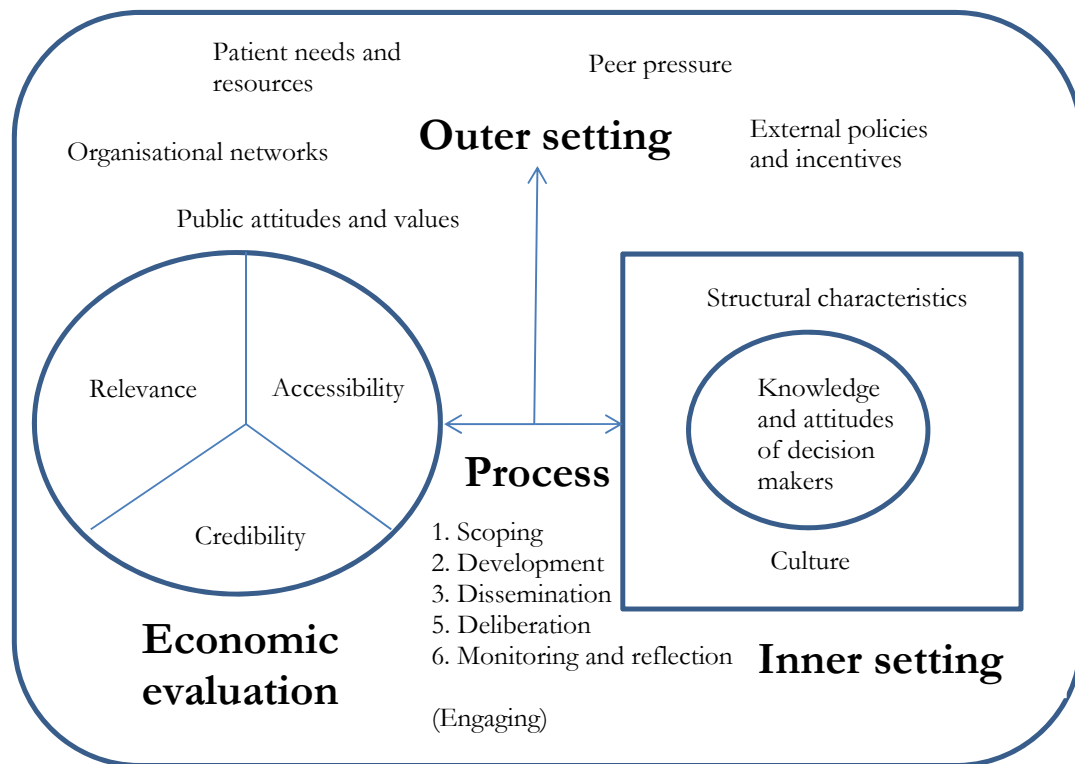
6 SYNTHESIS AND DISCUSSION

6.1 SUMMARY OF FINDINGS

The thesis used novel methods to explore the translation of evidence from economic evaluations into healthcare policy, including (1) the development of the CFIR-EE; (2) applying discrete choice experiment methods to evidence from economic evaluations; and (3) interviewing health economists about their experiences translating evidence from economic evaluations into healthcare policy and practice.

Study 1 involved a review of previous research assessing the barriers and facilitators to using evidence from economic evaluation in healthcare decision-making, and mapped the barriers and facilitators to the CFIR, resulting in the CFIR-EE, which forms the theoretical framework for the thesis (**Figure 11**).

Figure 11 CFIR-EE



CFIR, Consolidated Framework for Implementation Research adapted for Economic Evidence

The CFIR-EE is not the first theoretical framework designed specifically to understand the determinants of translation of evidence from economic evaluations into healthcare policy and practice. The Accessibility-Acceptability Framework—like the CFIR-EE—was based on a systematic review of the barriers and facilitators to using evidence from economic evaluation in healthcare decision-making. However, unlike the CFIR-EE, the Accessibility-Acceptability

Framework does not distinguish between characteristics relevant to the economic evaluation and characteristics relevant to the healthcare decision-makers, the context (inner or outer), or the process of implementation. The Accessibility-Acceptability Framework informed the three constructs used within the characteristics of the economic evaluation domain—relevance, accessibility, and credibility.

In **Study 2**, the discrete choice experiment measured decision-maker's preferences and the trade-off they were willing to make between the characteristics of the economic evaluation—relevance, accessibility, and credibility. The attributes that make up the credibility, accessibility and relevance of an economic evaluation were not dominantly preferred. The decision-makers were willing to trade-off between the three aspects of credibility, accessibility and relevance. The development of an economic evaluation should therefore consider what trade-offs between credibility, accessibility and relevance will be most preferred for the target audience of the economic evaluation. Considering such trade-offs does not necessarily require conducting a full discrete choice experiment for every situation rather a few more exploratory qualitative questions provide the researchers with an indication of what criteria are likely to be of importance in any given situation.

The discrete choice experiment represents the first use of this method for measuring the preferences for a decision-making tool. The discrete choice experiment is a useful tool for discerning which attributes matter most and what trade-offs are possible. The healthcare decision-makers had a clear preference for a good quality economic evaluation that is specifically applicable and communicated well to an independent researcher. The findings from the discrete choice experiment indicate that health economists should aim for high quality methods whilst also ensuring that the findings from economic evaluations are communicated well. The decision-makers surveyed using the discrete choice experiment were willing to wait for good quality research that they could understand and trust.

The interviews (**Study 3**) are the first qualitative investigation into the translation of evidence from economic evaluation into healthcare policy and practice from the perspective of the health economists producing the evidence. The health economist perspective provides essential insight into the factors relevant to the five domains of the CFIR-EE—characteristics of the economic evaluation, inner setting, characteristics of decision-makers, outer setting, and process.

In the interviews with the health economists and the literature review, the factors most commonly mentioned as being relevant to translating evidence from economic evaluation were **the characteristics of the economic evaluation**—accessibility, credibility, and relevance—as well as the **need to engage** with decision-makers, clinical experts and other stakeholders. Relevance of the economic evaluation depends on the research question, the outcomes assessed, and the adaptability of the evaluation. Accessibility depends on timeliness, complexity of study design, choice of

language, transparency, level of detail, and tailoring presentation to mode of communication. Credibility of an economic evaluation depends on the rigour of the methods, robustness of the results and whether the results match expectations. Engagement with decision-makers was viewed as improving relevance, credibility, and accessibility and improving the ability to trade between those characteristics. Engagement was seen to be part of the process of encouraging decision-makers, clinical experts and other stakeholders to feel ownership of the research and become comfortable with the research and or even champion the research.

6.2 FINDINGS BY STAGE OF IMPLEMENTATION PROCESS

The following section synthesises the findings from the thesis into strategies to facilitate the translation of evidence from economic evaluation. The strategies were recommended by healthcare decision-makers from qualitative studies in the literature (**Study 1**), are reflective of the preferences of decision-makers found in the discrete choice experiment (**Study 2**), or were used by health economists to translate their own research into healthcare policy or practice (**Study 3**).

The strategies are organised by when they occur within the five stages of the CFIR-EE implementation process domain:

- Scoping
- Development
- Dissemination
- Deliberation
- Monitoring and reflection

6.2.1 Stage 1: Scoping

The scoping stage is where the research question and the scope of the evaluation are determined—including the time, resources, and expertise required. Scoping is the earliest stage to determine what trade-offs are required in terms of the credibility, relevance, and accessibility of the economic evaluation.

The strategies during the scoping stage will be depend on whether the economic evaluation was initiated by a health economist or whether the research team enlists the expertise of a health economist. If the economic evaluation is health economist initiated then the health economist will need to engage with decision-makers, clinical experts and other stakeholders in order to determine the practice relevance of the research question, the outcomes to be assessed in the economic evaluation, what training is required, time constraints, and whether methods such as budget impact analysis, equity analysis, or MCDA are appropriate.

The majority of the strategies in **Table 14** were identified in both the literature review of barriers and facilitators to using evidence from economic evaluations as well as the interviews with health economists.

Table 14 Implementation strategies to facilitate the translation of evidence from economic evaluation (Stage 1: Scoping)

Strategies	Barriers review	DCE	HE interviews	Other sources
Develop a practice relevant research question	X		X	270
Engage with decision-makers	X		X	270
Confirm the practice relevance of the outcomes to be assessed in the economic evaluation	X		X	270
Determine what training is required for the decision-makers, clinical experts, health economists, or other stakeholders.	X		X	
Determine the appropriate timeframe for the development of the economic evaluation	X	X	X	
Determine whether budget impact analysis or equity analysis is appropriate	X	X	X	
Determine method of balancing multiple decision criteria (if appropriate)	X		X	

DCE, discrete choice experiment; HE, health economist; MCDA, multiple-criteria decision analysis

There were seven strategies identified that were relevant for the scoping stage. Three of the strategies are well established in the implementation science literature²⁷⁰ and were confirmed with the literature review of barriers and facilitators to using evidence from economic evaluation (**Study 1**) and the interviews with health economists about their experiences translating evidence from economic evaluation into healthcare policy and practice (**Study 3**).

1. **Develop a practice relevant research question.** The economic evaluations that addressed practice relevant questions were seen as more likely to be taken up and used to address real world problems.
2. **Engage with decision-makers.** Engagement was described as one of the most important elements for making sure that the research question and the methods used are relevant, that the health economist has credibility to the healthcare decision-maker, and for improving accessibility by involving decisions in the evaluation process. The decision-makers include health professionals and policymakers and other stakeholders.
3. **Confirm the practice relevance of the outcomes to be assessed in the economic evaluation.** Choice of health and cost outcomes should be tailored to the needs of the relevant healthcare decision-makers. Choices regarding health and cost outcomes include whether to measure health outcomes in terms clinical measures (e.g. life-years gained), health utility measures (e.g. QALYs), or valuing health outcomes monetarily. Similarly, the perspective chosen for measuring costs should be relevant to the healthcare decision-makers.

The other strategies were specifically pertinent to the translation of evidence from economic evaluation, and were identified through the literature review, the discrete choice experiment, and the interviews with health economists. The strategies were not from the broader implementation literature.

4. **Determine what training is required for decision-makers, clinical experts, health economists, or other stakeholders.** Determining training requirements is relevant for other types of research but is particularly relevant for economic evaluation because economic evaluation has a substantial researcher-clinician knowledge gap.
5. **Determine the appropriate timeframe for the development of the economic evaluation.** Healthcare decision-makers and health economists found that there are windows of opportunity where evidence can have an impact on healthcare decision-making. Some respondents recommended considering the importance of timeframe in the scoping process, particularly with regard to tailoring the level of complexity of the economic evaluation. The discrete choice experiment found that healthcare decision-makers were willing to wait for good quality research, but timeliness was valued.
6. **Determine whether budget impact analysis or equity analysis is appropriate.** A common comment in interviews and surveys with healthcare decision-makers in the literature and the interviews with health economists was that cost-effectiveness is useful for healthcare decision-making, but often not sufficient. The scoping should determine whether other decision-making criteria be considered as part of the evaluation process. The discrete choice experiment found a preference for economic evaluations that provided an analysis of equity impact but not for economic evaluations that mention potential equity impact compared with not discussing equity at all.
7. **Determine the method for balancing multiple decision criteria.** If decision criteria other than cost-effectiveness are going to be included in the economic evaluation—such as budget impact or equity impact—then the scoping should determine the approaching to balancing competing criteria. MCDA was a method discussed in the interviews with health economists.

6.2.2 Stage 2: Development

The development stage is when the economic evaluation is prepared (**Table 15**). The development stage includes data collection, economic modelling, and writing up the results. For a trial-based economic evaluation the development stage would include both the trial itself as well as the analysis of the costs and health outcomes after the trial is completed.

Table 15 Implementation strategies to facilitate the translation of evidence from economic evaluation (Stage 2: Development)

Strategies	Barriers review	DCE	HE interviews	Other sources
Seek contributions and feedback from clinical experts and other stakeholders	X		X	270
Follow good practice guidelines for data collection and analysis	X	X	X	
Avoid unnecessarily complex methods	X	X	X	

DCE, discrete choice experiment; HE, health economist

There were three strategies identified as relevant at the development stage.

- 1. Seek contributions and feedback from clinical experts and other stakeholders.** The importance of seeking contribution and feedback is well established in the implementation science literature and was confirmed in the literature review of barriers to using evidence from economic evaluations and the interviews with health economists. Similar to the importance of engagement during the scoping phase, the contributions improve the relevance, credibility, and accessibility of the economic evaluation.
- 2. Follow good practice guidelines for data collection and analysis.** The importance of using good quality data in an economic evaluation and following best practice for developing models was raised by both healthcare decision-makers and in the interviews with health economists. The discrete choice experiment found that, for healthcare decision-makers, good quality methods for economic modelling and good quality data informing the model are two of the most prioritised attributes of an economic evaluation.
- 3. Avoid unnecessarily complex methods.** The counterpoint to the importance of using good quality methods for economic evaluation is that the more complex the economic evaluation is then the less it is accessible to healthcare decision-makers. Complexity as a barrier to using evidence from economic evaluation in healthcare decision-making was identified in the literature review, the interviews with health economists. It is through the contribution and feedback from the clinical experts and other stakeholders that the correct balance between rigour and complexity will be met.

6.2.3 Stage 3: Dissemination

The dissemination stage refers to the publication and presentation of the findings from the economic evaluation. The findings from the barriers and facilitators literature review, the discrete choice experiment, and the health economist interviews all emphasise the importance of communication (Table 16).

Dissemination involves directly presenting the results to a decision-making committee through a report or in person, publishing in journals, conference presentations, press releases, media interviews, or publishing online or through social media.

Table 16 Implementation strategies to facilitate the translation of evidence from economic evaluation (Stage 3: Dissemination)

Strategies	Barriers review	DCE	HE interviews	Other sources
Tailor presentation and language to audience	X	X	X	²⁷¹
Ensure transparency in the communication of assumptions and results	X	X	X	
Prepare evidence summaries	X		X	
Report conflicts of interest	X	X		
Determine the ways the analysis can be adapted to specific contexts			X	
Consider adaptable online model			X	
Determine and enact media strategy			X	

DCE, discrete choice experiment; HE, health economist

The discrete choice experiment found that good communication was one of the most highly valued aspects of an economic evaluation by healthcare decision-makers. The literature of healthcare decision-makers perceived barriers and facilitators to using economic evaluation and the interviews with health economists identified strategies to improve dissemination.

1. **Tailor presentation and language to audience.** The importance of determining the appropriate audience and tailoring the presentation, including choice of language, for the research is a well-established principle in implementation science²⁷¹ and was identified as important by both healthcare decision-makers and health economists. Technical language is a commonly cited barrier to understanding evidence from economic evaluations.
2. **Ensure transparency in the communication of assumptions and results.** Both healthcare decision-makers and the health economists interviewed emphasised the importance of transparency of the assumptions of an economic evaluation. If the assumptions are not transparent then the credibility of the evaluation cannot be assessed by the healthcare decision-maker.
3. **Prepare evidence summaries.** Evidence summaries were seen by healthcare decision-makers and health economists as improving the accessibility of economic evaluations by being shorter than full economic evaluations and only providing the most relevant information.
4. **Report conflicts of interest.** To healthcare decision-makers, the credibility of economic evaluations has been damaged by the number of studies produced by pharmaceutical and medical device companies. In the discrete choice experiment, healthcare decision-makers

significantly preferred economic evaluations produced by health economists that did not have conflicts of interest.

Furthermore, the interviews with health economists identified factors relevant for dissemination that had not been reported by healthcare decision-makers in earlier studies.

5. **Determine the ways the analysis can be adapted to specific contexts.** The health economists found that in certain situations it is necessary to adapt economic evaluations in different contexts. The examples given were adapting economic evaluations to reflect differences in costs and clinical epidemiology between different hospitals and different local areas within a country.
6. **Consider adaptable online model.** A facilitator for improving the relevance of economic evaluations identified by one health economist was the use of adaptable online models. Adaptable models allow healthcare decision-makers to adjust the parameters (the inputs) of the model to reflect local conditions. So the decision-maker does not have to rely on an evaluation using costs or other parameters from a different setting. By having the model online it can be easily accessed and use can be monitored (see **Section 6.2.5**).
7. **Determine and enact media strategy.** The model put forward by one of the health economists was that the role of the economic evaluation was primarily as support for good decision-making. But it can become the role of the health economist to “go over the parapet” and directly engage in a media strategy to change public perceptions.

6.2.4 Stage 4: Deliberation

Deliberation is the stage where the evidence from the economic evaluation is used for decision-making (**Table 17**), which assumes that dissemination was successful and the decision-makers within the internal context are using the economic evaluation. The health economists interviewed stressed the importance of an appropriate cost-effectiveness threshold—so that the decision to say whether an intervention is cost-effective is representative of the opportunity cost. Both healthcare decision-makers and health economists highlighted the need to involve relevant stakeholders at the deliberation stage.

Table 17 Implementation strategies to facilitate the translation of evidence from economic evaluation (Stage 4: Deliberation)

Strategies	Barriers review	DCE	HE interviews	Other sources
Involving relevant stakeholders	X		X	
Selecting the cost-effectiveness threshold			X	

DCE, discrete choice experiment; HE, health economist

6.2.5 Stage 5: Monitoring and reflection

Monitoring and reflection on the impact of the economic evaluation was not a commonly reported part of the process of developing an economic evaluation either from the perspective of the healthcare decision-makers or the health economists (Table 18). However, monitoring and reflection of impact is a recommended strategy for other forms of evidence used in healthcare decision-making, such as clinical practice guidelines.²⁷¹ The difference in emphasis between economic evaluations and clinical practice guidelines with regard to monitoring and reflection is a result of the greater emphasis on guiding change in practice within the field of clinical practice.

Table 18 Implementation strategies to facilitate the translation of evidence from economic evaluation (Stage 5: Monitoring and Reflection)

Strategies	Barriers review	DCE	HE interviews	Other sources
Plan for monitoring and reflecting on impact of the economic evaluation			X	271

DCE, discrete choice experiment; HE, health economist

6.3 DISCUSSION

In bringing together the studies described in the thesis and the synthesis within this chapter there are two primary implications for understanding the translation of evidence from economic evaluation into healthcare policy and practice:

The first implication is that **economic evaluation needs to be considered in the broader implementation context**. It is not sufficient to publish an economic evaluation and hope that it translates into healthcare policy or practice. The process of developing an economic evaluation and communicating the results needs to include an awareness of the needs and preferences of healthcare decision-makers and the context in which they work.

The other implication is that **implementing evidence from economic evaluation is different to implementing other innovations, and involves unique challenges**. Economic evaluation is a type of research specifically designed to inform a decision—the results of an economic evaluation are specific to a decision-making context and are not generalisable to other contexts. The language and theoretical basis can be unfamiliar to health professionals. Economic evaluations are designed for decision-making at the population level, so implementation at the individual clinician level is lacking.

The CFIR-EE contextualises the translation of evidence from economic evaluation into a broader implementation framework, while addressing the features of economic evaluation that make it unique as an innovation. Using the CFIR-EE has implications for identifying barriers to using evidence from economic evaluation and for developing strategies to facilitate translation. The

CFIR-EE enables deeper analysis of determinants of translation from economic evaluation into healthcare policy and practice. Barriers to using evidence from economic evaluation can be categorised into the five CFIR-EE domains, clarifying the nature of the barriers and how the barriers interact. The CFIR-EE can also be used in the development of strategies to facilitate translation by targeting the strategies to domains or constructs within domains with the recognition of likely interactions between domains. Future evaluations of strategies can be used to categorise and compare the effectiveness of strategies targeting different CFIR-EE domains, different stages of the implementation process, or the different constructs that define the characteristics of the economic evaluation itself.

The synthesis in this chapter presents an example of the use of the CFIR-EE to characterise implementation strategies for evidence from economic evaluations. In the synthesis, the strategies to facilitate translation identified by healthcare decision-makers and health economists are categorised into the five stages of the process of implementation domain of the CFIR-EE.

Strategies that were particularly emphasised by the health economists that were interviewed include: (1) engagement with stakeholders and clinical experts; (2) communication and presentation of findings; and (3) health economist led advocacy.

Health economist engagement with stakeholders and clinical experts can occur at all stages within the process domain of the CFIR-EE, and were seen as crucial to improving the relevance, accessibility, and credibility of the economic evaluation. Health economists experienced the benefits of having stakeholders and clinical experts involved through the process of scoping, developing, and disseminating the economic evaluation in terms of ensuring that the economic evaluation addresses a practice relevant research question, improved stakeholder understanding of economic evaluation methods, and increased stakeholder belief in the health economist themselves.

Appropriate communication and presentation of findings is a factor that has been shown to be highly relevant in all of the studies discussed in the thesis. Poor communication from health economists was one of the most commonly cited barriers to using evidence from economic evaluation in the studies included in the systematic review and was consistent with the findings from both the discrete choice experiment and the interviews with health economists. The discrete choice experiment found that decision-makers had a strong preference for good communication from health economists. In the health economist interviews, the importance of good communication was one of the most commonly discussed factors for translating evidence from economic evaluations into health policy and practice. The health economists discussed the necessity for economic evaluations to use the language and level of detail appropriate for the audience of the economic evaluation and tailoring the presentation of findings to different audiences.

A key finding from the interviews with health economists was that there are times where the health economist needs to become an advocate for change, particularly in situations where the findings are inconvenient to the organisation that originally funded the research. In many of the example economic evaluations described by the health economist it was the funding organisation's responsibility to publicise the findings and advocate change based on the results of the economic evaluation. The problem with funder-driven implementation is that the level of support can depend on whether the results of the economic evaluation align with the interests of the funding organisation. The health economists described situations where the funder lost interest in the findings from economic evaluations when the results were not as expected and did not pursue usual funder-led advocacy. In the absence of funder-led advocacy, the health economist is left alone to engage with the media and with individual stakeholders to argue for the case of change.

6.3.1 Limitations

It is difficult to distinguish between research that has a symbolic impact compared with research that has an instrumental impact. If the purpose of economic evaluation is purely to signal legitimacy, then this is not research translation. Although some of the health economists interviewed provided examples where their research translated into healthcare policy or practice, it was not possible to demonstrate whether the economic evaluation drove decision making. Both researchers and healthcare decision makers have incentives to signal that research is having an instrumental impact rather than a symbolic impact, making an instrumental impact harder to detect. Further case study analysis, including document analysis and observation of decision-making processes, is required to positively determine whether evidence from economic evaluation is having an instrumental impact on healthcare decision making.

It is difficult to judge the relevance of the CFIR-EE constructs based on how well they are represented in the literature review (**Section 2**) or in the interviews (**Section 5**). Respondents were asked specifically about their views and experiences with economic evaluation and are therefore primed to consider factors that fit within the characteristics of the economic evaluation domain rather than contextual, interpersonal, or procedural factors.

The thesis emphasises the values and beliefs of health economists and health researchers and their experiences translating evidence into healthcare policy and practice. The interviews were only conducted with health economists and about 40% of the discrete choice experiment respondents were health researchers. This perspective influences the findings of the research; however it is balanced by the previously published literature in this area, which had largely ignored the perspectives of health economists and health researchers.

The interviews were only conducted in Australia and the UK and the majority of the discrete choice experiment responses were from Australia. This, along with sample size limits the generalisability of the findings. Experiences are likely to be very different in the USA, where economic evaluation plays a less central role, or in developing countries where there are greater resource constraints.

Neither the research conducted as part of the thesis nor the published literature compares the translation of evidence from economic evaluation with other types of evidence. Many of the factors relevant for the translation of evidence from economic evaluation will be relevant to other types of evidence. However, by focussing specifically on economic evaluation it is possible to discuss specific technical details relevant to economic evaluation including willingness to pay for health and MCDA.

6.3.2 Implications and Future research

The CFIR-EE can be used to guide future research examining the translation of evidence from economic evaluation into healthcare policy and practice by providing a framework to categorise barriers and facilitators to translation. By categorising barriers and facilitators into domains the CFIR-EE provides a systematic approach to assess how the barriers and facilitators interact. Under the CFIR-EE, barriers and facilitators are characterised by whether they reflect characteristics of the economic evaluation itself or the knowledge and attitudes of the healthcare decision-makers, the structure and culture of the organisation the decision-makers work in, or the incentives and community attitudes the organisation faces. The CFIR-EE was based on evidence from studies investigating the barriers and facilitators to translating evidence from economic evaluation. The adaptation did not consider factors relating to other types of evidence. It remains to be seen what would be the nature of an adaptation of the CFIR for translation of other study designs.

The discrete choice experiment was based on a single scenario where evidence from economic evaluations are used in decision-making—the decision to purchase a piece of hospital equipment. However, preferences for the design and communication of evidence from economic evaluation might be different for different types of decision and in different settings. Preferences for including equity analysis might be greater in scenarios where fairness and distributional concerns are more apparent, such as an economic evaluation of the Royal Flying Doctor Service. Preferences for quality and communication might be different in settings where economic evaluation is an established part of the process, such as the PBAC or NICE. Discrete choice experiments could also be used to measure preferences for other types of evidence and instruments used for decision-making—such as MCDA or budget impact analysis.

Further research is warranted into the perspectives of health economists—and researchers more generally—and their experiences translating evidence into healthcare policy and practice. The

experiences of health economists from other settings—such as from industry or from countries other than Australia and the UK—might vary. The challenge of translating evidence from economic evaluation in low- and middle-income countries was not explored in the thesis and has been neglected in the literature. The constraints faced by health economists in such countries and the difficulties translating evidence into healthcare policy and practice is likely to be greater than in Australia or the UK. There is no research comparing the challenges that health economists face in translation to the challenges faced by other researchers translating evidence into practice. Such comparative research would provide insight into how implementation strategies should vary based on the type of evidence.

The role knowledge brokers may play in translating evidence from economic evaluation into healthcare policy and practice remains poorly defined. The “going over the parapet” metaphor used by the health economist assumes that the translational activity must be by the health economist themselves and not a third party knowledge broker or implementation specialist.

Different settings required different approaches to translating evidence from economic evaluations. The optimal approach also depends on the funding available for evaluation. Some of the health economists’ interviewed found that MCDA can be useful where there is limited resource for evaluation.

The unique challenges of translating evidence from economic evaluation into healthcare policy and practice point to the need for best practice implementation guidelines for health economists. This thesis provides the evidence basis for future efforts to develop guidelines for translating evidence from economic evaluation into healthcare policy and practice. Such guidelines should incorporate the strategies described in the synthesis within this chapter. The development of such guidelines will require further engagement with stakeholders and collaboration with an expert panel.

7 CONCLUSION

Multiple methods were used to understand the translation of evidence from economic evaluation into healthcare policy and practice. **Study 1** identified the barriers and facilitators to using evidence from economic evaluation in healthcare decision-making and used those to develop the CFIR-EE. **Study 2** measured the preferences of decision-makers for evidence from economic evaluation. **Study 3** gathered the views and experiences of health economists on translating evidence from economic evaluation into healthcare policy and practice.

The CFIR-EE provides a framework for further qualitative research into the determinants of translating evidence from economic evaluation into healthcare policy and practice, and the development of implementation strategies specific for evidence from economic evaluations. The framework has been used in this thesis to identify evidence gaps in the literature, such as the limited barriers and facilitators relating to the outer setting domain or the implementation process domain. The framework has also been used to discuss the relationships between barriers and facilitators such as the synthesis (**Section 6.2**), which categorised strategies to translate evidence from economic evaluation that were often characteristics of the economic evaluation into stages of the process domain.

The discrete choice experiment represents the first use of this method to measure the preferences of decision-makers for evidence from economic evaluations. The attributes and levels were designed to reflect the constraints of producing an economic evaluation and the factors that need to be balanced to translate the results into healthcare practice. The discrete choice experiment found that decision-makers' preferences between credibility, acceptability and relevance are not dominant—the decision-makers were willing to trade between the attributes representing the constructs. Decision-makers had different preference profiles for the attributes within the discrete choice experiment. The decision-makers wanted a health economist who was good at modelling and communication, but fair modelling and communication was seen as no better than poor quality communication and modelling. In contrast, decision makers preferred fair levels over poor and good levels over fair for the clinical evidence and applicability attributes. In some cases the decision-makers were willing to wait at least a year for good quality research.

The activities involved in translating evidence from economic evaluations into healthcare practice have been outlined. The step most emphasised by both the health economists in the interviews and the healthcare decision-makers in the literature review was the importance of engaging appropriate individuals in the economic evaluation process at all stages. Benefits of engagement included improving the quality of the economic evaluation, building a relationship with decision-making, changing attitudes and knowledge of decision-makers, keeping individuals informed of progress,

and an increased sense of ownership leading to a greater likelihood that the individuals will become champions of the research.

To translate evidence from economic evaluation into healthcare process it is necessary at each stage of the process to find the correct balance between credibility, accessibility, and relevance taking into account the inner and outer setting and knowledge and attitudes of the decision-makers. To increase the impact of economic evaluation on policy, health economists need to engage with policymakers, healthcare professionals, and the community; communicate findings in a manner appropriate to the audience and mode of communication; and advocate for the best practice use of economic evaluation in healthcare decision-making. All of this takes time, planning and resources as well as a strong desire to take leadership and action—sometimes with little institutional support. As one health economist nicely surmised: it is akin to “going over the parapet”.

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**APPENDIX A: BRIDGING THE GAP: EXPLORING THE
BARRIERS TO USING ECONOMIC EVIDENCE IN
HEALTHCARE DECISION MAKING AND STRATEGIES
FOR IMPROVING UPTAKE**

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APPENDIX B: PRELIMINARY SURVEY TO DETERMINE ATTRIBUTES AND LEVELS

Cost Effectiveness Evidence and Infection Control Decision Making

1. Are you?
 - ☐ An infectious disease physician
 - ☐ An infection control practitioner
 - ☐ Neither

2. What is your gender
 - ☐ Female
 - ☐ Male
 - Other (please specify)

3. How many years have you worked in healthcare?

4. Have you received any training in cost effectiveness or economic evaluation?
 - ☐ No
 - Yes (please specify)

Section 1: Factors that influence use of evidence

1. Below are a number of factors that have been shown to influence whether cost effectiveness evidence is used in healthcare decision making. We are interested in how important these factors are to you if you were considering using evidence from a cost effectiveness study in your decision making within the context of infection control.

	Not at all important	Somewhat Important	Moderately Important	Important	Very Important	NA
Quality of clinical evidence informing the cost effectiveness study	1	2	3	4	5	
Rigour of methodology used to estimate cost effectiveness	1	2	3	4	5	
Length of time required to conduct the cost effectiveness study	1	2	3	4	5	
Making cost effectiveness studies easier to understand	1	2	3	4	5	
Professional training in cost effectiveness	1	2	3	4	5	
Considering equity effects of healthcare interventions in cost effectiveness studies	1	2	3	4	5	

	Not at all important	Somewhat Important	Moderately Important	Important	Very Important	NA
Considering budget impact of healthcare interventions in cost effectiveness studies	1	2	3	4	5	
Considering clinical need of healthcare interventions in cost effectiveness studies	1	2	3	4	5	
Avoiding conflicts of interest (e.g. studies funded by pharmaceutical or medical device companies)	1	2	3	4	5	
Using the simplest, valid approach to measuring cost effectiveness (avoiding unnecessarily complex methods)	1	2	3	4	5	
Clearly stating all sources and assumptions of the cost effectiveness study	1	2	3	4	5	

2. Which two factors would you rank as most important in terms of the usefulness of cost effectiveness studies for infection control decision making? (please mark ☒ for the two factors)
- ☐ The quality of the clinical evidence that informs the cost effectiveness study
- ☐ The rigour of the methodology used to estimate cost effectiveness
- ☐ The length of time required to conduct the cost effectiveness study
- ☐ Making cost effectiveness studies easier to interpret by improving communication and using plain language
- ☐ Professional training in interpreting and evaluating cost effectiveness studies
- ☐ Considering equity effects of healthcare interventions in cost effectiveness studies
- ☐ Considering budget impact of healthcare interventions in cost effectiveness studies
- ☐ Considering clinical need of healthcare interventions in cost effectiveness studies
- ☐ Avoiding conflicts of interest (e.g. studies funded by pharmaceutical or medical device companies)
- ☐ Using the simplest, valid approach to measuring cost effectiveness (avoiding unnecessarily complex methods)
- ☐ Clearly stating all sources and assumptions of the cost effectiveness study
3. Which two factors would you rank as least important in terms of the usefulness of cost effectiveness studies for infection control decision making? (please mark ☒ for the two factors)
- ☐ The quality of the clinical evidence that informs the cost effectiveness study
- ☐ The rigour of the methodology used to estimate cost effectiveness

- ☐ The length of time required to conduct the cost effectiveness study
- ☐ Making cost effectiveness studies easier to interpret by improving communication and using plain language
- ☐ Professional training in interpreting and evaluating cost effectiveness studies
- ☐ Considering equity effects of healthcare interventions in cost effectiveness studies
- ☐ Considering budget impact of healthcare interventions in cost effectiveness studies
- ☐ Considering clinical need of healthcare interventions in cost effectiveness studies
- ☐ Avoiding conflicts of interest (e.g. studies funded by pharmaceutical or medical device companies)
- ☐ Using the simplest, valid approach to measuring cost effectiveness (avoiding unnecessarily complex methods)
- ☐ Clearly stating all sources and assumptions of the cost effectiveness study

4. Please rank the following in order of importance from 1 to 4 where 1 is most important to you and 4 is least important to you

- ☐ Making cost effectiveness studies easier to interpret by improving communication and using plain language
- ☐ Professional training in interpreting and evaluating cost effectiveness studies
- ☐ Using the simplest, valid approach to measuring cost effectiveness (avoiding unnecessarily complex methods)
- ☐ Clearly stating all sources and assumptions of the cost effectiveness study

5. What factors do you think make cost effectiveness information more or less valuable?

6. How often do you **use** cost effectiveness information to make infection control decisions?

1	2	3	4	5	6
Never	Very rarely	Rarely	Sometimes	Often	Very often

7. How often do you think you **should use** cost effectiveness information to make infection control decisions?

1	2	3	4	5	6
Never	Very rarely	Rarely	Sometimes	Often	Very often

8. In general, how **valuable** do you think cost effectiveness information is for making infection control decisions?

1	2	3	4	5
Not at all valuable	Somewhat valuable	Moderately valuable	Valuable	Very valuable

9. In general, how **useful** do you think cost effectiveness information is for infection control decision making?

1	2	3	4	5
Not at all	To some extent	A moderate extent	A large extent	A very large extent

Section 2: Timeliness and conflicts of interest

10. Imagine a scenario where you have commissioned a health economist to produce an economic evaluation to inform an infection control decision.

What do you think would be a reasonable time to complete the economic evaluation?

What do you think would be the minimal time the economic evaluation could be completed in?

What is the maximum time you would be willing to wait for the completion of the economic evaluation?

11. Health economists may have a number of different types of conflict of interest. Please rate how important you think each type of conflict of interest is with respect to trusting the outcomes of the research.

	Not at all important	Somewhat Important	Moderately Important	Important	Very Important	NA
Health economist is employed by company that has a financial interest in the economic evaluation	1	2	3	4	5	
Health economist has received funding by a company that has a financial interest to develop the economic evaluation	1	2	3	4	5	
Health economist previously received research funding by a company with a financial interest in the economic evaluation	1	2	3	4	5	

	Not at all important	Somewhat Important	Moderately Important	Important	Very Important	NA
Health economist's attendance at a conference was paid for by a company with a financial interest in the economic evaluation.	1	2	3	4	5	

12. Do you have any other comments that you would like to make?

APPENDIX C: DISCRETE CHOICE EXPERIMENT SURVEY INSTRUMENT

By agreeing to participate in this study, you are agreeing that you:
have read and understood the information provided in the Information to Participants
section.
have had any questions answered to your satisfaction.
agree to participate in this survey
understand that once you have submitted your responses, these cannot be withdrawn.
agree that research data collected for this study may be published or may be provided to
other researchers

**Please read the statements above and tick below to give your consent to
participate:**

☐ I agree and give my consent

Please indicate if you are a healthcare **professional**, health **administrator**, or a **health
researcher**?

- ☐ Healthcare Professional
- ☐ Health Administrator
- ☐ Health Researcher
- ☐ None of the above

Please consider the following hypothetical scenario

Imagine you are to provide feedback to the management of your hospital on whether the hospital should purchase a new piece of equipment. There is some evidence that the new piece of equipment will improve the health of patients.

There is a significant cost to purchase, install, and learn how to use the new piece of equipment.

To help you provide feedback you can choose one of two health economists who will conduct a study to evaluate the cost-effectiveness of the piece of equipment.

You will be given comparisons of the two health economists in tables like the one below. You will be asked to select the economist that you would be more likely to choose.

	Economist A	Economist B
Quality of clinical evidence	Good	Good
Quality of economic modelling	Good	Poor
Length of time	12 months	6 months
Communication	Poor	Good
Equity	No consideration	Mentioned
Applicability	Specifically applied to context	Not applied to context
Conflict of interest	Employed by industry	No conflict

Comparison 1 (of 10)

Which health economist would you be more likely to choose to provide evidence on the cost-effectiveness of the new piece of equipment?

	Economist A	Economist B
Quality of clinical evidence	Fair	Fair
Quality of economic modelling	Fair	Fair
Length of time	6 months	12 months
Communication	Fair	Poor
Equity	Mentioned	Thorough analysis
Applicability	Generally applied to context	Specifically applied to context
Conflict of interest	Employed by industry	Independent with industry funding

Economist A ☐

Economist B ☐

Comparison 2 (of 10)

Which health economist would you be more likely to choose to provide evidence on the cost-effectiveness of the new piece of equipment?

	Economist A	Economist B
Quality of clinical evidence	Good	Fair
Quality of economic modelling	Good	Fair
Length of time	6 months	6 months
Communication	Fair	Fair
Equity	No consideration	Mentioned
Applicability	Not applied to context	Generally applied to context
Conflict of interest	Independent with industry funding	Employed by industry

Economist A ☐

Economist B ☐

Comparison 3 (of 10)

Which health economist would you be more likely to choose to provide evidence on the cost-effectiveness of the new piece of equipment?

	Economist A	Economist B
Quality of clinical evidence	Poor	Poor
Quality of economic modelling	Poor	Poor
Length of time	1 month	12 months
Communication	Good	Poor
Equity	Mentioned	No consideration
Applicability	Generally applied to context	Not applied to context
Conflict of interest	Independent with industry funding	Employed by industry

Economist A ☐

Economist B ☐

Comparison 4 (of 10)

Which health economist would you be more likely to choose to provide evidence on the cost-effectiveness of the new piece of equipment?

	Economist A	Economist B
Quality of clinical evidence	Good	Good
Quality of economic modelling	Fair	Good
Length of time	1 month	6 months
Communication	Poor	Fair
Equity	Mentioned	No consideration
Applicability	Not applied to context	Not applied to context
Conflict of interest	No conflict	Independent with industry funding

Economist A ☐

Economist B ☐

Comparison 5 (of 10)

Which health economist would you be more likely to choose to provide evidence on the cost-effectiveness of the new piece of equipment?

	Economist A	Economist B
Quality of clinical evidence	Poor	Good
Quality of economic modelling	Good	Good
Length of time	12 months	1 month
Communication	Fair	Good
Equity	Thorough analysis	Thorough ana
Applicability	Generally applied to context	Specifically ap
Conflict of interest	No conflict	Employed by

Economist A ☐
Economist B ☐

Comparison 6 (of 10)

Which health economist would you be more likely to choose to provide evidence on the cost-effectiveness of the new piece of equipment?

	Economist A	
Quality of clinical evidence	Fair	Poor
Quality of economic modelling	Poor	Poor
Length of time	6 months	1 month
Communication	Good	Good
Equity	No consideration	Mentioned
Applicability	Specifically applicable to context	Generally appl
Conflict of interest	No conflict	Independent w

Economist A ☐
Economist B ☐

Comparison 7(of 10)

Which health economist would you be more likely to choose to provide evidence on the cost-effectiveness of the new piece of equipment?

	Economist A	Economist B
Quality of clinical evidence	Good	Good
Quality of economic modelling	Poor	Fair
Length of time	6 months	1 month
Communication	Poor	Poor
Equity	Thorough analysis	Mentioned
Applicability	Generally applied to context	Not applied to
Conflict of interest	Independent with industry funding	No conflict

Economist A ☐

Economist B ☐

Comparison 8 (of 10)

Which health economist would you be more likely to choose to provide evidence on the cost-effectiveness of the new piece of equipment?

	Economist A	Economist B
Quality of clinical evidence	Good	Poor
Quality of economic modelling	Fair	Good
Length of time	12 months	12 months
Communication	Good	Fair
Equity	No consideration	Thorough analysis
Applicability	Generally applied to context	Generally applied to context
Conflict of interest	No conflict	No conflict

Economist A ☐

Economist B ☐

Comparison 9 (of 10)

Which health economist would you be more likely to choose to provide evidence on the cost-effectiveness of the new piece of equipment?

	Economist A	Economist B
Quality of clinical evidence	Fair	Fair
Quality of economic modelling	Fair	Fair
Length of time	6 months	12 months
Communication	Fair	Poor
Equity	Mentioned	Thorough analysis
Applicability	Generally applied to context	Specifically applied to context
Conflict of interest	Employed by industry	Independent with industry funding

Economist A ☐

Economist B ☐

Comparison 10 (of 10)

Which health economist would you be more likely to choose to provide evidence on the cost-effectiveness of the new piece of equipment?

	Economist A	Economist B
Quality of clinical evidence	Poor	Fair
Quality of economic modelling	Good	Poor
Length of time	6 months	6 months
Communication	Poor	Good
Equity	Mentioned	No consideration
Applicability	Specifically applied to context	Specifically applied to context
Conflict of interest	No conflict	No conflict

Economist A ☐

Economist B ☐

When making your choices between health economists did you find yourself focussing on one particular factor? If so, which one?

Have you received any training in cost-effectiveness or economic evaluation?

No ☐

Yes ☐

If yes, please specify:

How often do you use cost-effectiveness information for healthcare decision-making?

Never	Seldom	Sometimes	Often	Almost Always
1	2	3	4	5

How often do you think you should use cost-effectiveness information for healthcare decision-making?

Never	Seldom	Sometimes	Often	Almost Always
1	2	3	4	5

In general, how valuable do you think cost-effectiveness information is for healthcare decision-making?

Not Valuable	Slightly Valuable	Fairly Valuable	Valuable	Very Valuable
1	2	3	4	5

Are you:

Female ☐

Male ☐

What is your primary occupation? _____

What is your primary work setting? _____

What is your country of residence? _____

How difficult did you find this questionnaire to complete?

Very Easy	Easy	Neutral	Difficult	Very Difficult
1	2	3	4	5

Do you have any additional comments you would like to make about this research or the factors which influence your choice to use economic information?

Thank you very much for taking the time to complete this survey.

APPENDIX D: INTERVIEW PROTOCOL

7.1.1.1 Interview Protocol

7.1.1.2 Project: The influence of economic evaluation on healthcare policy and practice: attitudes of health economists

Date: _____

Time: _____

Location: _____

Interviewer: _____

Interviewee: _____

Participant Information Form signed: _____

I'd like to understand your experiences developing economic evaluations and using that knowledge to make changes in the healthcare system

The interview should take half an hour, is that OK with your schedule?

Did you receive the signed consent form? Do you have any questions regarding the form?
[Obtain signed request form]

Confirm OK with audio recording
[Start audio recording]

Main question	Additional questions
Can you describe your experience with economic evaluation	
Q1. I would like you to think of an economic evaluation that you have worked on in the past couple of years. Preferably one that is now finished.	
Why did you start on that economic evaluation?	<p>Why were the sponsors interested</p> <p>How do you decide how broad a perspective you are going to take?</p>
What methods did you use?	<p>Trial-based/decision analytic?</p> <p>How do you determine the scope of an economic evaluation?</p>
How did you disseminate your research	<p>How was it communicated?</p> <p>What was the response like?</p>
Was this economic evaluation characteristic of the types of economic evaluations that you do?	<p>If not how do others differ</p>
Would you say that the economic evaluation led to some change in the health system?	<p>If not</p> <p>Do you think it served another role?</p> <p>What do you think would need to change</p> <p>If yes</p> <p>In what way?</p> <p>Do you think it served another role?</p> <p>Are there cases where you would think it was <u>not</u> appropriate to do an economic evaluation?</p>
Q2. In what ways can the process of producing economic evaluations be improved?	
Q3. What do you think are the most important things you as a researcher can do to translate evidence from economic evaluation into practice?	<p>What do you think are the most important things your research institution can do to translate evidence from economic evaluation into practice?</p>

Is there anything we have talked about so far that you wish to elaborate on or anything you have said that you would like to retract?

Thank you!

APPENDIX E: INTERVIEW TRANSCRIPTS

(HE#, Health Economist; G=Interviewer)

HE1 Interview: 21st August 2015

G: My first question is, just broadly, in what ways do you think economic evaluation might be useful for healthcare decision-making?

HE1: In a simple world, where people are rational and risk neutral it's very useful. Because for the reasons the textbooks say, you can maximise health benefits given the scarce resources of a fixed budget. And that's a great starting point. And that's a good set of theory to talk about and to use. But the real world is a lot messier and complicated than that. It is useful to keep that framework but it's not a panacea. People don't respond to evidence rationally.

G: Can you think of instances where it has led to real world improvements in decision-making? Or even just changes?

HE1: I'm going to sound cynical and jaded but not really. I think people arrive at their own decisions doing sort of a bad economic evaluation in their head using their own experience. Sometimes they're right sometimes they're wrong. But I think when they are confronted with the good economic evaluation I'm not sure how much it changes their thinking.

G: Do you think they use it if it's convenient?

HE1: Of course. If somebody has got to a position based on gut instinct and a bad back of the envelope type of approach which is how most of these things are done and they find a paper that supports that view then they will stand squarely behind the paper because it validates their pre-existing position. What I'm trying to say is I haven't actually seen people switch based on a cost-effectiveness study that they weren't doing.

G: Do you think there is still a role for researchers to keep knocking at it, even if it's not...

HE1: It's interesting. And it does contribute to the debate but it's not this linear process where a cost-effectiveness study is done and a decision is made. It's really not like that

G: What would you see as a good topic for an evaluation? Maybe it's not going to change anyone anyone's mind but at least could lead to credibility for someone who

HE1: So actually the bigger... Sorry, I'm not really answering your question but I want to say this—the big Achilles heel is our floppy threshold. Because the threshold is almost anything you want it to be. It's from zero, which is how Queensland Health was running business for a few years. They wouldn't spend any more money to improve health. So their threshold was effectively zero. Only cost saving programs... up to \$400,000 or \$500,000 if you are going to help a child with cancer. So the threshold makes everything a bit of a joke because there is no threshold. And \$40,000 per life year gained, if that really a meaningful threshold. I think PBAC and MSAC at that level, when you are talking about allocation decisions with an annual cycle. And writing a health budget—well having a PBAC budget. Well, maybe the threshold has some meaning there but outside of that formal governance process where there's a committee and there's evidence and there's a process and there's a decision to fund or not fund a drug, I'm not sure.

So, your question was should we use cost-effectiveness evidence?

G: Well, my question was more just ... when do you see a clinical problem and think maybe that's where change could happen.

HE1: It's a useful teaching tool. So you know the sixth stool guaiac test⁴ was an absolute classic. You know the repeat testing, repeat testing, and repeat testing. By the time you get to the sixth test it's like 2 or 3 million dollars per life year gained. So that was a really useful teaching tool. It talks about diminishing marginal returns and those kinds of things. So that was kind-of useful. And you can imagine a clinician learning a lot from that kind of approach and changing the way they

think about things. So it's useful to change the way people think about making these decisions. Are you talking about the Australian context or any context?

G: Any context, yeah.

HE1: Ok, so. I think in other places like the NHS where they've got a much stronger culture and you've got things like NICE and people talk this language every day maybe cost-effectiveness has had more impact.

G: Do you think if you don't have that institutional structure...

HE1: Well, I think that's pretty important. You need a regulator and then apply the evidence. If you rely on individuals to use it then well only if it's convenient.

G: I guess then, even when there is the regulator. You as a researcher you need to communicate with the regulator. Maybe that's easier, you can focus on one person.

HE1: We do, sort of, have regulators in Australia. We've got the state government and the people who run hospitals and the people who run unit are sort of regulators. So if you can get a regulator who believes in explicit rationing then maybe. But you need to build a relationship with whoever your informal regulator is. If you are talking about cancer screening, if you got to know the people who run the cancer screening program from state government and got them on side and got a good relationship and did cost-effectiveness studies that showed what they should and shouldn't be doing then that might be a smart way of making evidence have an impact. You really need to have that relationship and that understanding in place. You can't just turn up to some strangers and say this is what you should do. I don't think the paper is going to change their thinking that much, because they have so many other constraints.

G: Let's go back to the process of you as a researcher. You are producing an economic evaluation, what's going to guide your decisions as you are producing the economic evaluation about how you are actually going to go about doing that evaluation? What methods are you going to use?

HE1: This is going to sound terrible but I think researchers are just as guilty as regulators in that we produce evidence for our own objectives. We sometimes fall victim to having the fanciest possible modelling approach. Hooking on to some big trial. Tackling an unanswered question so that we can get a really important publication out of it. And we can boost our own standing in the community and strengthen our CV have a better chance of getting a fellowship. A better chance of getting grants. So maybe we're selfish in the way we generate research evidence.

G: Do you think it's focussed on the credibility within your peers.

HE1: If there's a chance to get a paper in JAMA or the BMJ... I don't think we're focussed on the health problem I think we focussed on getting into the journal. Obviously the health problem is a vehicle for us to get into that journal. What I think we should be doing is generating really nice simple to digest and easy economic evaluations this is something we tried to do with [INSTITUTION] we tried to provide some simple nudge style evidence that isn't the best study and will never get into JAMA but makes it clear that there might be a better way of doing things.

G: So you find sometimes there's a trade-off between trying to be simple and trying to be credible to your peers.

HE1: Yes. I had a recent experience where we got a paper back from a journal and one of the reviewer's comments was this is a rather simple analysis as if that was a bad thing and I thought that was a strength. I think they were trying to say that maybe it was too glib or too shallow.

There's not enough new information or complexity but I think if you can make your point about making a decision in a simple way I see that as really strong. And maybe more likely to have an impact on decision makers.

G: What are the steps as a researcher you can do to have the most impact?

HE1: Well, unfortunately I think you have to get into a high profile journal. And maybe the fact that it is in a big journal... maybe you can do both things you can address an important question with a good method, complicated method, good data set and maybe that's going to improve its chance of getting adopted if it's in Lancet or JAMA, because decision makers are going to think right this is in Lancet so it must be really good. So maybe that's the smart way to do it. But then if it is really hard to understand and difficult and impenetrable then people will be impressed that it is in Lancet but

they won't have confidence or belief in it if they don't really understand what you've done. You're not going to change their practice if they don't feel ownership.

G: Do you think there will be a difference between if you are choosing a topic that would get you into the lancet vs a topic might be useful for decision-making.

HE1: Oh yeah. Ambitious researchers who want to build a CV will be attracted by Lancet. But maybe that's a stage of career thing. Maybe after you've built a CV with a hundred papers in in and you've got grants than maybe you're not so ambitious to make a name. Then you might want to actually get credit in other ways—trying to actually improve health.

G: Who would you see as the end users of an economic evaluation?

HE1: People who control budgets, people who make resource allocation decisions.

G: Would you interact with them as a researcher?

HE1: I think you should. You should do research with them. Doctors, nurses and allied health are normally pretty smart people. I keep going back to our [INSTITUTION] model but what we try to do is get them to engage with the research and do the work themselves with us.

G: Do you find this changes the way the economic evaluation is conducted?

HE1: Yeah, I think it makes it simpler. If you want them to involve themselves and understand it and keep participating in it then I think you tend to cut corners. But again, I think good simple research that makes a good point. Also cost-effectiveness studies are not about estimating the right answer, they are about informing the decision. And we tend to think—and journals are guilty of this—we tend to think we want a precise answer which is valid correct and reliable, whatever. But I don't think we are, I think we are looking for which quadrant are we in and which part of the quadrant are we in roughly. Is this a bottom left thing, is this a bottom right thing, is it a top right thing? And if it's top right are we more above the line or below the line. It's not about knowing the exact truth. But the way we've built science up it is all about knowing the truth, the exact number. How many exact QALYs, the exact change in cost. And all modelling studies are wrong but some are useful, that's the famous quote from George Box. And I really like that

G: The last thing I want to talk about... there is research out there talking to healthcare professionals about the reasons that they see for why they don't use economic evaluation evidence. I just want to talk through some of these issues that they brought up and see how relevant you think these are and what you as a researcher should do to deal with them. With the first one I guess we've talked about it a bit. The healthcare decision makers reported having difficulty understanding economic evaluations, even just knowing whether it is credible or not. But also just being able to follow what is in the paper. You brought up that as a relevant issue. Apart from doing simple studies is there anything else you think researchers and research institutions should be doing to decrease that knowledge gap?

HE1: Well we need to tell a simple story. BMJ is very good at having their "what the study adds?" What the take home message is, that kind of thing is very useful. So what's the bottom line? What's the story. When it's complicated then a decision maker is not confident enough to change their service around something they can't defend. So if they change their service to screening 50 year olds not 40 year olds and someone says "why did you do that?" It's not ok for them to say "I read this abstract and it seemed like a good idea" and so and so. They need to own that research and defend their decision. So they need to be intimately acquainted with all that evidence, they need to be able to reel off the methods, reel off the weaknesses, the caveats, the assumptions. Unless you have done the research yourself it's really hard to have that understanding of the paper. So I think it's about ownership and it's about credibility.

G: Do you think giving funding to healthcare professionals to do economic evaluations...

HE1: ...You build up their understanding. They own the research, they own the innovation and they will defend it because they know how they got to that conclusion

G: Another issue they found was this time constraint. It can fit in a couple of different ways. A big one is that they are healthcare professionals; they've got busy lives already they don't necessarily have time to access this information or to read through it.

HE1: One thing we are thinking of doing is this evidence check. It is up on the board there. It's a

Sax thing where they do a review of the evidence on a question, we are thinking of doing that but for cost-effectiveness. So we have a really nice, easy to read five page summary of the literature and the take home messages. So we do the hard work for them. So we say, this is what we think the literature is saying, here are the weaknesses and strengths. This is what it would mean for health services. So that kind of thing is a way of avoiding that. Like an agency, taking the difficult evidence and turning it into a simple story.

G: I guess then.... With that, how do you make sure they have credibility? As a centre producing these ...

HE1: You need to have a logo that people think is cool. That's why the consulting firms do well. Because people think their logos are cool. People think PricewaterhouseCoopers is quality, high intellect and good work. But the way they work is they would tell them the answer. They'd say "look, you need to get to this answer and you need to put a logo on the report, then we will show it to other people".

G: Do they try to do the same thing with universities

HE1: Yeah, it doesn't work with us. Not only are we slow but we are unreliable.

G: Has there been any cases where that has happened?

HE1: Sure. The [HOSPITAL NAME] has got a [EQUIPMENT]. They've done a very small underpowered trial where [POPULATION GROUP] were randomised to sham treatment or real treatment. So it was a tightly designed but small and underpowered. They showed that there was some improvement, that it has an effect. But to achieve that improvement they've got to put someone in 30 times. Just on that conversation I said please don't us to do a cost-effectiveness study, because you won't like the answer. There's no way in the world it will be a good answer. But they persisted. And they're going through this thing with MSAC at the moment. They need to produce economic evidence in support of getting this thing funded. And they kept coming back to us. And they naively believe that we would do what they told us to. And they paid us. And when they were paying us I was saying we won't do what you tell us to. We'll interpret the information as we see it. And it won't be a good story. I said it ten times. So we finally had a meeting about a week ago and I said it's not looking good. And there were "how dare you?" They were gobsmacked. The naivety was incredible. I think people see health economics as simply something they can control and they've just got to get it down, get the right answer and move on. They don't see us as an objective evaluator. Because cost-effectiveness studies are modelling studies which are in some way discretionary—what evidence you put in, what states you include, how you deal with uncertainty—we are so vulnerable to that game being played.

G: And the final question that people have to answer is whether this thing is cost-effective?

HE1: You can make anything cost-effective. But I've sat on MSAC and PBAC, and the PBAC economic subcommittee. You see this game being played all the time. So a submission comes in, it gets reviewed by the group. They pull it to pieces, and then the drug company goes and fiddles with some things and changes it a little bit so that it looks better. They just play this stupid game. And then the committee is so bored of it they just say yeah go on then.

G: Do you think it's good for committees to have this leeway, or does it just lead to gaming.

HE1: Ummm...

G: If you had a strong cost-effectiveness threshold would that have the same sort of risk for gaming?

HE1: I don't really like the idea of a company making a submission to the committee because you are always setting up a game. Why don't independent researchers evaluate drugs and technologies published in the literature, and then the committee just looks at what's in the literature, maybe does its own work in house if it needs to. If it's a really big decision then they need to improve what's in the literature then maybe they can commission some independent work.

G: Another comment that came up is that some people feel uneasy about using cost-effectiveness as your decision-making. That cost-effectiveness isn't the only thing that matters. As a researcher what can you do?

HE1: Yeah, we shouldn't just have a cost-effectiveness health system because that would be a strange thing. We wouldn't save premature babies; we wouldn't prolong life for terminal cancer when maybe we should prolong their life for a year. What's important I think is the opportunity cost that you are incurring by investing in non-cost-effective technologies and I think you need to know what that is. That's what you need to live with. So it's what you're not doing that matters. So as long as we can afford to be inefficient that's ok. If we are wealthy enough to tolerate some big inefficiencies then that's ok. What we can't abide is harmful things that we invest in. And we do a lot of that. Or things that just have no clinical benefit. I don't mind spending 100 grand per QALY on something that does generate real QALYs but I do have a problem spending 100 grand on something that hurts somebody or does nothing for them. Things that make no material benefit like MRIs for back pain, knee arthroscopies or whatever. There are classic ones that get trotted out every time. That's indefensible.

G: That's it from me. Is there anything else you would like to add?

HE1: You know I think a large percentage of us do it because they enjoy the process. And that's ok. And the way we reward researchers is by numbers of publications and impact factor in journals. If researchers were rewarded based on change to health outcomes then I think there'd be quite different research. But I think at the moment you get a fellowship if you get into big journals and the root to big journals is not necessarily doing useful research. Research that can make a huge difference to lots of people. When we moan about cost-effectiveness not being used maybe we should look a little bit inwards as well as outwards.

HE2 Interview: 27th August 2015

GM: First I'd like to think about an economic evaluation that you have worked on in the past couple of years; preferably one that is now finished. Go back to the start of doing the economic evaluation, what was the instigator for starting that?

HE2: I think probably the clearest example was a time when it was a group that was [INSTITUTION – REDACTED], their main function was [REDACTED], but they also provided advice on [REDACTED]. I think there must have been a lot of device reps around at the time and a lot of research evidence around the effectiveness for [INTERVENTION – REDACTED] and the idea is that you use these and they lower the risk of [ADVERSE EVENT – REDACTED]. So I think that's where it started from, but we get a lot call from [SPECIALTY – REDACTED] people buying these things and are they worth buying? There more... they were available as a standard offer, a standard offer being they've been approved and they've supplier and they are available for hospital purchase and then the hospitals can choose from amongst those listed which one they actually do choose to purchase. So they weren't really using them, they were probably pockets going on but they were obviously getting encouraged from the device reps to be using them more. So it was really driven by them wanted to understand whether they were going to be a good buy or not.

G: Do you think there was a negotiation aspect or was it just about the choice?

HE2: You mean a negotiation on price.

G: Price, yes.

HE2: I don't think so. Because these were public hospitals so all negotiations at that point were still done centrally. So in order that they keep even using these things they would have had to negotiate, presumably were Queensland Health goes out to tender all the different companies that make this device responds to the tender and they pick the ones from that group. And they fix the price with them. And then those things are available for all the hospitals that are covered by that agreement to buy at that price. So I think it was more a—so the pricing has already been fixed but the reps were trying to increase demand. So there is no guarantee that they buy them. It's just that they have locked in a price should they choose to get there.

G: Do you think this background affected the choice of perspective of the economic evaluation?

For these people making this decision what do you think matters or doesn't matter in terms of the

economic evaluation?

HE2: Although they are, in the grand scheme of things they only cost a few dollars each. That's compared to a few cents for the [COMPARATOR – REDACTED]. And they are used with such regularity. So there is a lot that get used. And therefore even though it is only a small per item increase it would have been a big chunk of their budget. So there is that going on but then at the same time it was when all of the kind of standard and the monitoring around [REDACTED] was ramping up. It was very much about what it meant for them, it wasn't about patient quality of life or patient acceptability.

G: And in terms of stakeholders, would it essentially just be them and I guess the manufacturers.

HE2: Yeah.

G: What sort of economic evaluation was it? Was it a trial-based?

HE2: No, it was a modelling study, pulling information from the literature. All of it came from the literature apart from some of the epidemiological data about baseline [INCIDENCE] rate, length of stay things that we had to make specific to [REDACTED] hospitals. And the costings obviously came from [REDACTED] pricing. But in terms of the cost-effectiveness of the interventions and any sort of predicted improvements in patient outcomes as a result or reduced [INCIDENCE]. At that point length of stay and mortality came from the international literature—there just hadn't been that work done in Australia.

G: And the choice to go with a modelling approach was that just pragmatic?

HE2: It was pragmatic base on time constraints really. I think also that the evidence was available. Because it was the financial driving it, it wasn't enough to present [INCIDENCE]. The [INCIDENCE] had to mean something to the hospital—so it had to be lives saved or bed days gained. Some metric that had an inherent value.

G: Did you end up using QALYs?

HE2: We did use QALYs but it was pretty meaningless because I think it was easier for them to understand in terms of bed days saved and lives saved. We did do it was QALYs but it's an acute event. Most of the people who had been in hospital anyway. So the QALY decrement post discharge was probably due to the underlying condition. So the actual gain in QALYs was miniscule. It was really about stopping people dying. So I think it can be really hard because otherwise you are either trying to put in in terms of QALYs saved per 100,000 [INTERVENTIONS- REDACTED] or 0.0012 QALYs saved per [INTERVENTION – REDACTED] and neither of those metrics really made sense to the people trying to use that information.

G: How did you present this information to them? What was the context of presenting this.

HE2: I think it went back to the centralised surveillance group. And their steering committee. It also went to various professional conferences—a national one and local chapters. It went out in a sort of quick, very short, very brief. You know, "research has shown that these devices are not an efficient use of money." It also got incorporated into guidelines, so those were being updated at the same time. So it also fed into that. It was also used as one the elements that was promoted in the pre-launch of the guidelines. So it kinda went through to them but not in a pure form. As I'm talking, I'm realising that that decision was almost made centrally but the central state health group and its steering committee. But these weren't value for money. That judgement was passed down, opposed to the actual results being laid out. Then everyone can make their minds up.

G: Did you publish the results?

HE2: Yeah.

G: What was the timing of publishing of the results compared with all this happening?

HE2: There must have been. It must have been around the same time as the guidelines were being launched. So I think there was fairly contemporary.

G: So essentially you had a manuscript but it would go to them and go a clinical journal at about the same time.

HE2: Yeah. Because I'm pretty sure they could cite the manuscript in the journal. And it was a journal that had a fast turnaround time. So I think they would have gone ahead with the thing if they hadn't been able to cite it. But yeah, I think they were able to cite the research evidence. But I

would have to check that one.

G: I guess they were the people paying you, but were they keen for you to get a publication or was that more something...

HE2: No, they didn't really care if it was published or not. Though I suppose the people doing the guidelines because then it backs up the evidence for the evidence base. But in terms of what was going to go into the guidelines—yeah they would have gone ahead with or without it with the same recommendations and suggestions. I didn't feel their drive to publish it.

G: I guess at your end it finished when you disseminated it to that group of people.

HE2: Yeah.

G1: What were the considerations you had when you were reporting your results to those people? For instance with your choice of outcomes, the level of your aggregation and disaggregation of outcomes. What were some processes you go through for that or decisions?

HE2: I think it was tossing up between what actually made sense. It was actually a bit of a compromise in a way between what we actually had good data to show and what was meaningful in terms of their decision. So even the evidence for the effectiveness of the devices tended to present—it's big flagship finding was the impact of these things on colonisation and not on infection. The further out you got the more tenuous the link becomes. Or the more uncertainty I suppose there is. But there wouldn't have been any point doing the economic evaluation at all if we were only going to look at it in terms of colonisation. Because it's completely meaningless to anybody because they don't have to—because that's not something you can measure and monitor for internal feedback and performance measures you wouldn't go outside the trial because it involves extra swabbing and laboratory work. So it had to be as a minimum infection but I think because there was this—the angle was very much we're doing this selfless thing but it's going to take a big chunk out of our budget. The focus did seem to be on... there was a focus on getting infection rates down but I don't think the driver for this one was can we optimise a service. You know, it wasn't about can we improve life and we are prepared to pay more to get better patient outcomes. It was about can we afford to do this.

G: Is it more like a business case?

HE2: Yeah. That's how it was. The metrics that really mattered were infection rates to some extent, but really what those infections meant. Really I suppose the focus was on bed days. I guess it was a given in a way that if you have lower infection rates you're saving lives. So that was a massive tick. It was going to do that, so that's why we are even talking about it. So I suppose what they really were interested in is minimising bed days, because they are going to have to use a business case way of thinking to offset the extra expenditure for the devices.

G: Were the costs fairly straight forward? Or were there going to be costs that some people would be more bothered about than other people.

HE2: There was a bit of stuff around treatment of infections and how you manage that. But it was fairly minor. I guess the only big one is this perennial issue of how do you value a bed day. And that was interesting because that did generate discussion. It was one of those even if you do value it and you adjust the consumable costs for a later day of stay. We did some accounting value for bed day, it was before the decision makers. Just some work that had come out about expenditure on consumables. If you took out all the hotel costs and whatnot and were left with just what it took to manage the patient in that bed day with the understanding that infections happen later in stay and in those later days less is being done to the patient than in the earlier days. So actually they are quite cheap. So we did look at varying the value given to a bed day. And fortunately it was one of those nice ones in terms of being easy for people to understand that it didn't make a difference. That these things were still cost-effective with long stays

G: In the end did you have a new product that costed more but is better?

HE2: Yeah.

G: How did they decide what was cost-effective? Was it mostly based on cost saving?

HE2: Yeah. All the way through it you felt that all they were interested in was something that was cost saving. And I got the feeling if it wasn't going to be cost saving then they weren't interested in

it.

G: Now I'm going to move to some more broader questions. In general do you think economic evaluation is useful for decision-making?

HE2: Yes, I have to believe that it is useful. Otherwise why am I doing this? Unfortunately I sometimes feel that it's used to justify a decision rather than make a decision. But I suppose that is somewhere on the spectrum of decision-making. Why do I think it's useful because a lot of the time it is what people are juggling in their head? It may not be that they assign it a monetary value but usually it is some kind of value that they've assigned and why something is worth doing. I guess that's tricky because sometimes the value that they are making those decisions based on isn't something that's able to be captured in an economic evaluation because it's not something that you can really put a monetary value on. But a lot of the time it is, and I think the climate—fewer and fewer resources and even the way that they are bringing in new initiatives and new monitoring processes a lot of it is focussed on economics as a way of measuring performance—or efficiency anyway. So I think it is useful, I think it's used I think sometimes it is misused and I don't think it is always the most important consideration to people.

G: When would you see a situation and think that's not a good time to be using an economic evaluation?

HE2: I guess when you... It's not necessarily a reason why you wouldn't do it but I think you have to be careful about doing it in context with other methods of evaluation. I think if it's a context where.... There's no point in doing an economic evaluation of the flying doctors service if that is the only thing you are going to do. And you are only going to think about the things that you can actually then attach monetary values to. I think you'd have to do it more in a broader evaluation framework about the value of that service to the community and to society and bringing in other principles that are founded in economics, like rule of rescue and equity issues but don't fit very nicely into a traditional economic evaluation. Because I think otherwise it can be misleading in the same way that just looking at effectiveness without the economic evaluation is misleading. The other time where I wouldn't do it is when it's just bleeding obvious. Why waste your time doing it. If it's really straightforward you can actually do it in your head and say these two things achieve exactly the same outcomes and this one costs half the price. You don't need to do a full economic evaluation to demonstrate that unless you've got concerns about is that price not reflecting the true cost of that. A lot of clinical things, if it's improvements or something that's come off patent things like that... it can be straightforward it's just that one is going to cost you less money. So if a service has gone in and it hasn't done what it was supposed to achieve even if you are kinda going "yeah but it didn't cost very much to implement so maybe we should see." If it didn't work or there is no actual evidence that it made a difference then it's got to be a waste of money. [Laugh] I'm glad you agree.

G: [Laugh] Well yeah...

HE2: I suppose what's difficult is how you share that kind of evidence. If you haven't done a proper economic evaluation than it's quite hard to get that information out sometimes. Do you spend the money... This is where there is this tension I think between implementing something for a need and you might want to monitor that if it is part of a quality improvement loop but evaluation adds this extra layer of monitoring and analysis and reporting on top of that which is really valuable for people externally but might actually not very important for people who can just see it if it is working or not working. I think you see it with funding bodies like aid agencies and things when they are giving out money to people to implement community disease control programmes and then they are insisting on very stringent evaluations of those but the people who are actually doing it there, they are trying to put a programme to address a need, and monitor for their own purposes to make sure it is running properly. And the evaluation is kinda useful for them but it is more useful for the donor agency for deciding which projects they will choose to fund or not. But they are the ones having to expand the time and energy collecting the actual information. So it's really... there is a tension there I think. I'm not advocating that you shouldn't evaluate things properly, but it does become...

G: Have you had experience with evaluations that people are using internally where you don't have some outside group—I'm thinking funding bodies but could be something else, a quality insurance body I guess—where it's people making decisions internally. Have you had... maybe they just don't have the resources.

HE2: You mean when they are trying to evaluate something internally and they're not looking to publish the information

G: And it's not necessarily designed to convince a group to give them more funding, it's actually just to improve their internal process

HE2: I'm trying to think whether I've...

G: I know it can get hard because with big organisations...

HE2: Yeah. I don't know actually how to answer that question. I kinda get the sense that sometimes people come to either me or to the [INSTITUTION] because they have been trying to do that and make decisions for their own processes and I think people must be implicitly doing this all the time but whether they are doing it very well I don't know. Actually I do know one. I have a student who's doing an economic evaluation of [INTERVENTION] and they've done their own internal monitoring pharmaceutical expenditure and incidence rates. They're looking at whether the programme has made an impact or not. What's interesting is how you... I think they have been using it to refine the programme. They haven't been using it to question whether the programme is overall any good. There are some quite interesting things about what costs they've chosen to include...

G: So it's more about what gets included in the programme or not rather than whether you should do the programme?

HE2: Yeah. So I think they have made refinements based on what they see they've put in. One of the troubles is that some programmes like this, their big costs are upfront and they have to buy new software and they have to do a load of staff training. So there is restrictions that once it's going if it turns out to not be very good value for money there it's not like they can cut it back and over time it will actually become more. Or actually it would become more efficient over time if they run it over time. But they can't immediately cut the expenditure. Do you see?

G: Yes.

HE2: And I think that's the other thing. I tend to evaluate things within a very short timeframe, which is also challenging because if your programme will probably become more efficient over time as you get slicker at doing things and you create more demand for your programme. But quite often they are doing it earlier on in the piece. So you get this massive set up costs and only a handful of patients in the first few months. So I think they are trying to but they are a bit inhibited in how much they use it because I think some of the groups they do it but the results are really terrifying and then they don't understand the choices that they've made in terms of setting up the evaluation and the impact that might have on refining. I'm not saying they should fiddle it, but you know what I mean, just understanding...

G: Yes...

HE2:... that if they evaluate it in the first year...

G: Whether those upfront costs should be included... what is truly the intervention and what the true comparator.

HE2: Yeah. So I think that is difficult. I think they do that, they don't like what they see. And don't understand why something... and how they could do it differently. And then just kind of bury it somehow. It just becomes a bit

G: Do you find as a researcher there is an incentive to find that things are cost-effective?

HE2: Yeah, I do. I think even with other researchers as well. So clinical trials or something. And there's a research team that doing the trials, so it's not a company, there's not commercial incentive. Even so. Because I think they are worried that it undermines the evidence that they've produced about whether it's effective. It's still seen as a negative result and not as publishable not a palatable. And then I think it's worse if it's within the service. A lot of the things that I get asked to evaluate have been put in as novel things to meet a perceived demand. So the problem is that

you turn around and say it wasn't cost-effective. There's still a demand, there's still a need and there is this sense of well if we don't do that what would we do? So there's this difficulty I suppose there with quite often what you are being asked to do is evaluate this versus nothing, you are not really given the time and the space and I wouldn't have the content area and time to evaluate this versus all other possible options. And then there are issues around whether those other options are actually feasible and practical. But yeah, so that gives a bit of a skewed picture, then it's like we can't say that it's not efficient because then we'd have to put that out to our funders and have to go back to square one where there's nothing to do to address it. So I think it's a little bit tangled up sometimes.

G: Apart from finding the results that they want [laugh], what are other ways that as a researcher you find that you can encourage your research to get translated into practice. What are the most important steps from your perspective as an individual researcher?

HE2: Some of things that I think people seem to be quite interested in is actually when you talk to them about costing out an intervention. I'm always surprised how much gets missed. An obvious one is sort of staff time that is put into a project. If they didn't have to actually employ a new staff member that quite often gets missed but also... I'm thinking what will the set up costs involve as well. And if you hold a launch for something is that counted or not? I'm going well... So I think that if they feel like the evaluation truly reflects their services as they see their service or their product or whatever it is—then I think people are more open to the result. I think if they think you've included things which they don't think of as part of the service. And I don't think it is about making it look good, I think it's just that they don't see that as being a part of what they are doing. I'm trying to think what else. I think it's different in different clinical areas. There are some areas where it's about trying to produce the same patient outcomes but at a low investment and other areas where they are much more focussed on... so I think that's more the acute care stuff and the more ongoing care stuff and the chronic diseases. I think people are more open to the findings where you actually have to invest more but you'll achieve better outcomes with patients. So I think again it's getting a handle on where they're sitting, what their goal—what they care about I suppose. People that are doing—going back to the example I was talking about—a lot of the drivers for that were the finances and the budgeting within departments was really what they were interested in was having the cost side noted very clearly and broken down so that they could see this is what they were spending and this is the areas that they were spending on. So in a way if they wanted to ignore the staff time costs they could do that in their own head. So they could just look at the expenditure on consumables and then look at the bed days with a lovely dollar figure attached to that. So maybe understanding why they are doing it helps with taking it on board. And I think they also seem to be very—it's nice if it's been done with a particular purpose in mind as well—if they are revisiting guidelines, if they've got a big report due to the Department of Health, if they've got some kind of showcase going on. You know there's loads of it to hospitals. Or if another area has come to look at them for inspiration than it, that also means they become about what it shows because it's as much about evaluating a particular thing as about showing that they are an institutional department that engages in reflection and evaluation of their own practices and procedures. That seems to mean that they are more willing to take on board the findings. But I do find... I think anything that if it gets overly complicated. So I think also doing a lot of uncertainty analysis and sensitivity analysis so you've got that information there but not necessarily presenting all of that at the time when you present the main findings. So if you check a few things out and know it's robust to all of those then maybe not actually going through all of that just showing that it's robust. Because I think people tend to glaze over a bit. Whereas if you found something that's really important or you know it's something that's really going to be questioned, that's divided opinion that can be useful because actually I think it gains a bit of trust from the different parties that you've actually done it from both points of view.

G: Actually, that's a good word to... what do you think establishes the trust?

HE2: Hmm....

G: Do you think the guidelines help establishing the trust?

HE2: You mean trust in you conducting the evaluation?

G: That you are part of this set of official guidelines—that you’re sort of bundled with this. And I guess working at a university...

HE2: Ummm...

G: [Laugh] Or maybe not?

HE2: Yeah, I don’t know about the university thing actually. I’m not really sure whether that carries weight. Because quite often I think there’s this sense of god you take ages, you’re really slow, you’re really pedantic, you communicate things in a way we can’t understand. There are people who prefer working with a more commercial consultancy firm because what they get is more straightforward. And some of them do a good job as well. And I think there is also sometimes a sense that you might just go off and do your own thing and actually we just want you to do this. Because there is that tension sometimes between wanting to make things more complex and more rigorous because I think there is more to explore in that question because I don’t really think they’ve got the time to do that. Or it’s not something that is really interesting to them. But I think actually it’s about being professional, because I think the criticisms that come back about the universities are if you think about it more about the manner of working than what you are doing. So I think failing to get back to people promptly not sending things through when you said you’d send them through. Poor project management, so no one has a clue what is going on and when. Pushing people to do a lot of—quite a lot of the time I’m asking people to get data out for me or find some bits of information and if I’m doing that—and I think again you have to work out how you do that with somebody—whether it’s somebody where you like to have everything you are going to need and they just go away and they get it for you. Or whether that’s overwhelming and they’re someone who really likes it if you just say “you need to find out this for me”, and they can go and do it bit by bit. But again maybe not if it’s... sometimes having an understanding the content area helps but that’s not always possible. So I think it’s good to have done a bit of background reading so that you are not asking really stupid questions. Appearing engaged, like bothering to actually have a proper meeting where you sit down with somebody and if it’s a service that they are evaluating just understand what that service is and then you can actually ask smart questions about it. Rather than thinking what it is and doing something then coming back and saying well we didn’t do that. Oh but we’ve also got this person who comes in two days a week and does that. That was part of it as well. Or not knowing where the patients go afterwards and whether it’s supposed to change that or not. So you actually feel like it is a tailored evaluation and not just a churn it out type of evaluation.

G: So it sounds like engagement...

HE2: Yeah, I think engagement and I think being professional about how you deal with people. But then I suppose there is a bit a sense of—I know this sounds awful—but I think people get this sense of “oh, is that all we are doing?” sometimes. I think they want to feel that they are doing something rigorously and not necessarily complicated. But I think scribbling... This is going to sound horrible... but going in with a data collection tool which might just be an excel spreadsheet that I have knocked up which breaks things down into categories—as opposed to just sitting and having a chat and scribbling in my scruffy notebook and going “oh, is there anything else you can think of”. Which probably... Yeah I think it’s about having a process. So maybe explaining some of the—in a very simplified kind of way—maybe some of the reasons for asking questions as well so that they understand that we didn’t just sit down and have a chat. There was actually a way of framing the whole decision. So if I sat there and said—how long did you run the service for and how long are you going to run it for. I don’t just sit there and go—18 months, 5 years of possible funding—I explain and “because, as we were just talking about if I evaluate this over a 5 year period it’s probably going to look more efficient than if it’s 18 months for these reasons”. Then I think there’s this sense as well that they are actually working with someone who can add additional expertise and theory to their problem that they wouldn’t have necessarily had themselves. They are either getting something from working with you rather than this kind of oh we could have just sat down with our sheet of paper and said I think we’ll do this this and this. So

maybe try to convey a bit more about the structure and the decisions within the evaluations.
G: That's an interesting point and something I hadn't thought of.
HE2: Well it'll be interesting to see what other people say. Whether other people go "oh no, it's all about the title. And that's what establishes me as an expert. Or it's all about knowing the content area otherwise you don't stand a hope in hell.
G: Well that's all of my questions, unless you have anything else to add?
HE2: No that's ok.

HE3 interview – 10am 8th September 2015

GM: The first thing I'd like to ask is if you could provide a bit of your professional background?
HE3: Ok..
GM: You don't need to say where....
HE3: It's ok. My background is in pharmacy, so I come to health economics from a health rather than an economics background. I then did a PhD in an area related to health economics and then I've done about seven years' post-doctoral research in health economics.
GM: What drove you towards health economics?
HE3: I guess a couple of things. One was an interest as a health professional in a more population focussed. I'd done a lot of work as a health professional with an individual focus. I wanted to do something that was a bit outside the square of what I had done but still used my expertise and experience of what I had gathered. That was my second reason; my third reason was that part of my role was working with a committee who was responsible for making decisions around the funding at a state level—of health technologies basically. So that probably sparked my interest in the potential for health economics.
GM: I'd like you to focus on an economic evaluation that has been completed.
HE3: Yep.
GM: So, the first thing is how did that start? Why did you start doing that economic evaluation?
HE3: That particular one.
GM: You can provide as much context for that economic evaluation.
HE3: The one that I'm thinking about was looking at [INTERVENTION]. It was for benign [CONDITION]. That was actually done as part of a fellowship. That was driven by the state government.
GM: So the state government...
HE3: They were interested in an evaluation of that.
GM: Why do you think they were interested in doing an economic evaluation for that?
HE3: Because they were looking at implementing it into the state hospital system. So they were interested in evaluating its implementation at a fairly small scale so that they could consider the value for money for doing it.
GM: So, was that based on a review of the literature and building a model around that or was that a trial.
HE3: My economic evaluation or what they were doing?
GM: Sorry, yes your economic evaluation.
HE3: So the economic evaluation I did was based on audit data. So there was no trial, it wasn't done within a research framework it was done more within a health services implementation framework. There was no trial, it used audit data and literature data to build an economic model but a fairly simplistic economic model as opposed to a full blown Markov, it was a fairly simple decision analytic model.
GM: How did you... Maybe it was determined by the limitations of the data, but how did you determine the scope.
HE3: Well, a few things. It was determined to some extent by the research question. Because we were looking to address a specific research question. It was determined by the limitations of the

data and the relevance of the data. It just wasn't a feasible thing to do a trial. You know, we had audit data and pre-implementation as well. So we did have some comparative data but obvious in terms of evidence it wasn't ideal. In reality we couldn't get an RCT. And then it wasn't modelled long term because it sort of wasn't within the remit of that research question and resources that were available to do it, and the timeframe.

GM: Were there long-term consequences which were really... because it was benign wasn't it?

HE3: Yeah, so it probably wasn't relevant to go into a longer, to go into a more detailed model. And the other thing is. The reality is that you want to keep things simple. You don't want to go into overkill. Because people need to be able to understand what you've done. I think doing a more complex model would have been first of all overkill for the research question and secondly it'd just look like something that was much more complex and harder to understand to address a question that could be addressed more simply with the data that we had. And you might ask this, but there was a lot of uncertainty left with addressing the question. But doing a model wouldn't have solved that uncertainty. So we did what needed to be done but it was reasonable given the data that we had and for the research question and for the audience that were going to be looking at it.

GM: How did you disseminate your research then? Was that just directly to them or was it published?

HE3: That one was published. But it was first disseminated to the people involved and the decision makers at state government. So I remember I presented to them at one of their meetings. I didn't present to the clinicians... if I remember correctly there were three or four sites involved across Queensland from the data perspective so I didn't present to each of those. But I was working closely with clinicians at each of those sites who had been involved in data collection and been involved in implementing the technology. So, as well as presenting to the decision makers I also published... now let me think there was an abstract. And if I remember correctly one of the clinicians presented the abstract at a meeting and I've certainly presented the abstract to one or two conferences. But I drove the writing of the manuscript and all the clinicians at the sites were on the manuscript. So that engaged them on the research. And the people from the state government who had been involved in the project implementing the project were also on the manuscript.

GM: How many physicians can use this technology?

HE3: Oh, I don't know the answer to that...

GM: I don't mean the actual number, but is it likely the people involved in the research were the people...

HE3: Well this wasn't really "research"...

GM: Yes, I... the auditing.

HE3: Well I call it... It was research. It was implementation research. But the state government would probably call it...

GM: Audit and feedback...

HE3: Yeah, the state government will call it an audit of an implementation to a larger scale.

Although, I'd call it research. It's implementation research if you'd like.

So how many people... sorry I've lost track. There were three or four sites. There were clinicians involved in each of those sites and possibly not all clinicians who did... It may have been select clinicians. And this technology could possibly be implemented. I'm guessing because BPH is quite common that it could be implemented more widely. Potentially to either [SPECIALIST] department or so forth.

GM: In terms of the live presentations, there were presentations to decision maker or bureaucrats and then to clinicians. Did you find that the presentations were different to those different audiences?

HE3: I never presented to clinicians... Oh, I presented at conferences but it wasn't specifically clinicians in fact I think I presented at a medical conference of a very mixed audience.

Was the presentation different? Yes, because the one to the decision makers many of whom

were clinicians but not necessarily in the field. Was a little more in the framework of the evaluation of the technology within that particular organisation. Whereas the presentation at the conference was of course much more a sort of introduction. Much more academic. And I didn't present myself to the clinicians involved with the technology. But the paper was a standard. The paper actually got published in a clinical journal. So it was written as very much with a clinical focus. But as an economic evaluation within a clinical framework.

GM: So the publication, was that after this internal process?

HE3: Yeah, it wouldn't have been published till after. I probably would have started writing it up alongside. But it wouldn't have been published and accepted till after I'd done the internal presentation.

GM: So there was a presentation to the government, was there also a document—a summary document. Or was it a manuscript?

HE3: Yeah, there was a summary document to the government. There was also a report I did for the government, but it was quite similar to—like an early version of the manuscript but it was slightly more detailed. If I remember correctly, I wrote more for the report and cut it back slightly for the manuscript.

GM: Why would you say there was more detail for the internal report?

HE3: More appendices I think. So it's not so much that there was stuff done it was just that I hadn't cut out the sorts of—it was probably just wording. I don't know if it was detail as such. It was probably just reformatted more than anything else. I think there were some appendices that were cut out.

GM: That it may have just not fit into a journal?

HE3: Yeah. Probably not.

GM: But could be of some interest...

HE3: Yeah.

GM: Apart from that was there any other formats for disseminating the research?

HE3: I don't think so. No I don't think there was.

GM: How much did you have to adjust you language for these internal reports

HE3: Ummm gosh.

GM: Or were they...

HE3: Do I remember? I don't know that I did adjust my language very much because it was always written with that sort of audience in mind.

GM: I guess the question I should have said beforehand was what sort of experience did these people had in terms of understanding for the reports.

HE3: Very variable. But quite switched on. Because they were a group of people who were quit immersed in evidence based medicine and decision-making already. And some of them would have been involved at a state level for different processes. So it would be variable. But I'd imagine that the concepts would be understood but the technical details would not as a general rule.

GM: I guess the other thing is that, what sort of concepts were brought up... Was it necessary to talk about QALYs for instance.

HE3: Not in that... No the closest it got to that would be the concept that the evaluation wouldn't have captured any. Because I think from memory it was a cost min. So it wouldn't have captured any difference in quality of life. See that would have been made clear as a limitation that these things hadn't been captured but we didn't have to go into QALYs. However, I think that generally a lot of these people would understand what a QALY is. But wouldn't know all the intricacies of the technical derivation.

GM: So it wouldn't have been necessary to do an ICER either? Because it would have just been a cost min...

HE3: Yeah.

GM: Was there an exploration of uncertainty?

HE3: There was. Because it used audit data alongside some other data to produce the model

there was some probabilistic sensitivity analysis. Which looked at uncertainty around the comparative estimates and there was some even though it was only a cost min. But I wouldn't have gone into extreme detail... in the manuscript of course and in the report I would have reported but in simplistic language what I'd done... Well, no... In clear language without dwelling to much on distributions. But of course so they would have been presented some range of uncertainty and that would have been understood I think as essentially a confidence interval around, which was quite wide.

GM: [laugh] So how meaningful is a cost min with a really wide confidence interval?

HE3: Yeah, so that's why I say, "does it address the research question?" The particular evaluation only addressed the research question with a very level of uncertainty. So from what perspective was that helpful? Well, it was helpful that it showed that there may be promise... that the technology might be cost saving. The extent of the variation of the data by hospital admissions and cost of hospital admissions and length of stay and all these sorts of things was sufficient that it was not easy with the sample size.

GM: Do you feel like they understood... did you get the sense that the uncertainty was understood?

HE3: Yes. I think generally because they can see a wider confidence interval that indicates that the result could go either way. And I also presented some probabilities of it being cost-effective in a fairly simplistic way. So yes, I think the uncertainty was understood.

GM: Do you think It changed practice?

HE3: Ummm...

GM: Even practice buy leading to further auditing.

HE3: That's difficult to answer. And I'm not even sure what practice... To be honest I haven't got a lot of insight into what practice was standard. So, I don't know if I can answer whether it changed anything. And the result like you said wasn't clear cut. I think it provided some level of evidence—you've got practice in terms of that technology and you've got practice in terms of health technology assessment. And I think it gives some reassurance that you are trying to value the implementation in some way, which is better than not evaluating it. Even if you don't end up with a solid evaluation.

GM: If you found very strong results, let's say that it certainly wasn't cost-effective. Would you say that would have changed practice?

HE3: That's very hard, because you are evaluating alongside implementation. One of the challenges is that at least with those trial sites you've already implemented the technology. So it's probably hard to think would it change practice. It may well change practice but particularly in terms of further implementation of the technology more widely. But if you've got not cost-effective results when you have already implemented at some sites with a technology of that nature—as opposed to a pharmaceutical where you are just buying per patient—where you've got a technology that you've invested in a particular device to do something and clinicians are starting to use it in some way. If it was not cost-effective it's really hard to think whether it would change practice in places at all really. Because then you are in the position where you have to pull out something which is in. But I'd think if you've got robust results that it's not cost-effective it would change opinions about whether it should be implemented more broadly or supported or extended. Or question why it's not cost-effective. Or reevaluate, again. And I guess there would be further questions of why it's not cost-effective. Is it cost-effective in some sites but not others, and if that's the case why? So it'd require a bit more looking into.

GM: Do you think there are other contexts—bringing it more broadly—where economic evaluation would have more of a strong role in terms of impact on decision-making.

HE3: Sorry, are you meaning..?

GM: Sorry... Are there contexts where economic evaluations are more likely to have an impact on decision-making?

HE3: Yeah, so I guess. I'm not quite sure what you are getting at. There are a number of processes that do use economic evaluation, and seem to pay attention to that. Which you

obviously know of. I don't know that I'd say that it's necessarily a difficult time to... in terms of the processes I've talked about I don't know if it is necessarily difficulty in terms of taking head of the economic evaluation it's often in terms of the decision makers involved or the organisation involved. I think it's probably more about the limitations of the data or the process, the resources that are available, or the research question which relates to in the case I gave an actual technology with high upfront costs. And the fact that it's technology related to clinical practice where there is practitioners using that technology as opposed to pharmaceuticals say where it's a very standardised one pill that doesn't have the same cost upfront, outlay or clinician training. I guess what I'm saying is that it is... these are all well documented in the literature. There are differences in technology that might make some technologies easier and more amenable to cost-effectiveness than others and to implementation and practice change. And in decision-making processes easier there are lots of reasons why a practice might be amenable to cost-effectiveness analysis. Although, I'm not sure that I'd say that it is not amenable to changing practice. It's more the potential challenges and barriers around that that don't necessarily relate to decision-making than the actual research itself.

GM: The validity and how valid you can be with that research...

HE3: Yeah, and the data and the technology itself. And there are examples where some of those barriers are less. Pharmaceuticals say. And the process that's in place. And the culture that's in place. It's always quoted that there are some areas where the culture is not amenable to value for money as evidence.

GM: As a researcher, what do you think are the most important things to consider in trying to make sure that the research you do gets translated into practice?

HE3: Alright, talking just generally. Not specific examples. If you are thinking about implementing and translating your research into practice, a few things that spring to mind is, first of all to make sure that you're researching a practice relevant question. You really want your question to be driven by people in practice addressing a relevant problem. On the coalface if you want to put it that way. You want to have people on board—crucial to have people on board from practice. So that you've got people that are interested in that research and champions of that research within the relevant practice or clinical area that would be responsible for implementing findings of the research. Then of course there is the making sure you engage with stakeholders who might be relevant to that. Then of course the scientific rigour, so that your research needs to be defensible and justifiable. Then the disseminating of it to the right places, so disseminating it to the audiences that have the power to change practice. You also need to think about how you explain the research in a language that people understand.

GM: I'm going to ask you a bit more about all those things. So relevance... How do you make sure that your research question is relevant? Is it just the research question that is important—are there other aspects that are important when thinking about when talking about relevance.

HE3: Well... Um.

GM: I guess methodology or....

HE3: Well, the research question is sort of clear. I was thinking of the relevance of what you were actually addressing. I mean, the methods have to be relevant to address your research question. So it's not going to be helpful if you sort of... and feasible to implement and all those things. So that's kind of a different question I guess. But what I was thinking was more about you could research lots of things, but it's the ones that address real world problems for people in practice or in clinical areas that are likely to be driven ahead and taken up by people in clinical practice, and that are likely to make a difference. It's important that the people who are interested in the answer to the question can understand what you've done; otherwise they are not going to believe what you say. But that's about having them on board and ensuring that it is reported in a way that can be understood.

GM: Is there a process that you can go through to make sure you are actually asking a relevant question.

HE3: Well, I don't know that I'd put it quite that way. It's more about how you start your

research. So a lot of the research I do is me joining someone who is actually a clinician to address a question, but they don't necessarily have the research skills to address that. Particularly the economics side. Which is why a lot of my research is where I'm part of a team that is often being led by somebody in the area. So that is how I know that it's relevant. I lead some research and that's because it's in my areas of expertise and it's in areas such as preference research where you know the area well enough that you know what's happening internationally, so you know how the trends are moving. If you've got expertise in a particular area you can be at the edge of what's happening. So you know and you can see what is important to do. Or to do next. So if I'm leading that I always involve clinicians from the areas, or researchers in those areas who are likely to know the field relevance of what's happening as well as me knowing the methodological relevance.

GM: It sounds like these partners as well as the stakeholders tend to be involved most from the beginning?

HE3: Yes. I think it's important to involve people who would be likely to know the current trends in the area. Whatever that might be—often clinical trends—early on. And people who not only know current clinical practice but who are quite on the edge of current clinical practice so that they know how things are changing over time. Because a lot of the things are fast changing. And what you do now might be completely irrelevant in 2 years' time.

GM: What do you do to make sure that what you are doing is rigorous?

HE3: Well, that's where your expertise comes in. It's about choosing the appropriate method to address a research question. Try not to be too blinkered with certain methods. Try to involve other experts if needed so that you choose the right method not just one that you would like. I often work in teams which brings more than one perspective. Peer review. With grants, if you can get external funding it gives you an element of peer review which gives you an element of reassurance of rigour. Hopefully, to some extent. Protocols, which gives an element of rigour. Because people give you feedback on the protocol.

Other than that, expertise. Keeping up with the literature in the area. Or doing a literature review in the area to ensure that you are working appropriately in the area.

GM: You have talked about the communication aspects; do you find you have to do some education?

HE3: Sometimes you have to do a lot of interpretation. Often people they want an economic aspect to their study, but they often don't know the best way to do the economics. They might have a general feel for the principles.

It's so variable because some clinicians have done economic evaluations in some way and you'll meet people who have done none. I don't think I've ever met anyone who doesn't think doing some economics would be a good idea. And to what extent that is driven by an understanding of the need to convince decision makers that something is value for money.

GM: So you haven't received any pushback on the more broad philosophical issues—whether cost-effectiveness is good?

HE3: I've never had anyone say to look at cost-effectiveness is not good. I have had comments from people about the hypothetical nature of some of the things that we do. And that might apply to various types of economic studies. I think if people have been trained strongly in evidence based medicine and levels of clinical evidence, sometimes excepting that you might model something not based on randomised controlled trial evidence or that you might use preference data based on hypothetical decisions. Those sorts of things sometimes people feel uncomfortable with. So you have to have conversations around that.

GM: What sorts of things could you talk to people about? Let's say with preference data.

HE3: By the way it's not just clinicians it can be other researchers as well. Look it's about accepting the limitations of the study, and that if you are addressing a research question that can't be addressed with actual decisions then accepting that you might look at hypothetical decisions might be a form of data that you can use. But acknowledging the potential limitation of that and looking for examples where hypothetical data do reflect real decisions. Or looking at

the data, and the face validity of what it's telling you. It comes back to choosing the right method for the research question. If you had a better method that didn't rely on hypothetical data, or you could use several different methods. Sometimes it's about things adding up across several different methods or studies. That things are consistent, even though you are using several different methods for several different limitations. I was also thinking in terms of the modelling and relying on assumptions in the analysis where if you have people coming from an evidence based medicine perspective where you are always looking for this very high level of evidence, sometimes if you are using hypothetical assumptions around data then you have to reassure them that or test those assumptions. That you can look at the impact of those assumptions, which can be difficult.

GM: Is there any way that you find you can make the assumptions easier for people to grasp?

HE3: I think it's about clarity. You've got to report in a clear way that so that people should be able to understand what you have done and it should be clear what assumptions are based on. It depends a bit on when you are talking about. If you are talking about the design stage it's more about talking about the methods, the limitations, and the limitations of any alternatives. If you are talking about the reporting stage it's about clarity of reporting what you've done and the assumptions that are needed for that to hold and what happens if those assumptions don't hold.

GM: In the literature, one of the factors that determine whether evidence from economic evaluations are used is credibility. Do you see this as a distinct concept from rigour?

HE3: Rigour is sort of the soundness of what you've done, while credibility is the extent to which some people believe what you've done. Obviously you need rigour for credibility but there's other things that must come into credibility. Such as expertise, or your actual findings might go to credibility. Because if findings are against what everyone else expects then everyone else will immediately say "well, is that right?" That then goes to some reassurance on the rigour of what you have done and being able to explain why you have different findings.

GW: Another issue brought up in the literature is the issue of time constraints. One way to think about time constraints is that they as clinicians have to access the research but that their time is constrained. The other way they might want a decision now but it would take too long to do an economic evaluation.

So in terms of the time constraint of clinicians, have you seen that as an issue?

HE3: In terms of clinicians accessing the findings of an economic evaluation? Not really, because my general feeling is that if a clinician is interested in something they will access it. So the problem goes back to if they are not interested. Obviously some will be interested and some won't be interested. And I probably haven't worked with those who are not interested. I've probably only met with a particular group of clinicians. Generally the ones I work with are engaged in the study that I'm with. And also a lot of the clinicians I've worked with have been working as clinicians in a particular clinical area. My general experience is that clinicians working in particular fields are very good at being up to date. So if you publish it—now, if it's not published that might be a different question—but if you publish it they are pretty good at being up to date at stuff that influences their practice. And I would imagine that includes cost-effectiveness studies as well.

GM: Would you think it actually comes back to the relevance. About making sure that the stuff you publish...

HE3:is relevant to your research. Yeah. Is relevant to clinical practice. To the current edge of clinical practice. But that said I would qualify that statement by saying obviously the people I've worked with are likely to be engaged in research or health economics etc. Obviously there could be another whole group out there who aren't engaged.

GM: [laugh] They just don't talk to you.

HE3: Yeah.

GM: Have you had issues with people saying cost-effectiveness isn't the only factor which matters?

HE3: I've heard that said lots of times, and I'd completely agree with it. So it's not an issue for me because I would probably be one of the first to say cost-effectiveness is important but it's not the be all and end all. To be honest I'd be concerned if we lived in a world where cost-effectiveness was seen as the be all and end all. If anything, I'm more concerned if decision-making were to go that way.

I think there is a risk that decision makers get driven by the cost-effectiveness bandwagon which is held to be very important in decision-making and people can see its relevance but I think one of the risks of people not understanding all the things underlying cost-effectiveness is that they don't understand weaknesses and limitations and then at risk of thinking "well, if something is not cost-effective we shouldn't do it". So I'm not necessarily saying we should do something that is not cost-effective, I'm just saying we shouldn't necessarily see cost-effectiveness as a discrete decision criteria—and obviously most people who make decisions don't from my experience.

GM: Do you think there are things you as a researcher can do to improve this?

HE3: As a researcher it comes back to the clarity of reporting limitations and being clear that this study suggests it is under these assumptions. But it doesn't take about of this, this and this. But as a researcher you are often doing that as a study around cost-effectiveness. A decision makers going to have to take that piece of evidence alongside other considerations for the decision. A lot of my research is looking at things that might be important. As a researcher you don't want to oversell the results of your studies. It's about clarity and transparency in a balanced way of what the findings are

GM: Do you get involved in including criteria other than cost-effectiveness, such as equity or access?

HE3: That depends on the research plan. It's important not to lose sight of how cost-effectiveness might be considered alongside other things in a decision but it depends on other things. If your study is about whether something is cost-effective then that is one thing, but if you are doing a full health technology assessment then yes, you would hope you would be outlining explicitly some of those other things. There is quite a lot of research happening around methods like multicriteria decision analysis and so forth that might be able to consider cost-effectiveness alongside other things within a systematic framework. But I don't know the extent to which that is actually done in decision-making.

GM: Have you had experience with multicriteria decision analysis

HE3: Not directly in a policy context. But I am involved in a study that's using it but in a research context not in a policy context.

GM: What have been the attitudes around multicriteria decision analysis?

HE3: It wouldn't be fair for me to comment because all of my discussions around it have been in a research context. I suspect looking at the literature it may be taken up more. But it will be interesting to see what happens in a few years.

GM: Were there any other issues that we haven't covered?

HE3: Not really. We talked about communication and we sort of hinted at this. But I think in the applied health area it's very important to talk applied health language not applied economics language. There's a distinction...

GM: They've got their own jargon?

HE3: Yeah. There's a difference in terms of jargon, there's a difference in terms of conventional ways of putting something. But that's kind of a common thing. Adjusting your language for the audience. You need to use the language that makes sense to people from a health background. For example talk in stats language not econometric.

You have to walk a fine line. I think you are always better to put something more simple than more complex, in terms of explaining it regardless of your audience. Because at least you take everybody with you and people can ask questions. But there is a fine line between doing that and then of course if you've got a more technical audience you need to give enough of an indication of the technical rigour that underlies what you are doing. But that doesn't necessarily mean you have to report it in a complex way.

It's about how you explain things and the level of knowledge that you expect your audience to have. You are better off explaining things in less technical language and assume a lower level of knowledge as a general rule. If you are talking to a health audience you largely need to focus on the consequences in terms of health and clinical aspects and explain and interpret what has happened underneath. And you generally need to keep things quite quick and precise. If you are talking to an economic audience you need to provide more detail on the exact type of modelling that has been used and more technical detail generally—which would be completely lost on a health audience. And, not only would that be seen as not to the point.

HE4 interview – 28th October 2015

HE4: we did in fact an MCDA for HTAs they had costs and organisational fees. So I think that's the way to go. The issue is getting practice into evidence. One of your quotes said that you've got to work with people. The paradox of that is that you are assuming relevance. That the stakeholders actually want accessible, scientifically relevant stuff. At the moment I think NICE are used to saying "we've done a thorough economic analysis, here's the result." But in most cases I think the decision is taken and it's judged on whether it supports the case. If it doesn't support the case then it will be rejected. In one way it's process utility. People are not really concerned—the people who are funding—or indirectly funding—the funders. They say we must get this rigorous background to our decision but when it comes to it that's all they want to say. We had a rigorous evaluation and here it is. And then whether or not it has impact—whether it changes the decision is unknown. And that's perfect, that's what politics is about.

GM: In Australia we tend to have two types of economic evaluations. In the first type you have a group like the PBAC where there is a process and they are going to make a decision based on the evidence. And the evidence is produced in order to make that decision—but maybe that's not the case.

HE4: Reimbursement

GM: Yeah. The other case we tend to do it is we've done a big project that is now completed, and you are demonstrating that the project was cost-effective.

HE4: I wonder what the cost-effectiveness of doing the cost-effectiveness analysis as a decision aid. I believe you have to measure decision quality. Having measured decision quality you say do you want a three month, a three day, a three minute cost-effectiveness analysis. The question is what would they do otherwise, what's the comparator? Because we will be making a decision somehow. So comparators go out the window when health economists talk about evaluating cost-effectiveness analysis. The comparator might be a normative checklist. A thing I published was on decision resource decision effectiveness. So you would expect a decision resource to be cost-effectiveness and that's fine, but it's up to the people to put a threshold

GM: Consultancies will sometimes do rapid evaluations. It'd take 2 weeks and it'd be rubbish by academic standards, but you would get a pretty good idea whether something could possibly be cost-effective.

HE4: My colleague in Law picked up this idea he's running side by side a rapid and a full evaluation and working out what's the gain from the full one compared with the rapid one.

GM: Whose this whose doing this?

HE4: A psychiatrist who got interested in MCDA and the software. So he's got two or three staff and he'll say "you do the full one and you do the short one", and what was the incremental gain from doing the full analysis. And maybe it's positive but it poses the same question is it effective compared with the intervention. In a sense the next question is that incremental gain for the decision transform into a bigger or small gain at the margin.

But you have to have an outcome measure of decision quality which is what we developed. To me all this has to be evaluated at the point of the decision not downstream. And so much happens in between. That retrospective cost-effectiveness is nonsense. I mean Martin, Huxley,

and Stephen (?) model—I think it’s called the payback model looking back at programs what was the payoff. Looking back explicitly is meaningful but recreating the cost-effectiveness.... I mean why would you want to know though.

GM: How much success have you had trying to get multicriteria decision analysis into NICE?

HE4: I don’t know whether I am. Times are changing, remarkably. So that it’s more acceptable for people like [REDACTED]—they’re all mainstream accepted people. Now they’re starting to do it. Even ISPOR is setting up a task force for best practice in MCDA. They keep asking me if I want to join, it’s like “no, I’m not interested in joining some consensus on this, because I know that my strong views about whether it should be done this way—I won’t be changing my views. I’m not going to say “This doesn’t meet your guidelines”. I’m sorry but your guidelines were based on a whole series of value judgements along the way among groups making trade-offs between rigour and relevance usually. But we don’t need them. All we need is for it to be context specific—whether it is done in 6 weeks or 6 months. There are certain principles, we agree, but the idea that the whole process needs to be standardised.

Cost-effectiveness is a classic example; there isn’t a correct way to do it. Every input into a cost-effectiveness analysis can be done in multiple ways.

GM: I don’t know if this is right, but I tend to think about cost-effectiveness as not a science but instead a form of argument.

HE4: Well, there are two different things. Just funding everything is completely wrong because if you ask a hundred people they’d all say we shouldn’t apart from a few deontologists and clinicians, they’d say no we have to look at what’s the benefits to the people who are benefiting what are the foregone benefits, and we’d have to make a decision on that balance. That is widely acceptable; it’s not an ideological position. How you do it, what you include in the benefits and harms, who does it. We just had published; did I send you the South West paper?⁵

GM: No.

HE4: This called NICE’s use of cost-effectiveness biased. But only because it’s not going into the South West Quadrant of the cost-effectiveness plane.

GM: This is what is happening in the PBAC as well. It also... it misses that these things are in flux. You are making this decision that it is cost-effective, and it was cost-effective 5 years ago...

HE4: But that was yesterday. I asked that question of NICE and they said, “well, we’ll look at that in three years’ time.” The whole apparatus is ossified. Things which should not be... Because the readers of the Daily Mail are asking for some drug. If you calculate the best estimate the drug doesn’t change anything. It’d be sensible to not fund it. But no we’d have to refer it back to a target group. Jobs for the boys. Although there are a few girls now. I’m not sure I can answer the questions you are asking. Because except for multicriteria decision analysis I’ve never done something that you would call an economic evaluation. Although I would insist that economic evaluation isn’t confined to QALYs.

GM: Well, I consider multicriteria decision analysis as part of economic evaluation. I think if you are considering costs and you are considering effects then I’m going to count that.

HE4: Talking about cost-effectiveness. I thought it was interesting when I came to do one with costs, of course out of pocket costs are money—but I wanted to put in the social costs. The opportunity costs. I was wondering how to do that and I was reading Karl’s article and it said the answer is to convert it to QALYs. They’ve gone back to the £12,000, which is their estimate of what the NHS values per QALY. So what this intervention will cost other people in QALYs. It won’t be a monetary amount, but it will be a monetary amount divided by 12,000 and therefore be so many QALYs. So you are depriving the population of so many QALYs by having this intervention. Then of course the criteria is effective on people and you get to weight that. As a separate exercise you can interview people and they say “I don’t give a stuff about people”—zero weight. It’s very transparent.

GM: If you turned everything into QALYs –it sounds like Net Benefit except instead of putting a monetary value on everything you put a QALY benefit.

HE4: Maybe you'd like a better measure but it's not monetary. The social cost to other people of the forgone benefits has to have a measure. At the moment put it in QALYs. Of course the ethicists hate it. They say it's alright to impose costs on other people is it? Well no, we don't like that way of doing it, we'd rather it was hidden.

GM: What do you think of the cost consequence debate? That you shouldn't have QALYs at all you should just report all the consequences and just let people make their minds up based on those.

HE4: That is sort of the MCDA approach.

GM: Yeah, the way I see the MCDA is it's a way of doing that but allowing people to do the trade-offs themselves.

HE4: Just putting it all out there is not helpful. That's my position. That's why the ANALISA is the one decision aid that produces a decision based on the evidence and your preferences—here's the answer. All the others, here's just helping you, go away and think about it and make up your mind and come up with an answer. It's fatiguing. You are increasing the problem. While with MCDA you say here's the answer so then you can say why did it come up with that? Well you had high weights for that and it's not very effective... It's a completely different discourse. These Mayo cards are starting to do what I call add-ons to other people's decision aids. Which drug you should take etc. Each of these cards a clinician hands out at the start?

GM: It goes to the patient? Or is it for the clinician?

HE4: Yes, it is meant to only be used in the context of the clinician. I'm saying that, no, sorry, I'm not interested in protecting the clinicians and leaving them in control. While they talk about these points. Then the individual can say how important these things are out of 100 points. So it's a big battle.

GM: What have been people's responses when they've seen ANALISA?

HE4: Over the years?

GM: Yeah...

HE4: Almost always say interesting, then they come back and they think about it and in my view and see the implications. They see either they don't like it for themselves or they would have to sell it to their colleagues. And of course then there is the NICE context, there is much context about all these other things you've got to take into account apart from QALYs but you have the lawyers and the other people saying "no, no, this is a cookbook approach. We have to wrestle with this at every individual case". Therefore, you can never come to a principled decision. We had this at NICE, they said well in some circumstances we will raise the threshold maybe from £20,000 to £30,000 or maybe £40,000. So, fine. I don't have a personal view about it—one what the answer is—but I do have a view on how it should be done. John Cairns and I got together and said, ok, let's have a discussion about the health multiplier for this should be. It's not going to be one by the sounds of things, even though one would be my answer. It's probably not going to be 10,000. So there's a number in there. Of course it only took them about four minutes before they said—oh no we couldn't derive an abstract number for this. We need to see what number emerges on a case by case basis. Well, it justifies what they've already done. And they come up with 1.4 in one case and 1.6. We are simply saying that if you are claiming to be equitable you have to use the same number. Whether it is about cancer or heart disease. If you change that number—the whole purpose of setting up NICE is to be consistent.

GM: Do you think NICE would face greater political pressure if they had a stronger threshold?

HE4: This came up so much that they took cancer drugs out of the NICE process. They have a separate fund.

HE4: I would say the prime output of a cost-effectiveness analysis should be a ninety second video. That should be your goal, your prime deliverable. Explaining what happened, why. But you can't think that's possible when you've got a problem. Forget the paper, nobody will read the paper.

GM: What if the primary purpose of the economic evaluation is political—to provide credibility for something they want rather than having an open mind...

HE4: I'm not sure how common that is. There are these points of political equipoise so it gets kicked into the cost-effectiveness long grass. Something where the parties aren't going to be able to resolve. One party has the power to commission it and affect the terms under which it is done.

GM: Can you describe an experience of translating a MCDA into clinical practice.

HE4: The main point there is the flexibility to develop an analysis which is timely, and that the inputs must always be the best estimates available now, which I call the BEANS (Best Estimates Available Now). And almost all cases we are talking person centred. There are no robust BEANS—because the trials have not been done and can never be done. So you've got to develop an entirely different mindset to the role of scientific evidence—great if you have but if not then let's get on with it. That's what the clinicians are going to do anyway. Whenever I see at the end of an old article pointing out all the difficulties of making this decision is if you have any doubt go consult your doctor. Well I'm saying, I've just read all that, how can the doctor know—how can he improve on it? Does he have some mysterious access. And the same with committees staffed with lots of irrelevant people—from NICE and all sorts of people with various roles. But they were there because they were something to do with something. Whether that something had any relevance to their thinking about these issues. The most irritating were the patient representatives because they are always in favour of whatever was being assessed. I kept pointing out that they were representatives of patients with this condition, they were not representatives of patients. Only the health economists were representing the whole patient—by drawing attention to the opportunity costs. Through patients who aren't directly being treated but who are going to suffer because resources are going to go somewhere else. So I don't think MCDA, if it is just captured by the establishment including academic establishment it will make no difference. It will just become ever more complex so my aim is to put these very simple ones out on open access to the community to say let's see what you think, have your say. Because it is empowering you relative to people who will just use MCDA in the same biased way as they use cost-effectiveness.

GM: With this one you are working on, you are working on it now?

HE4: What I do is I find decision aids, but they almost never present in a way which is accessible without a clinician who is there. And it never allows them to expressly trade-off between factors. In ANALISA you say how important these things are. It shows you that it matters, what your weights are and you get a result.

GM: Were you contacted by someone to do it?

HE4: No I read all these... I have a website. I call them translation algorithms. So someone produces a decision aid on something I say, well I'll put it into ANALISA because you haven't done that extra step of allowing a person to get their preference weights and see the results and some groups are opposed to this.

GM: Do you think the issue of credibility is relevant for MCDA the same way it is for economic evaluation?

HE4: Well, yes and no. All these techniques are grounded in some theory, it's not prescriptive in MCDA which is a plus for me. Which is hated by the prescriptivists, which building on how humans make decisions... well, good luck. Because in my experience that is a tough task. So I'll help them by giving the simplest possible implementation of the ideal decision maker. Within five-minutes, ten minutes, or ten weeks. You choose how much time you are willing to engage with this. So I'm not going to sign up to any set of normative checks which say you have to do this, you have to do that. That's building up an empire an academic empire. People will have to pay for these things. MCDA is the only way we can open up the decision-making to the ordinary person. Mainly because the vast number of them already go to comparison websites to buy a refrigerator. They know you have criteria and you performance weight them and then you decide is reliability more important than performance. So the language and competence is pretty much

already there and if you make it more complex you are losing them straight away. It just becomes another “ah... what’s that all about?” But of the problem is that people want that—many stakeholders want to show that we did this enormously complex exercise and that it’s rigorous, well done so now we can ignore it. But I’m saying no, I don’t want to make it more complex because ultimately I want it to be done at the level of complexity which is requisite to a solution. Now if you can’t handle more than five attributes—of course an attribute can be broken down into this and this and this. But ultimately this is a decision to be taken now and you have to say the overall rating for that is this on a scale of naught to one. If you can’t do it, well how are you going to make the decision?
[46:00]

HE5: Interview: 2nd November 2015

HE5: Well at that time I think, this was like 5 years ago, at that time innovation was a focus, so a lot of people thought about how innovation should be captured within economic evaluation. And MCDA was initially one of the methods that captured that so, and I think that NICE wanted DC to look at it. A few months later they organised a big workshop on different things, and one of the topics was complex decision-making. Trying to develop a more qualitative method to capture these issues. Yeah so I think just general interest in economic criteria, in particular innovation I think was the reason for DSU to look at MCDA.

G: And since then have they been using multi criteria decision analysis more, or?

HE5: I’m not aware of anything that they have done. Some of the other, they don’t call it MCDA, but some of the highly specialized technology assessments have a list of criteria that they follow.

G: But that’s not quite MCDA or they just don’t call it MCDA?

HE5: They don’t call it MCDA and they don’t use any of the weights of scores that you would associate with MCDA. Are you interested in the international level of things?

G: Well do you work internationally for it

HE5: Locally, locally

G: Well then yeah just probably just at a national level. It seems like the UK is more ahead than Australia in MCDA, but I’m not sure if that’s actually the case.

HE5: Well, it depends. I think UK is ahead partly because of methodology. On the MCDA taskforce three of the people from the UK run it. So they’re more aware of MCDA in terms of whether they are actually using it or not, I think hard to know. There are more discussions around the method. Whether they actually use it it’s hard to say.

G: Have you been mostly focused on MCDA from a NICE policy perspective or at the micro level?

HE5: Yeah most of the work I’ve been involved with is not national. MCDA can be used at different levels. So the work I’ve been involved with is mainly at the local level, so like the local PCTs [Primary Care Trusts]. They came to us to ask us for some health economics support. Because they wanted me to allocate their smoking cessation plan. So we’re doing some MCDA work with them. We essentially went through the process with them and said this is how we will do the process. We had a PhD student here, he did the workshops on MCDA and they came up with that outcome.

G: Did you have challenges trying to translate that research with those groups?

HE5: No, they were actually implementing the allocation. I think with MCDA or anything the issue is the buy in. If they are interested...

G: So they were initially interested...

HE5: Yeah. They didn’t know about MCDA but they were interested in having a way to prioritise. So when we explained MCDA it appealed. We also got some funding to do this in other areas, which is more on going to these local authorities and explaining to them the

funding. I think that has been a bit more challenging, because they already have an existing way of doing things and they didn't want to do something that isn't that they felt they couldn't understand.

G: Yes, it's similar to... In Australia we don't have these local authorities but we have to target individual hospitals. It's probably a similar in a way. As part of this project how are you going about trying to target these groups?

HE5: In the project we have three Local Areas and we went and we spoke to the authorities there. Our remit was just to help provide health technology support if they want to use it they could use it. If they didn't want that was ok. We did workshops and then in some places we did MCDA as well. Initially we just went to the different sites and did a half day or one day presentation and asked if they were interested in coming back. In some places we did the MCDA all the way through and in some places... At one it was one workshop then they decided that MCDA wouldn't be relevant. So we just stopped because we didn't want to go back to them and convince them. So from our point of view there is no need for someone to it

G: Is this research published or ongoing?

HE5: Part of it is published. There may be another one in review which is on barriers where some of these things come through. These are common barriers for decision analysis instruments, it's not just MCDAs. Language etc.

G: How did you go about trying to present MCDAs to the local authorities?

HE5: We explained to them that there are budget constraints and you have to make a choice. And then we explained how MCDA can help structure around this decision. We went through the separate steps and the options for the criteria that were important to them. And then we showed them examples of how MCDAs had been used before. There are examples of this in the UK—some not technically MCDA such as a simple score card or options appraisal. We gave them different examples of these techniques, some of them they knew already. And we said these are all the different tools you can use if you are interested we can come back help you. One of the aims was to do capacity building so that they could do it again themselves. So we didn't want to make it too complicated.

G: What approach did you take to try to build the capacity building?

HE5: Just walking through the steps of the whole MCDA process. Once they've seen it, it's not too difficult to do it again.

G: Was it covering economic evaluation as well or just MCDA?

HE5: We started with economic evaluation. We covered both cost-effectiveness analysis and cost utility analysis.

G: So you covered QALYS?

HE5: Yeah. And then we linked it to quick approaches such as the simple score card which do not go to the same level of rigour. One of the dimensions thought out was the evidence base. We said that there were two things; one was the evidence which is whether you get your data from expert opinion or from a systematic review and so on. That's one aspect that we had to cover was the methods that we use; whether we use random ad hoc methods or methods that have more structure. Because at the local level they know about QALYs but it's not practical for them to do a full economic evaluation.

G: So the economic evaluations aren't practical but maybe the MCDAs...

HE5: Yeah. Because if they have 15 options then for them to do cost-effectiveness analysis for each of the options... It's not going to happen. For drugs it's fine, it's a larger population when you are doing it at a national level. When you are doing it at a local level then doing a cost-effectiveness analysis is tricky.

G: Do you think with MCDA that it can serve two purposes? One where you don't have to do the full economic evaluation but you can still go through a—maybe this is the wrong word—thorough decision process even if you don't have all the evidence. And on the other hand you can use it when you've done a full economic evaluation to add extra factors apart from just cost-effectiveness.

HE5: It depends on the problem that you are trying to solve. It depends on the scale and so forth. It also depends upon whether you want the quick and rough answer or you want a precise answer. At the local level—or even in low or middle income countries where there is not enough time and resources to do the same things that people do in the UK or in Australia or Canada—MCDA is useful. Thailand use it, and Malaysia, and South Africa. The way they use it is the first way you mentioned, they use it to prioritise. And the second option that you mentioned is how to combine other criteria with cost-effectiveness. I think that's mostly for established organisations. Also, it depends on whether you think of cost-effectiveness as a framework or you think of cost-effectiveness as an attribute. I think, especially in the UK, that a lot of people think that cost-effectiveness is a framework. And QALY is the measure of benefit. So if you want to use MCDA to combine QALY with other measure of benefit, which may be equity or access or anything, you think of as value. Whether a framework or an attribute each has separate issues. If you think of it as an attribute then a lot of people will think... well the main issue seems to be opportunity cost in the UK. The threshold value is based on the QALY as the measure of benefit. If you are approving or not approving certain drugs because of other criteria then essentially you are not considering the opportunity of cost in a consistent way.

G: Do they have alternative ways to incorporate... well I'm thinking equity concerns...

HE5: So cancer drugs are the only ones where there is an explicit threshold for certain drugs. There is end of life criteria, where they are willing to go extra. And I think even those get criticised by people because they think every QALY should be the same. It should not be different based on other things. If you had other criteria based on cost-effectiveness these are the things that happen. I think most of the time you are only increasing the threshold. I've never seen examples where the threshold has been decreased. So people argue that it's not consistent and it's not really clear how you do it. So that's the issue with adding other criteria on top of cost-effectiveness. But equally to move to the other framework where you change from QALY to another measure of benefit. That is a lot of work because firstly people need to agree on what is a measure of benefit. Because QALYs are still contested by many people. The second issue is the threshold because the NICE threshold it started with historical decisions and it converged on the value. And I think York did some work with the threshold they came up with an estimate that is much lower. But they can't use it because they always had the context of the next few years. I think if there is a new measure of benefit, they'd have to develop the whole process again. Or come up with a new threshold, which would be quite the job. So those are two different ways MCDA can work within an economic evaluation.

G: When you are doing an MCDA for a local authority does it include an estimate of cost-effectiveness?

HE5: It depends. If they have a fixed budget and they want to prioritise which ones to run then they can do a budget impact analysis. Sometimes people have used cost-effectiveness but they don't measure the same way as cost per QALY. They could be anything. So people have used cost and cost-effectiveness within an MCDA. So the question comes back to the argument of whether using cost as a measure of benefit or whether you think cost should be measured against something else. There's no right or wrong answer, it depends on how much information you have about everything else. I can't remember exactly in the one that we did. There was a feasibility thing, which was in the MCDA. There was also value for money. They weren't quantitative in the sense that they were not... they put it on a scale. A lot of people have done a similar sort of thing. It's rated on a scale of highly cost-effective or moderately or not at all. I think in some of the MCDAs I've seen most of the time there is no data on these things, so the score that you get are a combination of subjective opinion as well as actual preferences. And sometimes there's no data so people might say this is really or not really cost-effective because there is no other way of measuring cost-effectiveness.

G: Can I ask about your experience with economic evaluation?

HE5: Yeah.

G: I'm trying to get an idea of the way economic evaluations are done through the decision

support unit—so you’ve done a technical appraisal?

HE5: Yeah, that wasn’t through the DSU. The DSU only does things that are complicated or there is a reason to send to other people. We also have a technology assessment group. I’ve done a few HTAs with that group.

G: With those—can you talk to me about how it starts. What are your deliverables for it? Do you present just a report?

HE5: It starts off with a scoping meeting where you meet with the company and you finalise the scope of the HTA. Once they finalise the scope you wait for the companies submission. You get the dates—from getting the company submission you have eight weeks. So you get given these dates—you prepare and do the whole thing. Once you get the company submission you have two weeks to read through and understand but you also want to liaise with some clinical experts because some of the things are not that simple, assumptions etc. Over those two weeks you have teleconferences and meetings to talk through the model. At the end of two weeks you’ll have a list a questions for the company—the company has two weeks to respond to your queries. For first deliverable in a sense is the list of questions that you need to ask. You need to say if something is not clear. Can you do this analysis for us. They may or may not do it based on other considerations. And then you get your responses back after four weeks. Then you have four more weeks to write up your report and to redo the analysis, and essentially critique or comment on the submission. There is a standard template for that—called the evidence review report—it’s a template you need to follow. There’s bits of it where you can write your critique and so on, and there’s opportunity to do additional analysis. And then you submit the report—that’s the second deliverable. I guess the next deliverable is the meeting. Before the meeting NICE might have a chat with you about some things and at the meeting you have to explain anything that the company wants to hear. And the company will also be there, they can explain if there is anything ambiguous. After that they might ask us to do additional analysis. Depending upon what what the company feels is valuable. Usually it’s two meetings but and then depending on whatever information they’ve you have to do an original analysis. So that’s the general process.

G: It seems like the challenge of trying to get evidence to practice is very different for doing it for these technical appraisals than it is for say one of these local authorities.

HE5: Yeah. NICE has guidelines, so everyone has to follow it and everyone has to be doing it the same way. And they have established guidelines on how to do different things. There is methods on pretty much everything, from reviewing, searching through to statistical analysis and sample modelling, mapping and so on. All of it has good practice recommendations you need to follow.

G: And you’re not going to be training them?

HE5: Yeah, all the company members. Even if they can’t do all the things they can understand what you mean. And the results have to be presented in a certain way—in terms of cost-effectiveness ratios and all the different ways of capturing uncertainty. Everyone knows and understands so there is no explanation around what is a cost-effectiveness acceptability curve and what is a plane and what is a relevant measurement. They already understood. It’s more checking whether the assumptions are valid, and the choice of states in the model, and whether anything needs to be done. At the local level there is no... they do lots of other things so they can’t have the same level of rigour. They don’t have the same level of process measures or guidelines. That’s why MCDA can be helpful because they can help them structure their problem in a more transparent way. Maybe because people think.

G: What challenges do you think there are to the good use of evidence from economic evaluations in NICE?

HE5: Challenges? What sort....

G: Well, an example might be in Australia we have the Pharmaceutical Benefits Scheme, which is like our mini-NICE. And one of the challenges we have is that we have this scheme and it is good for making sure expensive drugs don’t necessarily get in but if we have good evidence

that a drug that we are already paying for is not cost-effective then there is not much we can do about it.

HE5: Yeah. So the NICE technological programme only looks at new drugs. And it doesn't look at all new drugs either it looks at some drugs. And that's only part of the whole healthcare spending. It doesn't include other things like diagnostics, medical devices, highly specialized technology, and even things like healthcare delivery and public health.

G: They don't get captured...

HE5: No they've got different streams. But the way they do economic evaluations in those different streams is different. For example medical devices—they only look at cost saving devices. The idea is that health benefits are the same but you are reducing cost on the system. And if they think that a device is more costly but also more beneficial to health then they put it through a different system such as diagnostics—which is cost per QALY. The highly specialized technologies don't use cost per QALY because they don't have cost-effectiveness ratios. They have cost and health benefits separately.

G: They just do cost consequence?

HE5: Yeah. And public health is completely different because there is no evidence for certain things such as walking or cycling. They even use different frameworks sometimes such as cost-benefit analysis and sometimes things like return on investment. But it's a different way. And then I think they've started doing the healthcare delivery thing but it is at early stages. But that's even more complicated because every healthcare decision is different. What's relevant in Sheffield won't be relevant in London. In some of these other areas there are clear challenges to using evidence because sometimes there is no evidence or sometimes the evidence is not the same level as drugs. The challenges for methods are much more philosophical about the use of cost per QALYs. What's the best method cost saving or cost-benefit analysis is a better method. In terms of the technology appraisal, the challenge of implementation is prevalent in everything. One of the criticisms from York is that we are essentially giving more benefits to the people who we can identify. Their argument is that we know that the threshold is lower than £30,000/QALY so if you say yes to someone at greater than £30,000/QALY we are essentially giving them priority—but because we can't see who we say no to they don't really care. But that problem is everywhere. Sometimes NICE gets unfairly criticized, because it is one of the most transparent systems in the world. Because it's so transparent everyone can do any sort of analysis and say they are not consistent or they or not considering this thing and so on. But when you compare to other countries—it's like New Zealand is pretty much a black box. You don't know what is happening there. I think the transparency is sometimes a limitation because when you go to conferences and talk to people a lot of the time they say NICE said this but they are doing this. Consistency is a hard thing to achieve.

G: When you are trying to be transparent you have to consistent as well.

HE5: Yeah. But I think about how many people are really consistent in their personal decision-making. Because every situation is different. And I think NICE is the most consistent because they have a clear way of allocating resources. Whereas other countries are subject to... there's no clear way. That doesn't necessarily mean it's a bad thing either because New Zealand can do discounts and deals with the drug companies which other countries cannot. In some ways maybe that's better in terms of efficiency because you don't have to worry about consistency

G: You just make a deal with the company...

HE5: Yeah.

G: Do NICE do risk-sharing arrangements?

HE5: Very infrequently. Usually it's either a yes or a no. They can't even negotiate the price. Because the company comes up with the price. Because they try to do value based assessment, which was around negotiating the price. Instead they incorporating other things, which NICE didn't adopt. Yes for some subgroups and no for some. But if they only put forward one population they can only say yes or no.

G: As a researcher, what things do you think you can do to help make sure good evidence gets

into practice?

HE5: There are different issues. One is what is in your control and what is not in your control. For some situation it is not in your control—you have to follow what is proposed and go along with it. It's a tricky question. There are some people who think of their job as just a job and just do it. And there are some people who are a lot more passionate. I think I'm somewhere in the middle. If something is clearly wrong than I think you can say something about it. But the question is we don't know the full truth. My biggest concern is what is the value of the threshold. In some ways there is no point in trying to get the best evidence into practice if you know that the threshold is three times higher than it is meant to be. But there is also other things you can do that provide more incremental gains. It doesn't have to be at a national, it could be at a local level. If there are clear inefficiencies then you can make things better. And that doesn't have to be economic evaluation, it could be MCDA, it could be things like dynamic simulation modelling or something, which can streamline the service. But I think with the evidence it's tricky because in some ways the policymakers have to buy in. I think the main thing will be to get the policymakers to understand the value of what you are doing and then it will come. I've seen examples of times where people spend millions doing a research study and then showed that certain things were bad for peoples' health but then the government wouldn't act on it. For instance cigarettes and alcohol. But I think the main thing is to get buy in from policymakers

G: One of the things about doing economic evaluation is that you should be informing a decision—otherwise there is not much point.

HE5: So all the things that we do here have practical use. Either we are doing things for NICE where it's governing policy—which drugs, devices and health technologies to be funded and so on. Or we do things for consultancy—which again drug companies. Or we do things for public health. I think that's where it gets a bit more... For certain things public health stuff is still fine because they still use it. But for certain things it is a bit more challenging. I think the closest one is telemonitoring which was part of a big project looking at telemonitoring. We wanted to do models that go beyond cost-effectiveness because we wanted to look at financial monitoring and cost to stakeholders and so on. I think that is the only model where we did the model but there is no clear link between the work and the decision maker. But I think that does not necessarily mean that it is not happening. Because we have a website with the model. So different local health authorities log in and can redo the analysis.

G: So they can login in and...

HE5: Yeah. I think we turned our R model into a base model.

G: Does that mean those local authorities can login to make the model locally relevant to them?

HE5: Yeah. They can choose whatever data they want. And they can have different outputs. It's not just cost per QALY there's also loads of other things. So that's the only one where there is not a clear link between what we did and the people making the decision but people are using the model.

G: So you tried that strategy to make it locally relevant?

HE5: Yeah. They can put in the transition probabilities for the UK as a whole or they can put in their own values. Then they can choose the setting and so on.

G: That's exciting, I'll check it out. Is there anything we have talked about so far that you wish to elaborate on or anything you have said that you would like to retract?

HE5: No no. I think that's it.

HE6: 4th November 2015

GM: The general structure of the interview is I'll ask about the context that people work, what they see as ways that we do economic evaluation that could be improved and what they see as things that researchers can do to help users of evidence. It would be good to

talk about a recent evaluation that you've done.

HE6: Ok. The most recent one was an economic evaluation alongside a clinical trial. The area was about comparing different surgeries for triple A (Aortic aneurysms) in an emergency setting. Patients were arriving in hospital with some rupture of arteries and they'd have to quickly decide whether to do open surgery or a less invasive vascular procedure.

GM: Who instigated this study? Was it a NICE HTA?

HE6: No, it was NRHI's HTA programme which funds this project. But it still was within the HTA assessment.

GM: Does the NRHI have clout? If they find some techniques don't work or aren't cost-effective do they have the clout to stop payment.

HE6: It's up to the hospitals to improve clinical practice and also to provide a health interventions that are not only effective but also cost-effective. I think the general idea in the end, and especially in this context was that most endovascular units they provide surgery, but is there any scope for us to provide for endovascular services in hospitals. The trial was the first one in this setting, it's not easy to randomise emergency patients. So they tried to inform whether we should increase capacity of endovascular services in the UK, including other countries like Canada but it was mainly about the UK setting.

GM: So the economic evaluation was funded alongside the trial?

HE6: Correct. There's more trials now in France and Poland so there's increasing research in the area, but ideally will gather more routine data about the difference between the two procedures in terms of effectiveness and cost-effectiveness. Should we invest more and encourage increased capacity? I think that was the starting point.

GM: So it was probably a big team working on it. Were there any difficulties as a health economist coming in where you have a different perspective.

HE6: Yeah, that was a bit difficult. It was a project led by [REDACTED]. It was a bit difficult to convey some of the principles of cost-effectiveness and also why certain outcomes should be used. QALYs rather than mortality or adverse events or something else—some clinical outcome. The idea about not only the design, but also the interpretation and the value of the economic evaluation took some time

GM: I guess you would have had some time to work with the team. It would have been a fairly long project. Did you come in from the beginning of the project?

HE6: Relatively early stage. When I started on the project it was obviously running, it wasn't like I had an input on the design; on the sample size for the economic evaluation or other things.

GM: Were you involved in the dissemination?

HE6: Yeah, we were. There was a big conference on vascular surgery, so were all there. We did present the economic evaluation alongside the clinical results. It was well received. In the end there were no gains in mortality but substantial gains in terms of quality of life. And the endovascular procedure was much quicker with discharging people, like two days earlier. Also in terms of quality of life there was a massive difference. So it's not like open surgery is killing people but definitely it's taking people more time to recover and in the end this leads to lower quality of life—mainly because the endoscopic surgery is less invasive. Now we have a three-year follow-up going on to determine whether this differential in quality of life maintains over three years or if there is just initial gains which vanish. Most of the interesting results were from the economic evaluation.

GM: Did you have to do a model based on the trial?

HE6: No, but the next step is to design a model with some long term costs. Right now it's only based on one-year follow-up so we just recently published the one year results. But we hope that the three-year follow-up will help determine the long-term cost-effectiveness. And there we will include the decision model.

GM: You didn't have any push-back from the results of the economic evaluation?

HE6: Yeah, we have we have. I think the clinicians have a lot of resistance to play up the economic evaluation results even though they were consistent with hypotheses about improving outcomes. They needed to be convinced that the impact on, say, quality of life was non-trivial—that it's of interest to decision-making and the hospitals. They were more concerned with, say, mortality. Although here, because it was an emergency setting they want to see any difference in mortality. At least from our perspective it was very important to see the difference in other outcomes but I think . Not that they were sceptical, but there was a lot of resistance to play up those results

GM: Is it that they liked the clinical results?

HE6: Not really. And that, to be honest influenced the overall reception of the paper. Many of the journals have publication bias—so they all responded this doesn't offer any difference. For example compared with non-emergency setting.

GM: Any other challenges?

HE6: No... Once you got past that hurdle of why this is important. How to interpret these results and how to use them in practice they were more receptive to information other than mortality. Or other very specific outcomes. So they were more amenable to things we were doing. And we ended up publishing the cost-effectiveness results and it was well received. I think as health economists we are still learning how to best convey this information so that it is transparent and easy to understand. It's all new to the clinicians. They are not used to terms like net benefits and that stuff. So both parties are learning. There is still a gap between what we do and what they know. I've had other economic evaluations where clinicians were more aware of economic evaluations are about. But I think that's more the exception then the rule.

GM: Do you think there is anything you as a researcher can do to translate evidence from economic evaluation into practice?

HE6: One thing we learn is that at every step to make clear what we are doing is consistent with their research plan and research question. Making the economic evaluation design transparent. Try to take them on board. Ask them for suggestions, or at least reassure ourselves on what we are doing and that they understand. In the end if you try to impose anything from a health economics perspective it will be more difficult for them to understand and to encourage any use there. This wasn't a NICE appraisal, which is usually led by pharmaceutical companies. For them it's the other way around. They have to work towards the appraisal and understand different aspects of the process. I think with clinical trials it's a bit less so because the primary outcome is very rarely the cost-effectiveness or even cost-effectiveness outcomes. So we have to do more about translation and about communication of various steps. And where this is going in terms of how to use this information. I think they focus on clinical practice, perhaps something more about allocation of resources at local decision-making. Some of them do, some don't. Some focus on whether there is any clinical benefit to the patient. If no, "who cares?" Obviously quality of life is one of them. I don't think it has still been given the importance or relevance that other clinical outcomes—for various reasons—not the least because of the methods to measure quality of life. They are perhaps less clear to the clinicians. So they tend to have more confidence in clinical based measures, which are generally validated in there real setting. That's why perhaps quality of life is still a bit controversial or at least less accepted as a meaningful.

GM: Do they like their own functional measures of quality of life?

HE6: Oh yeah. Even if they cannot be generalisable. They trust them. That's the main thing, so they are eager to report them [functional measures of quality of life]. If it is something that is outside their familiarity they just frown at it. The functional measures rely more on clinical judgement, when confronted with patient reported outcomes they are like "yeah, yeah, yeah. The patient only knows so much." Obviously the patient

knows how they feel, but when it comes to reflecting any gains the clinicians think the patients aren't in the best position to them. But yes, if there is a disease specific or clinical outcome or functional outcome vs quality of life they'll choose the functional outcome. They have been validated and they include all the items the doctors care about maybe they perceive it as more relevant. But quality of life has been receiving increased attention.

HE7 – 5th November 2015

HE6: I was recently involved in assessing the cost-effectiveness of [REDACTED]. At the moment everyone who has diabetes is screened every year. [INTERVENTION] has been shown to be cost-effective but at what interval nobody knows. The idea was to use a large record linkage that combines hospital access statistics, screening records, treatment records. To inform whether we could have an algorithm to predict [CONDITION]. Looking at whether [REDACTED] was cost-effective compared to other intervals, but also whether having this algorithm to identify patients at higher risk helped find more optimal [REDACTED]. This was funded by the NIHR, one of the largest funders, it was a health technology assessment program of the NIHR The project finished in December last year, and in the last stages of the project we were preparing the report and finalising the model we were contacted by Public Health England/Department of Health, because Public Health England has asked them to evaluate whether it was good to give screening every year. So they heard we were doing this work and contacted us. So in addition to the things we were originally supposed to deliver, we had a request from the Department of Health to provide data for them to decide (all confidential) whether to change or not the current [REDACTED], for example to [REDACTED] for high risk. Our results showed that [REDACTED] is not cost-effective, or even every two years. Maybe every three years for the general population. For higher risk, every two years is cost-effective. For low risk, every five years at least. So we had to feed back this information to the Department of Health, and then what they did with the information is all confidential, but we got access to a confidential report, and what they have taken from all this is that they are thinking of changing the frequency of screening from one to two years, not based on cost-effectiveness itself but based on the fact that once we provide the service, that we tell them they should be screened every year if they have diabetes, if we now say every two years, people wonder if this is to save costs, are we receiving the care that we should? So that aspect of the perception of the patient ruled out something that we provided, the political cost. And also what came out from the research is the idea that you are able to identify patients as high risk whereas on the previous screening results it doesn't really work out in terms of the NHS in England. You need to have a consistent database of patients which doesn't exist at the moment at the national level, but then you are able to apply this algorithm. So in principle yes you should use risk factors to decide screening but in practice it's quite hard. Such a tailored screening at national level, which I think it probably common across most of the screening programs, you don't really have...

G: you could in theory have a more cost-effective screening program using a tailored approach...

HE6: And I would think that if there's any tailoring in any of the current screening programs in the UK, because of the difficulties the question of data and the logistics required to track these individuals as well provides support... So – confidential – we went for two years, and I think they will announce it. But the reason being to

G: You can't stop, and that's the problem – it's an interesting case of that disinvestment problem, but it's slightly different.

HE6: Yes, it's national. If you were looking at the local level I think it would be possible to – it happens all the time, not having cost-effectiveness.

G: But is it also that you're working with behaviours, consumer behaviours, and it might be ok to ramp up consumer behaviour – So do you know how they tried to get the two year recommendation? Because even that might be difficult.

HE6: So there are a lot of changes happening through this year, because of funding. They are for example making changing in terms of individuals at high risk being under surveillance rather than screening, so more costs. But it's confidential, so they are not disclosing it. We provided the data, they were very happy with what we provided, but then what happened after it's one of those meetings that there are no minutes.

G: so you didn't present to this group?

HE6: So we provided report to the Department of Health, and then with our information they went to present to Public Health England, and then a decision was made by Public Health England, and then what we know through the grape vine is that it's 2 year actually. So that led to several other projects, and now we're looking at whether this surveillance for individuals at high risk should be done every 3 months, 6 months, or should be done at all.

G: so you said this was based on routine data? And you did a model-based economic evaluation on that? So was there a clinical research project beforehand, and then the economic aspect got added to that, or was it more that the research question was an economic question from the beginning?]

HE6: Yes, it was an economic question from the beginning. So the title was the effectiveness and cost-effectiveness of... So we work very well because we have very good funding. The model was built together with statisticians, so we used a hidden Markov model – so very fashionable. And then that allows us to estimate things like sensitivity. So this is where we expect the individual to be, and this is what the screening result is, so then we can compare, and infer the sensitivity of the screening. So we working together constantly with the statistician, and then we developed the economic model around the hidden Markov... SO it was quite interesting because it was informed by a large data set, about 13,000 people... And with that data, besides estimating the natural history model it was possible to estimate the costs for example. The costs as a function of stage, cost as a function of visual acuity, gets the treatment costs as well, we were able to link to treatment data (if the patient was treated or not). So we provided quite a robust model that didn't need to rely on smaller studies... and actually used quite the rarity in that we had this really good data set to build most of the model. I think the only thing outside the model in the literature was things like QALYs...

G: And did you feel confident that the group who were receiving your report could interpret or understand it?

HE6: There are two reports, so the HTA report which was published last month ... is out there, so people can access it. What we produced for the Department of Health was a more concise report. We were constantly in dialogue with them, because they were asking us if they could interpret it this way or that way, and I'm fairly confident that they understood that it was not cost-effective, and these were the reasons. It was quite funny because they were leaning towards, people with high risk, they should be screening every six months, and then they realised oops – because a lot of people are screened and then they go to hospital and they don't get treatment because there is no treatment, or they've been treated before, so we're just throwing people at hospitals and if they have the disease then throw back. Very few people have treatment.

G: Does the six month screening end up with the same individuals going in and out of hospital?]

HE6: Yes, and it doesn't result in any different treatment [severely paraphrased] because the screener doesn't know if they're already having treatment or not, so the same

people end up clogging the eye clinics, so the people on the waiting list who really need treatment... So it ended up being quite an interesting project, because I think I've only had three projects that actually had any part in something changing. It hasn't changed to 3 years! But...

G: But changing from one years to two years, that's actually pretty good, particularly if they were considering going the opposite direction. And you were actually able to implement a disinvestment, which is one of the things that's it's been very hard to find, people who were able to achieve that.]

HE6: But I guess in the current climate it's not so much an issue. With the policymakers, I'm not sure what you think of policymakers. Maybe now is a good time to justify rolling back screening interventions. Because that's happening all over the place. NICE says do this – how many CCGs are actually implemented fully. But I guess that would be another study!

G: Do you think they will recruit you at all, if they're trying to get this message across? Probably not, they're just happy to have the report?

HE6: Yes.

G: And to make sure that the HTA was published.

HE6: But I don't think they're interested about that anymore. They have this specific meeting in 2014, and they wanted the information ... other considerations informed their decisions. This is confidential. We got a report of their meeting. One of the guys at the Department of Health was able to disclose.

G: And they control the purse strings? If they decide that it's every two years, then it can only be funded for every two years, right?

HE6: Yes. And whether they have evidence and not, well I'll check the website to see if they have anything supporting it or not. But they decide and that's it. It's similar to another project on [CONDITION- REDACTED], that was doing a long time ago. I was doing a cost-effectiveness model, it was a rare condition, and half-way through the project. Someone wrote a letter to a member of parliament, and the member of parliament then pushed the whole thing through. We were contacted at the time, there was no Public Health England, there was a committee that had the power to provide some estimate of costs and that was it. So we were halfway through the project on cost-effectiveness, and then it became just about costs, because it was rare and it was quite cheap to treat. That is an example where they didn't consider cost-effectiveness.

G: Have you had a different experience where there – there are two kinds of evaluation, one where it goes to a central body like NICE or Public Health England, or in Australia the PBAC, where it ends up being a group of people around a table who make a decision and they control the money, and there can be some issues but generally that decision is final. At AusHSI, we don't have a group like that, we just have to influence individual hospitals and practitioners. So do you have any evaluation where you've had a different experience, where you couldn't just have a report going to a group... it had to go

HE6: You mean like research going into the ether? You just publish and that's it, and you don't know if it's going to be used or not? I think that's the majority. I'm counting three only situations where the research led to a change. You do see sometimes – for example you publish a cost-effectiveness study of a screening, and it gets picked up by guidelines across Europe for example.

G: What can you do...?

HE6: Guidelines are not binding in any way. So... you know... And that's where the majority of research is ending, you publish and then you see who picks it up or not. Unless you are ground-breaking study, one that changes clinical practice. And what changes clinical practice is not cost-effectiveness but effectiveness. Things like statin trials, diabetes... But it tends to be clinical effectiveness that then drives through and changes practice.

G: If people are picking up, is that just going to be guidelines?

HE6: Yeah, I don't know if this has changed, but in about 2004 or 2005, I was involved in looking at local trusts and whether they considered cost-effectiveness evidence, and we asked which ones they were implementing and which ones they were not, and we plotted to see if there was a trend. And there wasn't a trend, they were not considering any cost-effectiveness evidence. Because I think at the local level, first you don't have the resources, then you have to implement it somehow, lack of understanding of the cost-effectiveness evidence so lack of reliability of a lot of the cost-effectiveness evidence. We have all these studies coming up of particular things, if it is a model it's more likely to be cost-effective which is quite interesting.

G: Really? Well I guess you are more likely to be published if it's cost-effective.

HE6: Yes, and if it's sponsor led then it's really cost-effective. So that kind of effects – not know about health economics, not understanding it, but also the lack of someone inside. To make a decision about what to invest and disinvest and taking cost-effectiveness into account I don't think it happens at the local level. We have NICE saying yes lets worry about it, not saying whether they should do it or not.

[Greg: Is there anything researchers/institutions can do to facilitate it?]

Now there is a lot of – in the last 2-3 years – funding bodies like NIHR are pushing researchers to engage with the public. A recent project that I've just finished, a strong component of it was meetings with patients and with representatives of CCGs to show the results and to engage them somehow. I'm not sure if that will lead to an actual change. What I know is that as part of that study I've estimated costs of patients with hip fractures and now I know that CCG level they are now using this cost to help them predict the impact.

G: So that they can budget accordingly

HE7: Yeah. Because in these cases they are trying to see ok if we invest in having a specialist consultant that's how much it will cost but these other patient savings I don't have. So they are using their estimates. The cost estimates are available even before they were published. I've seen that spreadsheet. Again, I wasn't contacted by the CCG it was through a clinician that I was working on a project with and they were telling me if I can help them these are the costs they would be quite happy.

G: So sometimes it doesn't have to be the full results of the economic evaluation but components of it can actually be useful.

HE7: Yes. You never know what they're using. I'm sceptical when they when costs— unless it comes from NICE—that cost-effectiveness evidence really changes anything in practice. Because in the end is it effective? Is it not? And that will be the motivating factor. In the end it's the consultant, the doctor in the hospital that decides or the GP practice decides if he's going to prescribe or if he's going to do something or not. So the CCGs here they control the money that goes to the hospitals. It's an interesting situation, so the CCGs have—are Clinical Clinician Groups—they hold £40 billion or something, a lot of money. And they are the ones that pay the hospitals, so they have an interest in what works and what doesn't. So they have the leverage.

G: Do you think the CCGs are more interested in the cost-effectiveness then...

HE7: It's cost saving. Really cost saving. That's what I've been hearing is. Will this save money? It's not whether the patient will be better off or not. Because of the current climate. Or maybe it was always like that. But it's changing and there are a lot—I think there are 200 or something—they can't all do this kind of analysis and then you have all the issues of the expected savings are not real from a cost-effectiveness study. Or they are not longterm. Reliability of the evaluation as well. It's not high on that ground I think. Normally the conversation is whether it can save money.

G: Then I guess it becomes the focus of your evaluation... do you think that changes the focus of the evaluation?

HE7: No, because I'm principled. But normally it comes down to that. I try to explain that there's hardly anything that saves money. If it saves money you don't really need cost-effectiveness, it's straightforward. But the current climate is a bit like that. It will only be implemented if it saves money. It might change. Today it was in the news... I don't know if you've seen?

G: No, I haven't.

HE7: But the news recently put out a report saying that care in the UK was amongst the worst in the developed countries.

G: Really?

HE7: Yeah. I don't know if it was... they were picking up cancer survivors which has always been. There's the lead time bias where you are picking up cancers that would never show up. But within Europe, so like Sweden for example which has the same kind of screening that we have here their cancer survival are much better. But then the UK statistics are rubbish because you don't even know the stage of most cancers. So you are not able to understand whether there is a more local cases being diagnosed for example in Sweden then here.

G: Yeah.

HE7: If you go through funding bodies like the NHR, the aim of the institute is to engage with the public. It's a bit unclear how that engagement should occur or if that engagement leads to anything because it's not measurable. You might have money from charities for example and their aim is to really put it out there in the political opinion and to shift policy by raising awareness. And they tend to be really good. So I worked with a couple of charities it is wasn't cost-effectiveness analysis it was a cost of burden study and we made a lot of publicity out of it. And raise awareness for diseases like [REDACTED]. But you do see that they are geared towards that. They do reports, they do press releases, they engage with politicians, they engage with BBC—so they give exclusive BBC interviews. So I was lucky to be involved in one or two projects like that and it does have an impact at the government level. And it's not cost-effectiveness it's cost. And the bigger the number the better.

G: It sounds like your role is different there. You are adding an element of rigour and a high number...

HE7: Yes! It was funny we worked for a charity and we estimated cost which was less than the previous costing study had. So they didn't want to make much publicity. So we got to publish it but they didn't do anything.

G: Good point. So what happens when it's an inconvenient result?

HE7: Yeah we do make sure that in our contract that we can publish whatever we want. I think there is something about costs that draws peoples' attention more than cost-effectiveness.

G: The difference between a figure and a ratio.

HE7: Yeah it's true I've done cost of illness and cost-effectiveness evidence. And I've never been picked up by a paper for any of the cost-effectiveness work ever. Cost of illness being picked up massively not just in UK but in Europe. They just love it.

G: That's my questions, unless there is something you'd like to add.

HE7: I'd like to say something about methodology. It's about having robust data using large data sets if possible or models that consider all types of evidence to avoid selection bias. And I'm quite concerned that we are going through a route of—especially in the UK—of value of information approaches. Which then are based on models that are pretty badly constructed and the decisions about that have huge impact in terms of the suggestion of whether to implement or not.

HE8: 6th November 2015

GM: I've been going around asking health economists to provide a bit of context about how they work and using a case study of say an economic evaluation that they've worked on and difficulties they've had trying to translate that to practice. The other two questions are more broad into what do you see as ways you can improve the way we do economic evaluations in general and what do you think researchers specifically can do to help people who are using economic evaluations. So, that's the general structure.

HE8: Most of the time I work on methods rather than applied econ evaluations. I am working on some, but the reason to do it is in order to demonstrate methods. All of the methods though are directed towards what I think policy-makers need to make good, accountable, evidence-based decisions.

G: So I think actually the methods might be a good one to look at.]

HE8: Ok. A core part of our work at the moment is around cost-effectiveness threshold, as the health opportunity costs, the health-care decisions and increasing healthcare costs. [REDACTED]. And there are a number of elements to that, redoing that estimation for different ways of data, exploring the uncertainty, the implications that has, using that work to – and the reason why that's important is that the uncertainty matters because it means the threshold you're going to use – the single value you're going to use – needs to be lower than the mean. The other piece of work we're involved in at the minute, we're just writing up, is using that to figure out what the non-marginal effects are, and that's really policy-relevant because of things like the Hep C drugs, big non-marginal impacts, the health opportunity costs are going to be proportionately larger, so we're doing that. That's directly policy-relevant to things that are on the agenda right now. It's also helpful in terms of thinking about whether NICE is doing more harm than good, and what the consequences of NICE being pushed to say yes when it should be saying no are. It's also directly relevant and we've used it to engage in debate around the Cancer Drugs Fund in the UK. The other aspect to it is a more global aspect, so I think being able to do both methods work and applied work to estimate this quantity means that people are thinking about what questions they need to ask to make good decisions, which can be influenced and changed. And I think that is having an impact and it's having an impact elsewhere in the world so we've also a program of work trying to estimate this stuff for other countries, lower/middle income countries in particular. So we're just about to finalise a draft of an analysis of 152 countries based on evidence of the effects of changes in expenditure on health outcomes around the world so we've got costs-per-DALY ratios from 152 countries. So that's anxiously awaited! We've presented initial work to WHL and as a consequence they've removed recommended threshold of 1-3 times GDP per capita which is what has dominated the global health field for a long time. Gates the invited a submission for grants so I've been visiting the Gates Foundation over the coming months to think about thresholds for their work in terms of informing their development programs. The global fund is wanting to know what these numbers are to inform their procurements. So it's quite exciting. And I've been involved with Norway, their commission has used our estimate as the interim value whilst they conduct similar work to ours. I'm an adviser on a project in Australia to estimate it. I'm helping as I can with people in Spain, commissioned by the government to do similar work there. Just putting together an application in the Netherlands – they have put out a call to do similar work in the Netherlands. Portugal's changed their threshold based on our work. There's people in Argentina trying to do similar things. So that area of work is quite exciting, it's definitely having a policy impact. And it's a mixture of – when I say methods it's really about conceptual clarity about what it is we need, and secondly getting your hands dirty and trying to estimate this stuff. And so that's sort of been the key.

G: And so the initial UK cost-effectiveness threshold stuff, who got you asking that question, or was that something...

HE8: Asking that question about seeing the threshold as fundamentally about supply-side

opportunity cost, that's something I and others have been arguing about for many many years, that it's not willingness to pay, it's what health do you give up, and we've probably been arguing about that for a very long time. [REDACTED]. When NICE announced threshold range of £20,000-30,000, which was based on what we as a committee had done over the previous four years, I was pretty unhappy about that, many of us on the committee were, not just health economists. There was a lot of argument about what the threshold should be and many of us argued strongly that we needed empirical estimates and that the work that NICE had commissioned around the social value of a QALY, willingness to pay, wasn't the quantity that they needed. [REDACTED]. In the process, unfortunately, NICE became a lot less interested in what that was, because we involved them, the way we conducted the research, we had an initial workshop which included stakeholders and academics, we wanted to keep everybody informed as it developed, so over time as we had initial drafts, those were circulated to – if you like – this working group. But unfortunately time when NICE was decidedly uninterested, basically because it wasn't giving them an answer they felt was politically convenient.

G: And so what did you try to do to...

HE8: Well, I think importantly the Department of Health was interested, remains interested, and I think the work that we did – we've been told at least, the work that we did – helped them in their negotiations – the pharmaceutical renegotiations, pharmaceutical price regulation – in some respects underpinned the fact that they were able to negotiate a cap on pharmaceutical pricing, so I'm very happy with that. In terms of NICE, I think it's important to distinguish between NICE and what it does and the technology appraisal program. It's the technology appraisal program which has been very resistant to wanting to hear anything that makes their – that challenges them to take, to say no basically. They seem more concerned...

G: Because they would have to say no quite a bit...

HE8: Or negotiate prices, which of course is the key. So what did we do? Well, having spent a long time going to meetings, workshops, explaining and realising that the problem wasn't the fact that people didn't understand. The problem was a political one. We published a paper (myself, [co-authors]) – all of us had been big and public supporters of NICE, even before – in fact [REDACTED] was responsible in part for NICE's formation. [REDACTED]

G: But given the amount of resistance...

HE8: Well, I'm comfortable. The most important thing I think in terms of our stuff with NICE is what we've said is, you know what, your threshold has come to mean a description of how you as an institution make decisions. What we've estimated is something different. What we've estimated is a purely factual question. Our best shot at answering a factual question. Which is what are the health opportunity costs. Now we're not asking you to change your threshold or the way you make decisions, what we are saying is that you need to take full account of the health opportunity cost. You can choose to implement something that does more harm than good but you are going to have to give a reason for that. That because it was innovative it's worth a loss of three thousand QALYs. Well, that needs to be in black and white. And you know, if they don't respond to that then as academic then I think one of our jobs is to hold those that make decisions on other peoples' behalf to account. And I intend to do that. And we'll see. I've got a website URL called NICE body count and we'll keep track of the number of patients that NICE decisions have killed in the NHS.

G: That's exactly the sort of thing I've been looking for!] [laughs]

HE8: Truthfully, truthfully I haven't bought that URL, but I will⁶. It's a good threat. You don't want to take notice of it but we will.

G: That's a pretty good answer for a question I was going to ask in a second, which was how do you get the public to be on your side? One of their problems if you change the threshold their going to have Daily Mail complaining.]

HE8: Well I think, I've said this from the very start, I've always been frustrated that NICE doesn't—see I thought NICE would be very keen on this work because it is very easy to make this real. And since we've had this available loads of radio, loads of TV, loads of journalists interviews for print. And it is an easy argument to make. And I've debated cancer patients live on the radio. And it's easy... well, it's not easy but if you prepare and you think about how you can... It's now possible to make what was this rather abstract bizarre nonsense of ICERs and thresholds real. If I'm talking about this I don't talk about thresholds I don't talk about ICERs. I go straight to what are the benefits, what are the scale of the benefits, what type of benefits, what do we lose elsewhere? What are the opportunity costs—I don't use the word opportunity cost. What do you get, what are you going to have to give up? Because these are resources that could have been used for other effective interventions. And we know something about how much we give up and we know where. Reduced survival in cancer and circulatory diseases, reduced quality of life in neurological—by the way that's Alzheimer's, remember—and mental health. And then people say it's a difficult decision and I say, absolutely, but the key question is the discrepancy between the price that's charged and how much we can afford to pay for the benefits. So I was hoping NICE would—and ever since NICE was formed one of my frustrations has been that as an appraisal committee member I didn't feel that NICE defended itself particularly well by saying this is about health opportunity cost. One would have thought they would use our work to defend themselves much more effectively. They don't and I think it's because they don't want to acknowledge the opportunity cost because it upsets their stakeholders.

G: Oh I see. So it's not just about political will.]

HE8: So I think there is a political will, certainly the Department of Health accepts our work, they've reduced their assessment of health opportunity cost to £15,000. And that's used now in all Department of Health impact assessments. The work on the threshold has gone to Treasury, so the department of health has used it in the comprehensive spending review saying to Treasury can you give us some money we've got the evidence. So NICE is out of line. And I think NICE ought to be careful that it doesn't make itself irrelevant.

G: Do you see that going in that direction?]

HE8: I don't know. We'll have to see. If NICE is doing more harm than good and is not listening to evidence then you start to wonder what it's there for. And it costs a lot of money and other people could be asking that question. It's very interesting, this government in coalition when they first came to power said that it was going to remove the funding mandate from NICE guidance and I thought that was a good thing because at least a local NHS could choose to not implement the cost ineffective guidance from NICE. What was really interesting is that the people that shouted the loudest for that not to happen were industry. And as a consequence the government changed their mind.

G: [Laughs] yeah]

HE8: So, NICE had lots of friends. I think all of this.. I'm not... Let's see what happens with NICE. I think NICE, let me be really clear, I think in terms of a process of assessing costs and benefits I think NICE does an excellent job. NICE isn't just the Technology Appraisal

Programme, which I do think has been captured by stakeholder interests. But it does lots of things that are really useful and worthwhile like guidelines, public health and diagnostics, and devices. So I think... We'll see how all of this pans out. I do think this issue about pricing and price negotiation and value based rebate schemes, which we proposed back in 2010 during consultation on value-based pricing, those things will have their day. The idea that value based pricing is dead is just nonsense, because there is a fundamental tension which is unresolved. Cancer Drugs Fund is an excellent example of that tension and there is no... the Cancer Drugs Fund is like a blank check and what it demonstrates beyond any shadow of a doubt is that there isn't a blank cheque big enough to fill this hole.

G: Because it's blown out its budget, the cancer fund?]

HE8: It blows its budget by hundreds of millions of pounds every year. The year that they instituted the first review and kicked things out of the fund, they did so in order to reach an already inflated budget target of 280,000,000. In actual fact it acceded that by 136,000,000. That only came to light due to a parliamentary question because NHS England stopped publishing the financial returns for the Cancer Drugs Fund. There's been a National Audit Office inquiry into the Cancer Drugs Fund and that's now published. And our work was used by them in their assessment of whether it is doing more harm than good. Our work suggests the ratio of harm to good is at least 5 to 1.

G: Wow.] [Laughs]

HE8: I think the ways to get impact are.. I prioritise invitations from Royal Colleges, clinical audiences. I was invited to do a plenary at the British Society of Neurological Surgeons on the threshold, which is amazing. They wanted a plenary session on the threshold that's unbelievable. These are brain surgeons

G: That's.. I can't really imagine that is Australia

HE8: No, it's astonishing.

G: And I'm guessing you couldn't imagine that 10 years ago?

HE8: No. I'm doing a question time plenary session for the Royal College of Oncologists.

G: So they are on board?

HE8: Yeah! Absolutely. They want to know. So I think... I fear that NICE has made a really big mistake in focussing on its intermediate stakeholder interests.

G: Because they still have these other stakeholders and if they get grumpy enough...

HE8: Also, the other audience that I'm keen to talk to are the manufacturers. Because at the end of the day, actually I don't think this is a threat. Because the alternative to this is an unsustainable business plan where if you don't get real about figuring out ways to offer differential pricing globally the alternative is much worse. The alternative is that people are basically going to tear up patent protection. People are going to reference price, competitive tendering, and we already see it. Middle income countries are saying, "hold on a minute, we're not so bothered about your intellectual property, we're going to licence a generic manufacturer for your branded product. And if you don't like it, what are you going to get us through the WTO? Well, the world has changed. You're the ones with the begging bowl and asking us to lend you money to sustain your budget deficit not the other way around. So I think manufacturers, there's some manufacturers I know realise that getting real and having predictable evidence based prices is in the long haul a much better option. Time – ideas are like water, bring mountains to the sea. You just have to wait awhile.

G: That's ok, there's no easy answers. But it's good to talk to someone...]

HE8: I think there's other things about, I don't think there is one way to present things and I'm constantly thinking if somebody doesn't get it there's a reason. It's your fault. If people don't understand what you've done then it's your fault. Eventually when you've tried everything you realise they actually do get it—which drives you nuts. Which is where I'm at the NICE Technology Appraisal Programme. Then you are at the end of the

road.

G: But the strategy you put... if there's a dead end then you go well are there other people who might be open. Then you go to those people. And again you try to keep it a simple message]

HE8: I think the clinical community is really important. The clinical community has a lot of power. The clinical community are actually the people who deliver healthcare. The clinical community are the community who populate policy at the highest possible level. They have influence.

G: When you talk to popular media, who do you think are the actual audience there. Do you think it's just the general public...]

HE8: That's a really interesting question. It's the same as NICE. [REDACTED] My position has always been that they are the ones who are going to have to stand up and go on the radio and take responsibility for what NICE does. And that means that I have to give them the ammunition as to why this is right. And I have to do that, not just in a way that I think is academically correct I have to do that in a way that they truly buy and own and secondly I have to do it in a way that gives them the way of communicating that to a much wider audience. And if as an academic I can't do that then I can't possibly expect them to go over the parapet into a hail of machine gun fire with no weapons. So it's not enough to have a good idea. That's not enough. Now if you give them a perfectly good weapon and they still don't want to go over the top then you have to go over the top or find someone else who is willing to go over the top. Then have them shot for cowardice.

G: yeah...

HE8: I think there is multiple audiences. So for example, do I think a minister will take notice of our work. A minister will take notice of our work if a minister thinks that by not taking notice it will create a political problem. It will create a political problem if people figure out that the Cancer Drugs Fund has basically been writing a blank check to a bunch of pharmaceutical manufacturers who are producing drugs of pretty modest benefit at astronomical prices. And that the minister did have the opportunity of making sure there is proper price negotiations. That the only beneficiaries of the Cancer Drugs Fund have been manufacturers; NHS patients haven't benefited. Cancer patients don't benefit because they could have got access to those drugs if the Minister had done what was promised in 2004 and introduced value-based pricing. Now as soon as that becomes the story, the ministers will take notice. Because it's their arse.

G: So it's the question of how to turn that into a story... which is hard]

HE8: I think for me the other audience as well is... I'm much more comfortable doing media stuff. But I have to say I don't like it, there is huge opportunity cost. It is exhausting. The prep time for 30 seconds on the television is enormous and afterwards you're exhausted. For me the more important thing is not whether you are cited in the Guardian or you are on the radio or you're on the television. The most important thing is that journalists understand your position and your work and are using that to ask the questions. As soon as that starts to happen, as soon as journalists own these ideas it doesn't matter whether you're interviewed, the journalist will be doing that for you. And I think in a way that's starting to happen. And I like journalists. Journalists are smart, really smart.

G: So the interviews take time and it's draining for hours later. Does that conflict with academic... or is it mutually beneficial.]

HE8: It's mutually beneficial. I suppose it's a bit like teaching. Teaching takes a lot of time if you try to do it well. When you've got an audience that's not part of your discipline, so you are having to explain things from first principles. If you give a lecture and they don't get it then it's your fault. Because you recruited the students and they're not stupid because if they were they wouldn't be there. They wouldn't be in your class. So then you need to think well what are the other ways in which we could explain this. And it's a bit

like that with journalists in the media. And it helps because it forces you to ask questions that you try to imagine the questions that you would ask if you had never heard this argument before. And sometimes it means that there are better ways to express things sometimes you realise you missed a bit. Something you hadn't thought of. And somebody says, "yeah, that can't be the case because...". You think oh well I hadn't thought of that. So I don't think it's in conflict. There is an opportunity cost though, just like with teaching. If you do too much you don't have time to do the research. If you don't do any teaching—I like teaching and thinking of best ways to express things. It also prompts ideas for research and the same goes with the media. I have to say I think many of my colleagues now or have been Appraisal Committee members. Being a member of the appraisal committee was very important to me in terms of having to really see what I need with a decision maker to make a complicated decision. Really helps you write, really helps your methods. I think a lot of the methods development in the UK hasn't been methods development as it is in some disciplines which is just motivated by can I get a peer review publication in a top journal. It's been methods development motivated by understanding the needs of the decision-making process. And it's been those demands that have pushed things forward.

G: Can you think of examples of things where you might have thought before hand "oh, that might be useful for a decision maker but...

HE8: What comes after the but?

G: Sorry, yes. What are examples of things you might see where you as a reader think well that's not actually useful for decision-making

HE8: Oh ok great example is a paper, I'm co-author on this one. One of the most highly cited papers in the field. Which is around cost-effectiveness acceptability curves...

They're a nightmare. Doing an appraisal when you've got 15 bloody scenarios and you are looking at curves. I mean, they're not helpful for a decision-making process. What's much more helpful is to just see a table. What were the QALYs, what was the cost, what was the net benefit at a particular threshold, what's the probability that each of these possibilities is the best. The different scenarios. Such a little thing. I think cost-effectiveness acceptability curves and frontiers in terms of getting people to focus on decision uncertainty, to understand how that's linked to threshold is really important. But in terms of a means of putting that on the table in a decision-making process where everybody's been reading about six inches of paperwork on the train for two hours before. It's not the best way to do it.

G: That's a great example. I had earlier interviews where people were talking about cost-effectiveness thresholds and I had a seminar where someone said: "why don't you just do a cost-effectiveness acceptability curve"? And I thought, "well, I'm not so sure".

But my issue was that you were putting the onus on them to make the decision

HE8: Well, A: what the hell do you think the threshold is and B, [mimes holding pieces of paper] I'm trying to compare these curves.

G: You know that's one of the things you can't find in the literature that I'm trying to work out here. What's difficult when you've got a document with 50 pages to interpret

HE8: Absolutely, and I've learned a lot by having to do that prep on the train. What's irrelevant. What don't I care about. What's really important for me to see. And if I don't see it, you know. So what are other things? Yeah, you know the basic stuff about ICERs. I mean ICERs are useful as a summary but the way those are set out and making sure that we've got ICERs that move from the least costly least effective – non-dominated and make sure that if someone leaves dominated strategies in this list then it is a total nightmare. And on the train I notice and I'd like to redo it myself but I can't interpret it without.

G: Because that's an important part of these documents. Because you have to consider that mistakes can be made.

HE8: Yeah

G: And you'll probably identify mistakes while you are there. And what's a process of presenting that in a way where you can easily say "there's a mistake there but we can easily fix that up".

HE8: I think networks of evidence is another one. I personally don't like the diagrams. I understand them but I don't particularly like them. What I want to see as a decision maker is a table. The rows are the trials. [First column] Trial number. [Second column] Page number where the detail of that trial is in the appendix. [Third column] Alternatives that we are considering and [Fourth column] the bottom-line results of that trial. So you can see how they all line up. What's connected to what. Whether this is consistent. You get an immediate picture and if you want to know the details say well that trial really stands out it's completely inconsistent then go straight to the appendix. What was the eligibility criteria, what was the protocol. And that's annoying because that's not often done. And you can put a lot of information in a very simple summary table. The other thing I pitched is that we want tables which represent the decision space and the evidence space. So the trials that are relevant go beyond the decision space—they are outside the decision space we're comparing it to stuff we're not making a decision on. But it's linked, it's linked to evidence inside. My argument was this is the way we should see it. If a submission has excluded some trials we'll be able to see which ones we threw out and we can justify that. And I'd like to see the evidence itself organised that way. In terms of... In other words for a particular indication, for a particular disease area that's the way we organise and record clinical trials and their results. We've already pre-extracted the basic stuff organised in that way. Then say to the manufacturer, look this is the evidence space do the analysis. And if we threw something out, explain it. Tell us why.

G: Don't just have some paper excluded

HE8: Yeah, or not mentioned you know.

[interview interrupted]

HE8: The biggest mistake in my career, in that respect. Kind of the start of my career, and then my early papers, I mistook methods for principle. So principles are what assessments you need to make in order to make good decisions, methods are how you might inform those assessments. Now all the value of information is still decision modelling, probabilistic analysis. They're not principles, they're methods. They're ways of making assessments that matter for decisions. But instead of selling the principles, I tried to sell the methods. And the response was "yeah, but, you know what you missed a bit there." So what did we do? Put more effort into making more sophisticated and adding in the knobs, bells, and whistles, which was kind of great geeky fun, but after we'd done that and went back and said "we've fixed that bit," they went "but what about that bit?" Oh my god. Everyone's a critic, you make it even more complicated. But it didn't change much, and the reason why is that I hadn't established that the principles matter. That these assessments are key, and that was a big mistake. As a consequence, we made value of information and all that – in a sense the entry level is quite high. It was as if you've got to build the most swanky, amazing model that characterises all sources of uncertainty, that you've got evidence synthesis, that you've done elicitation, you've done a whole load of analysis to allow you to capture structural uncertainty. And only then can you get something of value that's meaningful. It's a load of shit. So an opportunity to put that right was two-fold. One was work that we did, MRC-funded, allegedly for NICE, although again NICE were not interested in the results, basically because what we found was that we should be more restricted when we're more uncertain, which was around informing research recommendations. And that was a real attempt in that report, which is all about value of information, we don't mention value of information once – it's in a footnote. "By the way, this type of analysis, in different settings, is called value of

information, it's called real options, it's called expense of opportunity lost, in different fields – financial, economic, blah blah blah..." The other opportunity we had which we took was to do some work for PCORI where they're not allowed to look at cost-effectiveness, they're not allowed to use the QALY word, what can we do to prioritise comparative effectiveness research? What we did was we used the principles of value information but ran them straight off the bottom of a standard meta-analysis and we did a report for PICORI. In other words, we pared it all the way back to these very basic elements. What assessment do you need to make? Would more information improve health? And to what extent? And that paper's going to be published in the BMJ next week. Which I'm very proud of, it's rolling it all the way back. The question of what about the costs, well, we've said what we do for PCORI, we said there's a whole load of other stuff which is potential for harms, PICOR's allowed to look at systems impacts, and other aspects of benefit, and you can specify a minimum clinical difference you would want to see to change clinical practice. And we can run that analysis for a range of different minimum clinical differences, which is exactly the same as having a threshold in a cost-effectiveness analysis. The hope is that eventually some republican is going to say "yeah but what should the minimum clinical difference be?" – well that's alright, we've got an app for that.

G: that would be excellent, just finding this back door to...

HE8: Exactly! Exactly! Exactly! people who try to come up with new labels for the same thing just to put a stake in the sand...

G: You really should be proud of that, that's awesome.

HE8: So I mean a general principle is I hate intellectual monopoly, I despise publishers almost as much as family law specialists and dentists. But I hate it the academic field as well. We produce public goods, and that's what we do, we're not there to say "this is mine, and I've created a label, it's different to other labels." It's appalling, it doesn't help, it's destructive. So I think the general principle should be to destroy any intellectual monopoly wherever you see it. What does that mean? Well it means in a general competitive equilibrium, we're all working minimum wage.

G: Oh well

HE8: I think a move for me, how can you retain some surplus, to continue to do good research, you retain surplus not by trying to preserve a brand or some false monopoly, you preserve surplus by continuing to invent good stuff. If you can no longer invent good stuff, then you deserve to be working minimum wage. If you can, you get a bit of surplus until everyone else figures out how to do it, and you want to encourage them to do it as quickly as possible, and move on. And for me, in terms of the way I fell, the role of academics is to destroy intellectual monopolies as quickly as possible. Invent something good, make sure as many people can do it as possible, and don't worry about trying to preserve a brand. The more effort you put it to preserving a brand is effort that could have been put into the only thing that will save you, which is having another good idea. So for me, those who try to preserve brands will die, and deservedly so.

G: Back to the value of information, what have you found has been the response to that – it's actually been quite popular at QUT. It's been taken up there, but I don't know to what extent...]

HE8: I think intellectually academic circles, when you present it at short courses, everyone thinks "this is bloody brilliant!" That's not reflected in the take up amongst policy-makers. And I think there's been two reasons for that. The first one is the mistake I made early in my career and that others are responsible for as well, which is to think that this is the principle when in fact it's the method and we haven't done a really good job of saying "actually, these are the assessments you really ought to be making to make these decisions." We haven't done a really good job of communicated that as maybe we could. I think that's changing, but that's the core of it. And instead we've focussed our effort on

a kind of competition of geekiness. We've competed ourselves into a geek-hole. "Oh, you've missed a bit, and I've put that bit in!" And so on and so on and so on and so on. And so, collectively, through academic competition, we've dived into a completely pointless hole, and missed the real value which is making sure we communicate those principles of what assessments are needed really clearly. In other words, it's Say's Law: demand brings forth its own supply. With value of information, we've put it the other way around. Supply ought to bring forth its own demand. It never does. So make sure there's demand. I think that's changing a bit. I think to be fair to ourselves as an academic community, I think there's another issue which is two things: there's been a separation in most healthcare systems between those responsible for making approval decisions and those responsible for research decisions. And there's a separation there. So we have approval decisions that don't take account of the impact on evidence and research, and research decisions which aren't linked to the decisions that need to be made, and that's a structural thing. Secondly, there's been much more accountability and demands for accountability and transparency applied to the ones that are making the approval decision, "are we getting this drug or not?" Much less accountability and transparency applied to those making the research prioritisation decisions. So bringing those two things together and getting the same levels of accountability, it's not been the same. And I think that's part of the explanation, I think we as an academic community haven't done a good job. But I also think it's a structural issue out there. And it's not surprising we've made much greater advances on the "how do we inform yes or no given the evidence" than on "well, what kind of evidence do you want?" And bringing those two together is a task. [REDACTED] People, ministers, policy people, clinical people, are taking seriously the spin on it. Which is this is about acquiring evidence. And that's where I think there's a way in, which is, "Ok, well we know how to figure out whether we need more evidence, and if we do what kind, and will you get it by having some proxy observational registry study whilst you're paying a fortune for this drug." And I'm hoping that the [REDACTED] paper will have a big influence on the clinical field. I think a lot of clinical communities are quite enthusiastic about accelerated access, and I'm hoping that the [REDACTED] paper, because it can communicate to them, they'll start to actually think about what's actually key. I'm hoping the [REDACTED] paper – can I pitch it to you? I regard the [REDACTED] paper as a lobster pot. Ok? So the lobster is the conglomeration of business innovation skills, Office of Life Sciences, and their stake holders, and inside the lobster pot is some lovely food, and we don't talk about cost-effectiveness, we don't mention QALYs, it's all in very familiar terms, so they go "ooh, smells quite nice." And then it appears that what we're saying is, "Actually, we should compare the value of implementation and value of evidence, and maybe we should implement things sooner, if we can acquire the evidence, on some other day. We shouldn't be waiting for rules of statistical significance. They're thinking, "Fantastic!" They're starting to come towards the lobster pot, because that's like preaching to the choir. And blah-de-blah-de-blah. And they're thinking "ooh, we can make it quantitative. Oooh, this is great. Ooh, it's in the BMJ. Ooh, it's got credibility." Into the lobster pot. Right? Once they're in the lobster pot, they realise this provides a quantitative way of comparing the actual benefits to the NHS of implementing this stuff at that price, with the value of resolving the uncertainty. And at that point you start to realise, "Actually, we should be withholding approval of things that are uncertain." Unfortunately, poor lobster's in the pot, pull him out, drop him in boiling water. There you go, that's the plan.

HE9 interview – 16th December 2015

GM: I try to cover three questions in each of these interviews. First, go through a case

study of an economic evaluation that you have worked on and the process of how you tried to get that into practice. The second question is how we can go about improving the way we do economic evaluations generally and lastly what you think we as researchers can do to assist users of evidence from economic evaluations. So if you can think about an economic evaluation you have worked on in the past. You don't need to necessarily explain what it is.

HE9: There's a couple. Depends what you want.

GM: I'm happy with a PBAC one, but also if you have something where...

HE9: Ok, I'll give you a non-PBAC one. Because PBAC is easy. Getting it into practice is mandatory. They just do it. A harder one was for patients with acute heart attack. What traditionally happens or what used to happen. They'd be picked up and taken to the hospital and they'd be taken to the ED and be given an anticoagulant essentially—there's a few on the market they cost about a thousand dollars an injection. But it was pretty effective.

GM: So that's a tough one...

HE9: A big decision. So I was commissioned by the NBMC(?) to see what was the cost-benefits. Whether they work in practice. So I undertook an economic evaluation around that. The key outcome was survival rate, those who ended up dead those who survived and compare the result.

GM: Was this based on clinical evidence that already existed or was it...?

HE9: It was a bit of both. The clinical evidence was really from what happened in practice and how long it took. Time from the call to emergency to get to the patient, which will change depending on which scenario you use. That was a key factor. The next key factor is that they brought in 12 ECGs. This is probably 10 years ago now. It takes a lot more to read what is really going on. Is it an EMO that you are having, what type of EMO? There are different types of elevation. Different types of infarcts that people can have. So the ST elevation is typically from the blockage of the main artery. So that they can identify that then take them to the ED. So the key thing was diagnosis. The next thing was travel time from needle and time to needle. And time from needle to ED is another outcome. So traditionally it was time to needle from the phone call, getting them into the ED with this new approach. So we've reduced travel time by about 20 minutes and then assessment time in the ED by about another 20 to 30 minutes. After 8 hours it's lost all effect. But people still do it and even after 12 hours there is still just a small effect.

GM: Was it cost-effective in the end?

HE9: It was. It was cost-effective actually. The key additional cost was the training of the staff. Some of the other components was the cost of the drug. You see it's all very well if you've got these departments around the state and the big ones always had stock. If you've got a thousand ambulances running through the streets of Queensland and you have to stock each one it'll cost a million bucks in one go, just to stock it. The training of the staff who should be able to use it is a key factor. CU paramedics are trained first

GM: How much were they interested in cost-effectiveness, or were they interested in cost in terms of budget.

HE9: They were only interested in cost-effectiveness- for each health outcome. So cost-effectiveness was more paramount then cost-benefit. We analysed it on cost-effectiveness grounds, so we used survival, we knew heart failure reduces quality of life so we could factor that in. We modelled that based on what was in the literature. And what was observed—for deaths especially. Now that was observed in Queensland. And time as a predictor of death. So we provided evidence of cost-effectiveness and we came up with an actual number—cost per QALY gained. And then we looked at budget impact. Most of budget impact was training, refresher courses and all those sorts of things depended on budget impact more than cost-effectiveness. To get that translated we had to build a business case. At the time—this'll change now—it'll say here's the cost and this

is the benefit you will get from it. So it's more than just the cost utility analysis. So we built the business case that went to state parliament. Because at the time the minister for emergency services—which is the police, fires and ambos—the ambos fall under that. So anyway, they've now moved back to health. So they had two different budgets.

GM: Interesting. So that minister—I guess his from the same party at least—but...

HE9: That's right.

GM: It's not as bad as maybe state versus federal.

HE9: Absolutely. You still have to go to state for discussion on approval and juggling budgets to do that. They've looked at it, they've implemented it and it's rolled out. So still not all ambos do it but now if you have an occlusive heart attack and the ambulance is far away then....

GM: Would you consider the target audience of the economic evaluation to be the MP? Because a lot of times you have either an intermediate body—like NICE—or the evaluation has to go to hospitals.

HE9: Well it was a whole different department with two different budgets so it had to be done at that level.

GM: So what do you have to do in order to be understandable or appealing to an MP?

HE9: It's a business case. What's the budget, what's it going to cost, what's it going to gain. In basic terms not. So they are most interested in cost and shifting budgets.

Because no one wants to lose part of their budget or part of their portfolio. But that doesn't mean they don't ask what's in the best interest of the community. It's one of those things where it's in the best interest. The other thing I didn't mention about the study was that although it was time to needle there was some cases where if you had a heart attack here and Logan hospital is only three blocks down the road they wouldn't do it they'd just take you to the ED. There's the threshold there of where is too close.

GM: Was it actually the ambulance association who contacted you.

HE9: Queensland Ambulance Service, yeah.

GM: To what extent did you work with them on that?

HE9: Pretty closely, yeah. And doing research that is translatable. Doing economic evaluations that are translatable is largely driven by the stakeholder. It really is. If it is NRC or CRC funded it is going to be a nice piece of research you know... nice piece of academic theory. But getting out into practice is so much harder.

GM: Which type of work do you find is easier to publish though?

HE9: The academic stuff yeah... but I still published the other stuff. As an aside, as an academic I like doing this type of research because it's demanding and tangible. But I usually only take on these projects if they are publishable. That's usually part of the contract.

GM: By publishable you mean that they will allow it to be published and they are not going to veto it?

HE9: Yeah.

GM: But say it someone wanted to do something very rough and dirty. Let's say something to be done in two weeks or less and it's not publishable. Would you say no to a project like that?

HE9: Yeah, I would. First, you are not going to get much out of it. It depends where it's going to lead though. I can say I'll do a quick one that's going to be indicative and we can identify the key areas of uncertainty. I think it's fair enough to do the quick and exploratory things.

GM: With the idea of using it more as a feasibility study?

HE9: Yeah. Although I don't do that very often. Because there is a certain amount of time and resources. There's always meetings and communications and so much you need to do to get through the [university] system.

GM: Even doing a small one [economic evaluation] that still takes time?

HE9: There's still the contract and a certain overhead associated with it.

GM: Sorry, I've gone a bit off track. With the ambulance study, how did you present the findings? Was there a presentation directly to the MP or to a different group?

HE9: There was a presentation to the ambos—to the chief of Queensland Ambulance. And they took it to the minister—I don't report to him that was the line of communication.

GM: So what did you actually provide them?

HE9: I provided them with a report. The report came in two parts—the economic evaluation and the business case.

GM: Should we move to more general questions?

HE9: Yes, sure.

GM: In the way that we do economic evaluations, and I'm specifically thinking of Australia, how do you think we could improve the way they are done?

HE9: Well. It's pretty standard how they are done.

GM: Well, I'm thinking more about how to get it into practice.

HE9: Research translation?

GM: Yeah.

HE9: Well I think the economic evaluation is fairly standard. I think we have to stick with that. To translate it that's more about the budget impact. The other side is what can be done is more subgroup analyses with a strategy to roll it out. You might have an intervention and say this is good. Let's say heart failure. You might say instead of rolling it out for everyone with heart failure you do subgroup analysis. You start with a small subgroup, and then you send it to the next subgroup and the next subgroup. And we'll leave it to the powers that be to roll it out. And the budget impact, all around is about staff training, management and budgets, facilities. It's all the stuff like a cathlab (?) vs a hybrid operating room. What's going to be replaced with the new things we'll be doing.

GM: Have you had any problems the valuations—I guess I'm thinking more along health services rather than say PBAC—where you have the challenge of trying to communicate differently about budget impacts to different hospitals where it is going to impact them very differently.

HE9:....

GM [Laughs] Or has that not really been....

HE9: Yeah, I haven't really struck that. I guess I've been dealing with the big hospitals rather than the small ones.

GM: do you think that's a way to get it communicated to the small hospitals that if you can get one hospital to do it

HE9: No. It makes things worse. Why, because there is a number of changes in Australia that have happened over the last few years. One was setting up HHS's—I think that's created more barriers than then helped. Because now each of them is their own entity, has their own thing, they don't really communicate with the one down the road, which is very sad. I mean they do professional conferences but there is not much time to go into detail.

GM: Do you think the use of economic evaluation has gone downhill since the introduction of HHSs?

HE9: I think it has become more fragmented. And now some HHSs undertake economic evaluations—or cost analyses—for certain interventions but the evidence doesn't get to anywhere else. No one else knows. So many barriers between them. And there's all sorts of other things with Pharmacy Queensland was really good until HHSs were brought in. Because they had a centralised pharmacy for supply. So they did all the purchasing, they had a monopoly. They could haggle with the drug companies

GM: And with the certain amount of drugs you would want to have in the state...

HE9: They had their own formulary. Now that's gone by the wayside. Because each HSS

does its own thing. There's still some oversight

GM: And I guess the bigger hospitals...

HE9: They still don't have as much power.

GM: Now the last thing, and we have sort of touched on this. What can individual researchers, or even research institutions—say universities—can do to help the use of evidence from economic evaluation.

HE9: I think universities are struggling with that themselves. Innovation and translation is really the thing. And it's one of the things that are earmarked for performance. I've had numerous discussions with actors up the chain about how they can evidence translated. You've got people have identified a gene or a gene fault and most times it doesn't lead to anything but the odd one does lead to something. Melanoma treatment is the latest thing and there's going to be something for MS hopefully one day. And nationally there was a big one; it was a drug for myeloid leukaemia. And it was one of the first drugs for leukaemia to get up – but it was developed at the start of the 60's, but it didn't get to market till 98 or something. Or it didn't get to trial before 98 so a long time in development. I've heard the person who developed it say, well he's the innovator he really translated it. He identified what the problem was and he identified what the therapy should be. And he generated that therapy. Now chronic myeloid leukaemia, the sufferers are typically older men. It's the acute the lymphocytosis that tends to hit younger. He identified that as a major chromosomal disorder and here's the drug that should counteract that because that mutagen generates an incomplete proteins. He identified the drug that shuts that protein down. Brilliant, should work. So that's as far as he got. But he couldn't get the drug to work so he went on to something else. He handed the project to a team of people and it took them 30 years, lots of monkeys involved, lots of dogs all sorts of things, bred very specifically to do this. The theory was right but he couldn't get it to work, someone else came along, "oh, we'll try it this way". It was oral form instead of IV. The oral form worked but they still don't know why. So they put it through clinical trials and then he came to me as a health economist what's the evidence, what's the cost-effectiveness of it? How much can I charge for it? So I did the submission to NICE. So that's a long story, but it takes all those steps.

GM: Do you see a distinction between the sort of research that was happening before...

HE9: The basic science?

GM: Yeah, the basic science. Is translation of basic science different to translation of cost-effectiveness evidence?

HE9: The basic scientist will say "wow, this is fantastic. They've developed this and it's translated into new line of chemotherapy. Well, no. It was a whole chain of events from the molecular stage to a pharmaceutical stage. Wow that's fantastic. Then someone else translated the pharmaceutical into a clinical trial. So there's a whole raft of translational issues and who gets credit for what. I think economists really miss out on that, because it's the economist who makes the case to government to say this is good value for money. Here's the evidence, here's what it's going to cost, here's what it's going to save, we are going to extrapolate that out for the country. Bam, is this worth funding? Is this worth the government subsidising.

GM: Would you say it was the last research component in the process?

HE9: I think that's right.

GM: Those were my questions, but is there anything else that I forgot?

HE9: Back to your second question. About what can be done about economic evaluation? I've spoken about it as being fairly black and white. It's either good value for money or it's not. But in between there are some grey areas. Do you fund something if there is a good deal of uncertainty but it looks like it might be cost-effective—there are longer term outcomes that aren't clear because we haven't done longitudinal stuff or follow-up studies. Do we do some clinical trials and fund it or do we wait for that

evidence to come through. You can either fund it and wait for evidence or not fund it and wait for evidence. Unless you can say this is poor value for money no matter what and we're never going to fund it. So there is four categories. Those middle two really need a lot more work they, those two categories we can really say, right, what are the key things we really need—simple survival, there will probably something else, rate of rehospitalisation, or some other measure of clinical benefit. It might be some parameter. So, what do we do? We know that there is some kind of benefit. If we fund it we know some people are going to benefit. There is some risk of benefit but we don't know what those trade-offs are. That in Australia is poorly done, It's really poorly done. They'll get something, go on an approve it or they'll say they won't don't even go there. They'll defer it—usually to wait for more evidence. That's where risk-sharing agreements come in. PBAC mostly used them for population risk—the biggest source of uncertainty. And then you get to value of information. Identify key parameters.

GM: So if you think of value of information as almost its own type of economic. What are the challenges for translating value of information?

HE9: Lots of challenges. There's technical challenges—because you've got to develop the probabilistic sensitivity analysis. PBAC don't like that. There are major barriers at that point. The government just don't like PSAs. It doesn't get used in the clinical setting. They say they want to know what are the key drivers of the model and that's sensitivity analysis. That's true, but I think you've got to do both. There's technical barriers for the economist getting the model together and there's barriers for the reader—the end user—to say “what does this all mean?” It's got to be in a format and language so that they can understand