Attributes that influence human decision-making in complex health services: A scoping review

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Article

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Attributes that influence human decision-making in complex health services: A scoping review

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Article Type: Original article, scoping review

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Abstract

Humans currently dominate decision-making in both clinical health services and complex health services such as health policy and health regulation. This scoping review identifies and maps attributes that influence human decision-making in complex health services. A systematic search identified 140 potential articles. Inclusion and exclusion criteria were developed. Based on these criteria, four articles were deemed relevant. Four additional articles were added through citation tracking. The results of this review highlight key themes that underline the complex and nuanced nature of human decision-making. The results suggest that rationality may be entrenched, and may influence the lexicon of our thinking about decision-making. The results also highlight the counter narrative of decision-making that is underpinned by the uniquely human attribute of intuition. The review, itself, takes a rational approach, and the methods used were suited to this.
Healthcare can be broadly divided into clinical health services, health policy, and health regulation. It is important to make a clear distinction among these three spheres, to ensure clarity in discussions, arguments, and decisions relating to healthcare. Clinical health services refer to the diagnosis, treatment, rehabilitation, palliation, and prevention of disease, and focus, for the most part, on individual healthcare. Health policy refers to decision-making, strategy, planning, and actions that aim to accomplish specific objectives and outcomes in the context of public health. Health regulation is a complex set of laws, rules, regulations, and procedures that set and update standards, and ensure monitoring and compliance in healthcare.

Health policy and health regulation are closely related, and may overlap. Their scope and scale may apply to local, regional, national, or even global populations. For example, in the Covid-19 pandemic, they formed a continuum of public health measures, rules, and laws that may vary from one region to another, and from country to country.

An array of organisations at different levels of government may be involved in the oversight and control of health policy and health regulation. Numerous private entities and commercial concerns may also provide input and influence outcomes. Therefore, there are often differences in perspective and tension between opposing interests. All these factors make health policy and health regulation far more complex than clinical health services. Therefore, these two areas of healthcare can be viewed as “complex health services”. Healthcare, then, can be broadly divided into clinical health services and complex health services. The latter encompasses health policy and health regulation, and excludes clinical health services. Healthcare, as a whole, is transforming rapidly. In clinical health services, the advent of artificial intelligence (AI) and its real-world applications has resulted in a sea change. AI is now deployed in a raft of clinical health services, from medical imaging (Savadjiev et al., 2019) to augmented reality microscopes (Razavian, 2019), from patient engagement to accurate diagnosis and treatment protocols.

AI algorithms are already better than human radiologists in identifying malignant tumours. AI-based smartphone apps offer an array of personalised services that support fitness, healthy lifestyles, health monitoring, and diagnosis. While AI has made significant inroads across the entire spectrum of clinical health services, this is not the case, as yet, in complex health services. However, there is a rapid increase in the use of machine learning systems and sophisticated decision support in complex health services (Ashrafian & Darzi, 2018). Humans still dominate this area, but AI is making quantum leaps in maturity, utility, and influence. It is only a matter of time before AI begins to drive, or dominate, complex health services as well. This may diminish the relevance of human decision-makers in key areas of health policy and health regulation in the foreseeable future.

On the other hand, it is possible that humans may have certain unique attributes that influence decision-making, in this context, when compared to AI. For example, humans may offer a holistic and intuitive approach to decision-making (Jarrahi, 2018) that may
well present a competitive advantage to humans in future. Humans also have attributes that are a competitive disadvantage, such as escalation of commitment and sunk cost fallacy (Arkes & Blumer, 1985; Brockner, 1992; Thaler, 1980). These attributes influence individuals or groups to persist in committing time, effort, and money to an outcome, even when that outcome has negative consequences.

Several theories seek to explain the basis of human decision-making. Expected Utility Theory (Ramsey, 1926) is a prominent theory in the field of economics which has been applied to health services. According to this theory, decision makers choose between possibilities that each carry a degree of risk, by comparing the expected utility of the possible choices. Expected Utility Theory is rooted in rationality. It underpins assumptions inherent in many modern health service models. For example, these models assume that the cost per unit of health improvement – cost-effectiveness – influences decision-making to improve healthcare for a given population (Moayyedi & Mason, 2004).

Numerous theories have sought to modify or challenge Expected Utility Theory. Bounded rationality (Simon, 1955) is one of the important modifications. Under bounded rationality, decision makers have limits, such as computational capacity, knowledge, organisation, and memory utilisation. Prospect Theory (Kahneman & Tversky, 1979) challenges Expected Utility Theory. It explores decision-making in the face of uncertainty, and how people make decisions based on gain versus loss framing. This theory is particularly relevant in the Covid-19 pandemic, in an environment fraught with risk and highly emotional responses (Hameleers, 2021). There is mounting evidence that decision-making may not be based on rationality alone (Sahlin et al., 2010). Human beings are capable of making decisions using both intuition and reasoning (Epstein et al., 1996; Evans, 2008; Evans & Stanovich, 2013; Padilla et al., 2018). Emotion also plays a major role in decision-making (Lerner et al., 2015). Researchers have sought to describe, distinguish, and differentiate cognitive processes based on rationality, on the one hand, and intuition, on the other (Epstein et al., 1996; Hammond, 1996; Kahneman, 2011). These two cognitive processes can be viewed as System 1 and System 2 (Kahneman, 2003, 2011; Stanovich & West, 2000), which form the basis of Dual Process Theory.

Humans have the ability to apply some attributes internally and externally, such as behavioural flexibility (Uddin, 2021) and cognitive complexity (Cokely et al., 2018). Competencies such as advanced adaptive expertise (Croskerry, 2018), dialectical thinking (Schweiger, Sandberg & Rechner 1989), and neuroplasticity (Costandi, 2016) allow humans to make nuanced decisions. In contrast, attributes such as cognitive bias (Featherston et al., 2020; Kahneman, 2003; Kørnøv & Thissen, 2000; Stanovich & West, 2008) may lead to an over-reliance on previous knowledge or expected observations, which can result in sub-optimal decisions. However, cognitive bias may improve the efficiency of decision-making when used in combination with heuristics (Shah & Oppenheimer, 2008). Heuristics are rough, rule-of-thumb guides that reduce the effort
needed to make decisions – mental strategies that allow decisions to be made easily and quickly (Shah & Oppenheimer, 2008). The availability heuristic, representative heuristic, and anchoring and adjustment heuristic can enhance complex decision-making. When combined with other factors that influence decision-making, such heuristics form an important part of critical thinking (Stanovich & West, 2008). However, heuristics can result in errors and bias – for example, the representative heuristic can propagate stereotypes (Tversky & Kahneman, 1974).

Decision-making in complex health services needs to address the uncertainty of foreseeable events. It also needs to consider and address the radical uncertainty of unimaginable events (Kay & King, 2020). Radical uncertainty refers to events like the Covid-19 pandemic, where decisions and actions lead to outcomes that are profoundly uncertain. In such situations, it is challenging or impossible to establish the structure of the problem at hand, determine probabilities based on a comprehensive list of knowable outcomes, or choose among various possibilities (Kay, 2015; Keynes, 1937; King, 2016; Lehner, 2002). In the current era, which is dynamic, connected, and complex, important decisions are made under radical uncertainty across many domains, including economics, finance, politics, and government (Tuckett & Nikolic, 2017). Conviction Narrative Theory (CNT) is a framework for decision-making under radical uncertainty (Tuckett & Nikolic, 2017). CNT proposes that in radical uncertainty, decision makers should build narratives that map the future outcomes of all proposed actions. They should then develop enough conviction to make a decision by selecting an action. In complex health services, CNT is relevant in contexts such as the Covid-19 pandemic, where decisions need to be made at speed.

Results
This scoping review was designed to answer the following research question:

- What are the attributes that influence human decision-making in complex health services, as reported in the literature?

The results span forty-five years, from 1976 through 2021. Overall, 140 articles were identified, and 43 duplicates removed. The titles and abstracts of the remaining 97 articles were screened, based on inclusion and exclusion criteria. This process resulted in the exclusion of 85 articles. Both authors read the full text of the remaining 12 articles. Of these, eight were excluded because they neither related to complex health services nor specifically mentioned health policy or health regulation. The remaining four articles were found to be relevant to the research question.

Citation tracking was then undertaken – a snowball search of all references within these four articles. This process identified four more relevant articles. Thus, a total of eight relevant articles were included. Figure 1 shows the PRISMA flow diagram of article screening and selection.

The key results relevant to the research question are presented below.
1. The included articles were reviewed in detail to identify the human attributes mentioned and count the frequency of mentions (Figure 2).
   - A total of 45 human attributes were identified.
   - Rationality is mentioned in seven of the eight articles – it is the most frequent attribute mentioned.
   - This is followed by expertise, mentioned in five articles.
   - Morality is mentioned in four articles.
   - The ability to apply personal, specialist, or experiential knowledge (phronesis) is mentioned in four articles.

2. A comparative analysis was then conducted to identify any broad qualitative themes (Table 2). Two key themes were identified:
   - the complexity of human decision-making in complex health services, various aspects of which are discussed in six of the articles, and
   - cognitive processes involved in decision-making in complex health services, which are discussed in two of the articles included.

Discussion

Two key themes were identified in the articles included in this review – the complexity of human decision-making, and the cognitive processes involved in human decision-making, in complex health services. These themes indicate that human decision-making is complex and nuanced. It involves many cognitive processes that are based not only on rationality, but on intuition as well.

Rationality has been a focus ever since Ramsey (1926) first postulated the Expected Utility Theory. It is the most frequently mentioned human attribute (n=7) in the articles included in this scoping review. Other attributes based on rationality are also mentioned frequently – for instance, expertise (n=5), and the ability to apply knowledge (n=4). However, there is wider acceptance and acknowledgement that human decision-making is based on more than just rationality and the attributes associated with it. This is reflected in the findings. Morality is mentioned four times, cognitive bias and collective understanding receive three mentions each, with attributes such as dialogical thinking and emotion receiving two mentions each. The latter set of attributes may be considered more intuitive than rational. Therefore, viewed through the lens of Dual Process Theory (Kahneman, 2003, 2011; Stanovich & West, 2000), the attributes identified in this review can be broadly divided into those based on rationality and those based on intuition (Figure 2).

The methods used in this scoping review are as rigorous and transparent as possible. The Peters et al. (2015) framework was adopted as a useful, contemporary guide. An informal exploration was undertaken to determine optimal electronic search system and database combinations. This resulted in the selection of three electronic search systems that contain many subject areas relevant to the research question. The search
strategy included a database search of all databases available in these systems, as well as citation tracking.

This scoping review also has limitations. Searching other systems and bibliographic databases may have yielded additional results. This review only includes peer-reviewed journal articles published in English. These limiters may well have resulted in missing some relevant articles.

**Conclusion**
This scoping review identifies and maps attributes that influence human decision-making in complex health services. The review itself has taken a rational approach, and the methods used were suited to this. However, there may be scope to take a more intuitive approach. The results of this review indicate that human decision-making is both complex and nuanced. Rationality has been so entrenched that it has influenced the lexicon of our thinking about decision-making. This review has highlighted the counter narrative of decision-making that is underpinned by the uniquely human attribute of intuition.

**Methods**
This scoping review maps the attributes that influence human decision-making in complex health services. It provides a clear, reproducible methodology (Sucharew & Macaluso, 2019) and is reported in accordance with the framework and recommendations by Peters et al. (2015). As the topic of interest merits broad review to scope and understand literature from a holistic viewpoint, a scoping review of literature is appropriate here.

**Review Question**
This scoping review was designed to answer the following research question:

- What attributes have been reported in the literature that influence human decision-making in complex health services?

**Inclusion Criteria**
All articles relating to human decision-making in complex health services were included. The concept is decision-making in the context of complex health services. The population of interest consists of human decision-makers. The following inclusion criteria were applied:

- articles published in English;
- peer-reviewed journal articles; and
- any year of publication.
Exclusion Criteria

Articles that focus on decision-making in areas not relevant to the research question, were excluded. For example, articles focusing on the following topics were excluded:

- clinical health;
- health workforce;
- legal matters;
- environmental health, contamination, and toxicity;
- computers, human-computer interaction, and automated decision rules;
- mathematical modelling; and
- assessment of organisational performance.

Search Strategy

All available databases were included within each of three search systems – ProQuest, Scopus, and Web of Science. Search terms and a search strategy were defined for each of these systems (Table 1). Once the search results were evaluated and relevant articles identified, manual citation tracking was also undertaken – a snowball search of all the references within the articles deemed relevant.

Data Extraction

The first author (ND) removed duplicates from the database search results and read the titles and abstracts of the remaining articles – or, where abstracts were not available, the full text of the articles. The first author then read the full text of the remaining papers, applying inclusion and exclusion criteria until only relevant articles remained. The second author (LH) reviewed this. The extracted data was cross-checked by both authors to minimise personal bias (Singh et al., 2016). Any disagreements on data extraction and the categorisation of articles were resolved through detailed discussions, leading to a consensus between the authors.

Data Analysis

Key attributes were analysed to identify any broad qualitative themes in the articles deemed relevant. A basic descriptive analysis was also undertaken to:

- identify the attributes mentioned in the literature reviewed;
- conduct a frequency count of attributes (analyse how many articles mentioned a given attribute); and
- map these descriptive results visually in diagrammatic and/or tabular form (Figure 2).
Data Availability

Data generated or analysed during this study are included in this article and its Supplementary Information.
References


**Acknowledgements**
We are grateful to Ms. Carlie Nekrasov, librarian at the University Library, Southern Cross University, who provided invaluable insights on the search strategy.

**Author Contributions**
Nandini Doreswamy conceived the idea and concept, conducted the search, extracted the data, performed the analysis, and wrote the manuscript. Louise Horstmanshof supervised this work, verified the methods and results, and provided expert guidance on all aspects of this review, including guidance on the manuscript. Both authors read and approved the final manuscript.

**Competing Interests**
The authors declare that they have no competing interests.
Supplementary Information: Figures and Tables

Table 1. Databases and search terms used to identify literature for review.

<table>
<thead>
<tr>
<th>Database</th>
<th>Search terms</th>
<th>Number of articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProQuest (All ProQuest databases)</td>
<td>TI (decision) AND TI (human) AND TI (health) NOT papillomavirus NOT AB (clinical) NOT virus NOT Fukushima</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td><strong>Expansion of abbreviations:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TI=Title</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AB=Abstract</td>
<td></td>
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<tr>
<td></td>
<td><strong>Limiters:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Source types included:</em> Scholarly journals only.</td>
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<tr>
<td></td>
<td><em>Limited to:</em> Peer reviewed.</td>
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<tr>
<td></td>
<td><em>Languages:</em> English only.</td>
<td></td>
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<tr>
<td>Web of Science (All Web of Science databases)</td>
<td>TI=(decision AND human AND health) NOT TS=(papillomavirus) NOT AB=(clinical) NOT TS=(virus) NOT TS=(Fukushima)</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td><strong>Expansion of abbreviations:</strong></td>
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<tr>
<td></td>
<td>TI=Title</td>
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<td></td>
<td>AB=Abstract</td>
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<td></td>
<td>TS=Topic</td>
<td></td>
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<tr>
<td></td>
<td><strong>Limiters:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Document types included:</em> Articles, Review Articles, Other, Editorial Materials, Abstract, Other, and Unspecified.</td>
<td></td>
</tr>
</tbody>
</table>
Document types excluded: News, Reports, and Meetings.

Languages: English only.

<table>
<thead>
<tr>
<th>Scopus (The Scopus database)</th>
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<tr>
<td>TITLE(decision) AND TITLE(human) AND TITLE(health) AND NOT papillomavirus AND NOT ABS(clinical) AND NOT virus AND NOT Fukushima</td>
</tr>
<tr>
<td><strong>Expansion of abbreviations:</strong></td>
</tr>
<tr>
<td><strong>ABS=Abstract</strong></td>
</tr>
</tbody>
</table>

**Limiters:**

Source type included: Journals only (all peer-reviewed).

- **Note:** The [fact sheet about Scopus](https://www.scopus.com/about.jsp) states that the Scopus database consists of peer reviewed literature only.

Languages: English only.

<table>
<thead>
<tr>
<th>Total records identified by the database search</th>
<th>140</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total records after duplicates were removed</td>
<td>97</td>
</tr>
</tbody>
</table>
Table 2. Key features and categorisation of articles included, listed in chronological order.

<table>
<thead>
<tr>
<th>Article No.</th>
<th>First Author and Year of Publication</th>
<th>Title</th>
<th>Country of First Author</th>
<th>Source and Article Type</th>
<th>Topic / Summary</th>
<th>Comparative Analysis</th>
<th>Attributes Mentioned in the Article</th>
</tr>
</thead>
</table>
| 1           | Carminati 2020                       | Behavioural economics and human decision making: Instances from the health care system | United Kingdom | ProQuest Review of literature | Individuals are not always rational and tend to make decisions without maximising, to simply satisfying their needs. They have a narrow capacity of information-processing which relies and depends on heuristics, as short-cuts and informal algorithms, to deal with judgements and choices; adopt preferences biased towards the present time, which are also related to monetary | Complexity of human decision-making in complex health services | • Rationality  
• Cognitive limitations of memory and ability to acquire information  
• Heuristics  
• Present-time based preferences  
• Satisfaction versus maximisation  
• Monetary motivation  
• Inertia of actions  
• Framing  
• Collective understanding (considering shared social norms). |
<table>
<thead>
<tr>
<th>Article No.</th>
<th>First Author and Year of Publication</th>
<th>Title</th>
<th>Country of First Author</th>
<th>Source and Article Type</th>
<th>Topic / Summary</th>
<th>Comparative Analysis</th>
<th>Attributes Mentioned in the Article</th>
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<tbody>
<tr>
<td>2</td>
<td>Lechanoine 2020</td>
<td>COVID-19: Pandemic of cognitive biases impacting human behaviors and decision-making of public health policies</td>
<td>France</td>
<td>Web of Science Opinion</td>
<td>incentives, inertia of action, salience of information and the way information is framed; are loss-averse; and respond to social pressure.</td>
<td>Cognitive processes in formulating health policy</td>
<td>• Rationality</td>
</tr>
<tr>
<td>3</td>
<td>Gaissmaier 2019</td>
<td>A cognitive-ecological perspective on risk perception</td>
<td>Germany</td>
<td>Citation tracking / snowball search</td>
<td>Cognitive processes in formulating health policy</td>
<td></td>
<td>• Fear</td>
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<tr>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td>• Cognitive bias</td>
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<td></td>
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<td></td>
<td>• Risk perception</td>
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<td>Article No.</td>
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<td>Title</td>
<td>Country of First Author</td>
<td>Source and Article Type</td>
<td>Topic / Summary</td>
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</tr>
</tbody>
</table>
| 4          | Russell 2014                        | Being 'rational' and being 'human': How National Health Service rationing decisions are constructed as rational by resource allocation panels | United Kingdom | Web of Science Rhetorical analysis | Philosophy and practice of rationality in decision-making in the English National Health Service. | Complexity of human decision-making in complex health services | • Rationality  
• Dialogical reasoning  
• Values  
• Ethics  
• Morality  
• Emotions  
• Narrative reasoning  
• Sense making  
• Intuition  
• Holistic approach  
• Empathy  
• Critical reflection  
• Ability to use experiential knowledge (phronesis) |
| 5          | Greenhalgh 2009                     | Evidence-based policymaking: A critique. | United Kingdom | Citation tracking / snowball search Critique | A critique of evidence-based policy and research as the basis of policy decision-making. | Complexity of human decision-making in | • Rationality  
• Logic  
• Collective understanding  
• Dialectical thinking |
<table>
<thead>
<tr>
<th>Article No.</th>
<th>First Author and Year of Publication</th>
<th>Title</th>
<th>Country of First Author</th>
<th>Source and Article Type</th>
<th>Topic / Summary</th>
<th>Comparative Analysis</th>
<th>Attributes Mentioned in the Article</th>
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<tbody>
<tr>
<td>6</td>
<td>O'Brien-Pallas 2008</td>
<td>Toward evidence-based policy decisions: A</td>
<td>Canada</td>
<td>ProQuest Case study</td>
<td>Public policymakers share different burdens of uncertainty in complexity of human decision-making in</td>
<td>• Rationality</td>
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<td>• Values</td>
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<td></td>
<td>• Beliefs</td>
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<tr>
<td>Article No.</td>
<td>First Author and Year of Publication</td>
<td>Title</td>
<td>Country of First Author</td>
<td>Source and Article Type</td>
<td>Topic / Summary</td>
<td>Comparative Analysis</td>
<td>Attributes Mentioned in the Article</td>
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<td>case study of nursing health human resources in Ontario, Canada</td>
<td></td>
<td></td>
<td>decision-making when compared to administrators and clinical policy-makers. Assuming the role of research is to reduce uncertainty, public policy-makers must weigh research-based facts, along with several other factors to determine action, such as societal values, competing priorities, relationships, effective communication and pressure from the public, media and other interest</td>
<td>complex health services</td>
<td>• Collective understanding</td>
</tr>
<tr>
<td>Article No.</td>
<td>First Author and Year of Publication</td>
<td>Title</td>
<td>Country of First Author</td>
<td>Source and Article Type</td>
<td>Topic / Summary</td>
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</tr>
</tbody>
</table>
| 7          | Tenbensel 2000                       | Health prioritisation as rationalist policy making: Problems, prognoses and prospects | New Zealand          | Citation tracking / snowball search Commentary | The pros and cons of rationality and rationalism in the policy decision-making process. | Complexity of human decision-making in complex health services | • Rationality  
• Expertise  
• Specialist knowledge  
• Generic expertise  
• Technical expertise  
• Medical expertise  
• Relationships and alliances  
• Morality  
• and moral considerations  
• Compassion |
| 8          | Mechanic 1997                        | Muddling through elegantly: Finding the | United States of America | Citation tracking / snowball search | Human decision-making and health rationing: complexity, diversity, | Complexity of human decision-making in | • Rationality  
• Inflexibility and flexibility  
• Social considerations  
• Moral considerations |
<table>
<thead>
<tr>
<th>Article No.</th>
<th>First Author and Year of Publication</th>
<th>Title</th>
<th>Country of First Author</th>
<th>Source and Article Type</th>
<th>Topic / Summary</th>
<th>Comparative Analysis</th>
<th>Attributes Mentioned in the Article</th>
</tr>
</thead>
</table>
|            |                                      | proper balance in rationing |                          | Commentary             | uncertainty, and flexibility, versus rationality, cost-driven decisions, and inflexibility. | complex health services | • Political considerations  
• Thoughtfulness  
• Medical expertise  
• 'Give and take’  
• Compassion  
• Discretion  
• Emotion  
• Aspiration  
• Preferences  
• Social bias  
• Ability to deal with complexity  
• Engagement  
• Humility |
Figure 1: Flow Diagram Adapted from the PRISMA 2020 Statement (Page et al., 2021)
**Figure 2**: Human Attributes (n=45) That Influence Decision-making in Complex Health Services: Frequency of Mentions in Included Articles.