Adaptive decision-making: how Australian healthcare managers decide

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Abstract. Despite many calls for the utilisation of research evidence in health policy-making, it is not widely practised, and little is known about how decision-makers in healthcare organisations actually make decisions. We recruited a purposive sample of Australian healthcare decision-makers to complete a web-based survey. We then took a sub-sample from willing respondents for individual interviews. All interviews were audio-recorded, transcribed verbatim and coded thematically. We found that resource allocation decision-making varied greatly across the Australian healthcare system. Decision-making was highly dependent on the operational context in time, place and purpose, and that research evidence was rarely exploited to its full potential. Decision-making involved a multifaceted interplay of elements in situation of inquiry. All decisions were made by networks or collectives of people; and no instance of individual decision-making was reported. This varied, social and contextual nature of decision-making points to a complexity that is not reflected in systematic evidence-based reviews or evidence-based models for decision-making, and we did not discover an appropriate model to reflect this complexity in the health-related literature. We developed a model of ‘adaptive decision-making’ that has potential to guide robust decision-making in complex situations, and could have some value as an explanatory or theoretical model for teaching and practice.

What is known about the topic? The topic is certainly novel and original, relevant and timely for academics and healthcare decision-makers. Despite increasing calls for the use of systematic evidence-based reviews including economic evaluations, the way in which decision-makers arrive at their allocation decisions and how such decisions reflect concern for economic efficiency is often blurred. This topic is an important one for its relevance to the current difficulties in the complex situation of healthcare.

What does this paper add? This paper shows that decision-makers acknowledged the integration of economic principles as contextual realities into their decision-making activities, rather than utilising the results of ever-more seemingly ‘technically sound’ economic evaluations, which cannot address the inherent uncertainty attached to complex decision-making activities. We developed a novel adaptive model of decision-making generated by the interplay of multiple behaviours and factors in the situation of inquiry. The model is new and takes into account the complexity of the context in time, place, purpose and administrative location.

What are the implications for practitioners? This paper should be of interest to a broad readership including those interested in health economics, public health policy, healthcare delivery, healthcare resource allocation and decision-making. The adaptive decision-making model designed in this study has the potential as a guide or heuristic device for teaching and practice. Healthcare decision-makers need to be prepared for complexity and ambiguity and cannot expect the data to tell them everything they need to know. We expect to see a shift in the literature on healthcare decision-making, not away from evidence-based practice and economic evaluation, but towards contextualising these methods in broader, adaptive models of decision-making.

Additional keywords: economic evaluation, evidence-based decision-making, health (care) system, resource allocation.

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Introduction

At a time of rapid change in science, technology, demography and epidemiology, along with economic and political movements, healthcare policy-making is becoming increasingly complex and inter-dependent. Political, economic, institutional, ethical and other decisions shape healthcare systems through many choices among available alternatives. This is because each profession brings a distinctive expertise to bear on issues, problems and questions.

There have been increasing calls for, and practice of, research-informed decisions and policy-making. Each profession employs more or less different approaches, methods and sources of knowledge in making decisions, and hierarchy of evidence for evidence-based decision-making is now widely known. The discipline of economics, for instance, has developed and refined methods to support decision-making, and members of the sub-discipline of health economics have called for increased use of evidence from economic evaluations to inform rational decision-making generally. Economic evaluation is ‘the comparative analysis of alternative courses of action in terms of both their costs and consequences’.7

Attempts to improve financial resource allocation decision-making have now concentrated on economic principles of technical (i.e. productive) and allocative efficiency, and other ways of incorporating competing demands into existing resource constraints. However, research-informed policy-making has proved challenging. It is well understood and widely acknowledged that many policy issues, including financial resource allocation decisions, do not reflect research evidence to the extent that in theory they can, and that research evidence rarely feeds directly and instrumentally into policy decisions. This is where a major gap emerges between theory and practice, or action and research.

In view of evidence that scientific research (including evidence from economic evaluation) is not utilised as often as social scientists (including health economists) recommend, including a lack of evidence about what foundations decision-makers use, we were interested to discover how Australian healthcare administrators decided to allocate scarce resources.

Methods

A mixed-methods approach, using web-based survey and constructivist grounded theory permitted exploration of resource allocation decision-making. “A constructivist approach places priority on the phenomena of study and sees both data and analysis as created from shared experiences and relationships with participants”. The potential Australian healthcare system decision-makers, whose contact details were made available to the general public, were identified and invited to participate in this research study. A purposive (non-probability) sample of 91 participants was then recruited to complete an online questionnaire. The participants were healthcare administrators at multiple levels of organisational structure drawn from the Commonwealth and New South Wales Departments of Health and Ageing, with responsibility for financial resource allocation decision-making. From willing respondents, we took a subsample of 25 participants to participate in face-to-face interviews.

Participants were invited to illustrate how they made financial resource allocation decisions, including questions about the formal methods, skills, heuristics (rules of thumb), experience and natural talent they used in decision-making. Practise interviews with participants were audio-recorded and transcribed verbatim to maintain the ideas and concepts reported. Full text transcripts of interviews and field notes were imported into NVivo software for thematic analysis and coding.

The data were initially coded line-by-line and closely examined for any similarities or differences. As we became familiar with the data, they were coded by larger segments of data; that is, closely related (initial) codes were condensed into more directed, selective and enduring categories with stronger analytic directions (focussed coding). The data analysis was followed by selective coding to conceptualise how categories bind to each other, and were integrated into a central category. Extra categories that best fitted the data and situation of inquiry were selected and the least relevant categories were excluded, culminating in the creation of several interrelated major categories. Emerging categories together with findings from quantitative data analysis were then mapped. In addition, we employed memo-writing as a reflective strategy to record abstract thinking about the data while conducting interviews. The ongoing process of data collection and analysis continued until saturation was reached and no new data emerged from the subsequent interviews.

The University of Sydney’s Human Research Ethics Committee approved this study.

Findings

Face-to-face interviews (n = 25), and the larger survey (n = 91), which was reported elsewhere, showed that resource allocation decision-making varied greatly across the Australian healthcare system. Given that all the respondents understood that resources are limited, most resource allocation decisions, they said, took account of the context; and were not purely based on the use of technical or research data. The main contextual factors that commonly contributed to resource allocation decision-making include politics, together with policy directives or the requirements to follow national policies, ethics, shared knowledge, economics and organisational and institutional complexity. Recognising context was fundamental when proposing a new intervention and when evaluating whether an intervention that existed in one setting might work in another. Examples included:

You would be very naïve to think that decisions are not affected by the political environment at the time. [Interviewee 16]

The control over decision-making is set by higher levels of authority in the shape of policies and procedures such as delegation manuals. [Interviewee 25]

Some decisions are politically driven and some are community driven, a lot of the time the senior executives make decisions based on needs, and sometimes there is good evidence that we need to change our practice. [Interviewee 9]

Further, all decisions were made by groups or collectives of people, and no instances of individual decision-making were
reported. Participants reported that a specific decision was not simply a matter of an individual actor’s knowledge, but incorporated multiple human and non-human factors in a specific situation. They described a distributed, collaborative decision-making network with mutual goals, but with different processes employed in each part of the network, and for different decision-making tasks.

There is a broad base of experience, knowledge and expertise that we rely on as well as those specific policy decisions and clear cut financial delegations. We have a lot of strong partnerships with Commonwealth government, state government, local councils and other community health settings to provide a very broad health service to our local community; which in turn is reinforced by another decision support unit in our hospitals. All that knowledge and experience that we get from those people help us make, hopefully, the right decisions. [Interviewee 1]

This varied, social and contextual nature of decision-making pointed to a complexity that is not reflected in systematic evidence-based reviews or research-informed models for decision-making, and participants did not point to a model or theory of decision-making that reflected the complexity of the processes they engaged in, nor we discovered an appropriate model to reflect this complexity in the health policy, health economics or healthcare administration literature. Although some models of decision-making, such as the ‘Garbage Can model’, are still relevant for researchers and practitioners, and have notions of task complexity, these models become less sensitive to changes in task complexity as the number of tasks needed to be completed increases.18,19 We felt the need for a model of resource allocation decision-making in healthcare that could cope with the realities, complexity, uncertainties and pressures found in real-world settings. An adaptive process of decision-making emerged from the data as a pattern, which made sense of complex and varied practices in many contexts.

As data analysis continued, we undertook a wide ranging search for an appropriate model of complex decision-making. We found a promising model in the literature about managing natural and environmental systems called ‘adaptive decision-making’.20–22

The adaptive decision-making process is a problem-focused, action-oriented participatory process aimed at producing use and management strategies that stakeholders agree with and feel like they own. This process recognises multiple stakeholders who have different values and knowledge systems and use multiple paradigms. It acknowledges the need for a dialectic decision-making process supported by rigorous single- and multidisciplinary research. [Lal et al.21]

We scrutinised and modified the adaptive decision model to reflect information from our interviews, which we have simplified in Fig. 1. Our data suggest that health managers used something like adaptive decision-making process in practice, in spite of increasing calls to use more structured and formal methods or systematic evidence-based reviews.23,24

Referring to the figure, the first step towards decision-making involves recognising a problem or issue (pre-decision-making step). Problem recognition refers to awareness of a discrepancy between an actual state and a desired state of affairs significant enough to induce action aiming to reduce the inconsistency.25 Participants in this study frequently asked: ‘what kind of problem or situation is that?’ before any effort could be made to solve the problem. However, they reported that with little or no participation of others, problem recognition could not be feasible.22

Our research indicated that, in practice, healthcare managers constantly worked together in formal groups or informal social networks with meaningful interactions based on recognition of mutual concerns and needs for new knowledge (Step 1). In particular, working together emerged when evidence-based information failed to fully address contextual complexities. The premise behind working together was that knowledge might emerge in social interactions that was not available to individuals working alone. Our participants reported that the decisions, which were made collectively, were significantly different to what any or all the individuals could make independently.

I really do strongly believe that the fastest and most efficient way of getting anything done is letting everybody know about that and giving them the opportunity to identify problems. People are much more likely to support you if they feel involved in decision-making. I believe that using a team is easier to make change happens. [Interviewee 1]

Social contacts within and outside the organisation involving stakeholders with knowledge of, or an interest in, the outcomes of decisions continued through all the steps outlined in this model. One key reason is that when individual decision-makers confer with others, the quality of decision-making is enhanced because of the reflective practice and peer support networks that are created through interactions.26 With these interfaces, research evidence has the most potential to be utilised.27,28

In this study, the Australian healthcare administrators reported that they devoted most of their time and attention to problem situations with incomplete information and significant unknowns (Step 2a). However, limited information and constraints on time and resources did not prevent them from acting. In contrast, they operated deliberately and were not immobilised by limited data.

We have labelled the major information gathering strategy ‘probing for information and patterns’ (Step 3). In the absence of a complete set of evidence-based data, our participants sought information through people and sources available to them, often those they believed might have relevant special knowledge. Although this may result in uneven information-gathering, selective (inappropriate) utilisation of research evidence and some information gaps, recognising or finding patterns in information allows decision-makers to find coherence in a situation29–31 and fill the gaps. They can then make sense of the merits of different available alternatives and select which to adopt.

Sense-making (Step 4) entails casting information and potential patterns explicitly into words and can serve as a stimulus to action. Sense-making is central to decision-making in complex situations because this is where meanings cohere to inform and constrain action.32 It involves a collaborative and cooperative
It is more than an attempt to discover linear causal relationships. Sense-making is followed by selection of one or more solutions and then trialling, evaluating and monitoring those solutions for fitness in context (Step 5). The selection process is the key decision-making step that informs the proposed adaptive decision-making model. It is purposeful and based on some weighing of costs and benefits along with systematic evidence-based reviews from the perspective of decision-makers. The outcome of this pre-decision evaluation and the review of evidence can be used as an input into the selection of one or more solutions to test.

Fig. 1. Adaptive decision-making.
Practical, natural experiments or organised field trials developed to generate new knowledge should be integrated into decision-making activities.\textsuperscript{34,35} Alternatively, feedback can be sought on the implementation of solutions, or relevant data can be harvested from routine reports.\textsuperscript{34}

The biggest issue is how to get resources in the first place. We deal with problems as they arise. We have got to make judgements about whether resources are sufficient, what else is needed to make our solution work properly and I guess we just get used to doing that in the way we are thinking is [going to] work and sometimes they work and sometimes they don’t work. So we have to then readjust our settings to make sure that the people and the resources are there to get the job done. [Interviewee 22]

Our participants identified a range of criteria they used to rigorously evaluate and monitor the proposed solutions (Step 6). Often, an emergent solution was evaluated based on the collected data of the environment and its merits relative to other alternatives. To do so and get a quick response with low cost and time, decision-makers applied explicit mechanisms and ‘best practice’ guides if there were any. If not, they reported applying heuristic analysis and intuitive thinking to make judgments about decision patterns in order to identify contributing factors and select a satisfactory choice. This helped them link learning from any outcomes of experimental trials to the decision at hand.

Participants frequently pointed to the effectiveness of setting priorities to ensure that resources are assigned where there is a ‘need’ for them and where they could provide ‘benefit’. When evaluating the effectiveness they mainly applied critical assessment skills and expert-driven information. The evaluation of trials, if any, was followed by formal economic evaluations. All participants factored costs and some of them factored benefits into interventions to make sure that their allocation decisions were cost-effective or cost-beneficial. This is where decision-makers tried to apply health technology assessment and evidence from economic evaluation studies to make a judgment about the reliability of the measures of the costs and benefits.

We found that the cost of providing Flying Squad, a group of people who are trying to keep the patients in their home, was cost-effective versus having aged people coming and stay in hospital. A cost-benefit analysis was done where we found it was more economically positive to keep them out of hospital in a proactive way, where they can be monitored. [Interviewee 11]

Once the intervention was evaluated on the grounds of efficiency, questions of equity and access arose.

A lot of money goes into a lot of areas; you think ethically why should we save people that are going to be a huge economic cost to the community for years? That’s one area. Financially, it’s very difficult to tell people that you can’t have new pieces of equipment, because we haven’t got the budget for it. [Interviewee 15]

Once an intervention was evaluated on the grounds of need, efficiency, effectiveness, quality and safety, and ethics, decision-makers have reached the point of being able to implement the solution or decision, probably subject to approval of the higher authorities.

In an adaptive management model, the test by which intended solution sets should be evaluated is generally ‘fit for purpose’ (Step 7).\textsuperscript{36} Resource allocation decisions are inevitably taken under conditions of complexity and uncertainty. There is no ‘one-size-fits-all’ solution, strategy or value-based process to complex and stubborn situations confronting decision-makers; similarly, no explicit decision-making theory or approach existed to guarantee all new modes of policy implementation. In view of the different functions performed by decision-makers and the diversity of government programs, emphasis should move towards a metaphor that is flexible enough to allow decision-makers to adjust their decision-making processes to the situation of action.

Solutions should perform adequately under reasonably foreseeable circumstances. If solutions are found not to fully fit the purpose, information should feedback into Step 2b of the adaptive decision-making model. Here, the effect of alternative solutions in the intended health outcomes is the key criteria, which is behind methods of health economic appraisal. If solutions are judged to be reasonably fit for the purpose, they can be implemented as desirable patterns of activity (Step 8). Although ‘fitness’ was not explicitly used as a test of solutions by decision-makers in our sample, it appeared compatible with their general discourse.

After solutions are implemented and stabilised, new patterns can emerge and it is not unusual to find unexpected consequences or new problems (Step 9). Informal networks, communities of practice and other strategies may facilitate feedback about emerging patterns.\textsuperscript{37}

The process of adaptation in complex systems involves selection from an enormously large number of potential solutions. In practice, a theoretically huge number of possibilities is reduced by selecting only from those that are adjacent to the current situation. The number and quality of adjacent possibilities available is enhanced through feedback cycles. If one adjacent possibility is determined to be less than optimal, the feedback cycle facilitates the discovery of other adjacent possibilities that may be a better fit for the purpose.

If the innovation appears to be fit for purpose, suited to the context and not generating undue novel problems, it may be stabilised and made part of routine management (Step 10). Once a pattern is stable, its path appears logical within the system; however, this is only one of several potential patterns that could have stabilised, each of which would appear logical in retrospect.\textsuperscript{38} Stabilising may include staff development, orientation of professional and expert staff, and development of new procedures. As this proceeds, the previously complex issue becomes increasingly routine, and enters the ordered domain of complicated or even simple knowledge. From this point, the situation may be managed through routine operations, until a new issue or problem is detected.

\textbf{Discussion}

Although research on healthcare resource allocation decision-making is dense, very little has been documented about the adaptive nature of these decisions. Owing to complexity and limited evidence, our article has limited ability to discuss the
adaptive decision-making in more detail. However, in general, there are two different strands to the literature that relate to this study: the literature specifically on the importance of research utilisation in policy-making, and the literature about models and theories of resource allocation decision-making.

Most of the conclusions that were reached by previous studies are still meaningful in relation to the gap between the potential use of research evidence and their limited effect on policy formulation.3–6,38 We found that scientific research (in general) and evidence from economic evaluations (in particular), as presently constituted, are underutilised in policy decisions. Researchers have identified many relevant factors,12,13,39 but the key barriers appear to centre on the fact that scientific research is rarely constructed to reveal the real contexts in which behaviour occurs or allocation decisions are made.13,40,41

A flexible, integrated and trans-disciplinary decision-making approach is needed to meet today’s health challenges and uncertainties that will have both known (classical viewpoint) and unknown (contemporary perspective) attributes,42 and that will identify all the situational factors in the decision context.31,43–45 Linear, reductionist approaches are only one of the tools that can be used in such an approach. The issue is whether they are ‘fit for purpose’. If the ‘purpose’ is about how community resources are best used to maximise health gains, then economic appraisal methods based on economic evaluation concepts have a role to play.

Several studies of research utilisation have revealed that the direct use of scientific evidence in decision-making may be reduced because of the enlightened use of research.15,31,46 According to the enlightenment model of research utilisation, scientific evidence does not directly influence policy; rather, it is more likely to be applied through the gradual ‘sedimentation’ of concepts, ideas and perspectives. Although our study added to the value of these findings, we did not ever reach the point of measuring the enlightenment or interactive use of research evidence in decision-making. We are not clear about the extent to which tacit, contextual or other forms of knowledge – that are not explicit and rational – are used in adaptive decision-making process in healthcare.

Our findings showed that the model of adaptive decision-making is a better approximation of what healthcare decision-makers actually do most of the time, than research-informed or evidence-based models of decision-making. It has the potential to depart from historical emphasis on rationality and reductionism, in favour of flexibility and adaptability.

We found that the process of decision-making was highly dependent on the operational context in time, place and purpose, and people responsible for making policy decisions most often employed shared knowledge, experience and accumulated knowledge (intuition and judgment). Most notably, our study emphasised the importance of the collective intelligence and communities of practice in decision-making in order to discuss possibilities and outcomes. Quite often, decision-makers refuse communication with other experts and make their choices without acknowledgement of advice from outside knowledge.47,48 Our participants reported that, in unfamiliar situations, executives who made decisions collectively would make a significantly more efficient and effective decision than counterparts who made decisions individually. Through involvement and collaborative efforts, cognitive processes and self-schemas evolve and decision-making judgments are better informed.49

Conclusion

Though our sample is small and perhaps biased, and as the data are limited to self-reporting, it is possible that, in practice, healthcare administrators make most of their decisions by involving others, especially those with specialised knowledge, and adapt to circumstances rather than following formal procedures. Our findings tentatively suggest that professional advice about how to make decisions using evidence and formal economic evaluations may be better suited for simple and less complex situations than all situations. This does not mean that such evidence is inaccurate, but we believe that its use is appropriate in some situations, and most matters facing decision-makers in a contemporary health system are more complex and require adaptive management.

Systematic and methodological decision-making methods may work well when questions are clear and sufficient information is available, but many decisions involve shadowy conditions of complexity and ambiguity with short deadlines. Evidence-based decisions work if the information is accurate, complete and available, but that often does not happen in the real world.

Current evidence-based practice may offer a set of theoretically valid, rational principles for conceptualising resource allocation, but decision-making in the Australian healthcare system is never a matter of individual rational choice. Even at the micro-level, a surgeon deciding which scalpel to use or a physician writing a prescription are social acts undertaken in team context and subject to review. If systematic evidence-based reviews are to help in real-life policy decisions, then they must be pragmatically appropriate. If those on the ground conducting research present information in a more useable form and make relevant research data available at key points of adaptive decision-making process, the uptake of an innovation would be almost always faster.

The Australian healthcare system is in a period of rapid change from healthcare technologies, significant demographic shifts (including population ageing), global warming, economic crisis, increasing globalisation and rapid changes in information technology. What is needed in this context is flexible decision-making, constant adaptation to change, innovation as well as stability and continuity to produce reliable results and dependable high quality healthcare for the population. In these conditions ‘decision-makers must learn to accept that rigid decision frameworks, even if very conservative, are not any more protective than risk-based, adaptive ones’.50 They need to be prepared for complexity and ambiguity and cannot expect the data to tell them everything they need to know. We expect to see a shift in the literature on healthcare decision-making, not away from research-informed decisions and evidence-based policy-making, but towards contextualising these methods in broader, adaptive models of decision-making. Testing this adaptive decision-making model in the field is a direction for future research.

Competing interests

The authors state that they have no conflict of interest. There has not been any financial relationship with any entities that have an interest related to the submitted work.
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