The design of patient decision support interventions: addressing the theory–practice gap

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Abstract
Background Although an increasing number of decision support interventions for patients (including decision aids) are produced, few make explicit use of theory. We argue the importance of using theory to guide design. The aim of this work was to address this theory–practice gap and to examine how a range of selected decision-making theories could inform the design and evaluation of decision support interventions.

Methods We reviewed the decision-making literature and selected relevant theories. We assessed their key principles, theoretical pathways and predictions in order to determine how they could inform the design of two core components of decision support interventions, namely, information and deliberation components and to specify theory-based outcome measures.

Results Eight theories were selected: (1) the expected utility theory; (2) the conflict model of decision making; (3) prospect theory; (4) fuzzy-trace theory; (5) the differentiation and consolidation theory; (6) the ecological rationality theory; (7) the rational–emotional model of decision avoidance; and finally, (8) the Attend, React, Explain, Adapt model of affective forecasting. Some theories have strong relevance to the information design (e.g. prospect theory); some are more relevant to deliberation processes (conflict theory, differentiation theory and ecological validity). None of the theories in isolation was sufficient to inform the design of all the necessary components of decision support interventions. It was also clear that most work in theory-building has focused on explaining or describing how humans think rather than on how tools could be designed to help humans make good decisions. It is not surprising therefore that a large theory–practice gap exists as we consider decision support for patients. There was no relevant theory that integrated all the necessary contributions to the task of making good decisions in collaborative interactions.

Discussion Initiatives such as the International Patient Decision Aids Standards Collaboration influence standards for the design of decision support interventions. However, this analysis points to the need to undertake more work in providing theoretical foundations for these interventions.

Introduction
When Lewin proposed that ‘nothing is as practical as a good theory’ he was emphasizing the value of hypothesis-led experimentation to advance understanding [1]. When considering decision support interventions (DESIs) for patients (including decision aids), there remains significant potential to improve our understanding of why and how they achieve their impact on patients’ knowledge and their participation in decision making [2]. Holmes-Rovner et al. [3] and Nelson et al. [4] have questioned the overall aims of ‘decision aids. Charles et al. has requested greater conceptual clarity [5]. Achieving greater clarity about the relationship between theory and practice in this field will help address a number of outstanding debates about the relationship between design, deliberation process and outcome measurement [4–10].

O’Connor et al. defined decision aids as: ‘interventions designed to help people make specific and deliberative choices among options by providing information about the options and outcomes that are relevant to a person’s health status’ [11]. In 2009, Elwyn et al. went further and stated that: ‘DESIs help
people think about choices they face: they describe where and why choice exists; they provide information about options, including, where reasonable, the option of taking no action. These interventions help people to deliberate, independently or in collaboration with others, about options, by considering relevant attributes; they support people to forecast how they might feel about short, intermediate and long-term outcomes which have relevant consequences, in ways which help the process of constructing preferences and eventual decision making, appropriate to their individual situation [12]. This definition introduces new issues, not least that the intervention cannot be viewed as a leaflet, video or website alone: the intervention is inevitably part of a social interaction. In other words, they are complex interventions [13]. DESIs for patients have been researched for over a decade [14,15]. Yet, it is only relatively recently that theory has received detailed critical examination. Decision-making theories examine how individuals make decisions. Prescriptive (normative) theories address how people should make decisions (according to their tenets), while descriptive theories focus on how people actually make decisions [16].

A literature review by Bekker et al. revealed that few interventions made explicit use of a theory or model of decision making [17]. Bowen et al. reported similar findings when examining interventions for informed decision making in bowel cancer screening [18]. Durand et al. reviewed the use of theory for the stated design of decision aids included in the O’Connor’s Cochrane review. Few interventions cited the relevance of theory and of those that did, many did not explain how theory had informed the design of components [19]. The review noted that the majority of theory-based interventions had used normative theories of decision making, such as expected utility (EU) theory that assume unbounded rationality. See, for example, Pauker’s and Llewelyn-Thomas’ ground-breaking work in the 1980s and 1990s [20,21]. These theories have been superseded by more recent developments that take account of the emotional, cognitive, environmental and time constraints that people face when confronted with difficult decisions.

These findings point to difficulties. It is likely that decision theories, as conceptualized to date, may not address the needs of the patients facing difficult decisions, which require collaboration with others. It is also possible that developers are unaware of the range of decision theories and do not know how best to operationalize their propositions. The reviews also noted examples where developers had combined elements from different theories and had described a ‘framework’ approach [19] arguing that patients, when making decisions need to integrate new information, seek professional advice and discuss their views with those of close relatives and others [17,18,22]. We need to consider that basing the design of interventions to support patient decision making on narrowly focused cognitive theories may not be the ideal way in which to make progress in this field.

Basing our conceptualization on Elwyn’s et al.’s definition of DESIs [12], we considered the contribution of theory to the design of two core components. These are information components, components that contain information about options (i.e. relevant attributes and outcomes), and deliberation components, components that aim to help individuals deliberate about their choice [7] (see Box 1). Yet despite the interest in including deliberative strategies in these interventions, a debate continues whether too much deliberation reduces the quality of decisions? There are opposing viewpoints [23,24] and a debate about how people arrive at preferences in order to make informed preference-sensitive decisions [14,23,25,26].

In the light of these questions and the largely atheoretical approach to date to the development of DESIs, we wanted to address the theory–practice gap. Our view was that making an effort to obtain greater clarity about the relationship between theory and practice would help address a number of debates about the relationship between design, deliberation process and outcome measurement.

We therefore set out to examine the following questions: if a theory (or model) were used as a basis for the design and evaluation of a DESI, what would be its manifest contribution to (1) information components, (2) deliberation components, and (3) the specification of a theory-relevant outcome measurement? The aim of this study was to address this theory–practice gap in order to help decision support researchers and developers in the field.

**Box 1 Information and deliberation components in DESIs**

**Information components:** Information provision is essential for DESIs [29]. At a minimum therefore, all DESIs will have information about the health context in which the decision is relevant, a description of why a decision is required, the options that are considered reasonable (or available), the attributes (harms and benefits) of the options, and the characteristics of the options in terms of the process (or procedures) involved and the timescale of potential consequences, short, intermediate and long term outcomes (both a description and event probabilities). There is, however, considerable variation in how this information might be presented. Decision-making theories and models provide a system for organizing and prioritizing how information might be presented.

**Deliberation components:** Most researchers have taken the view that active deliberation using knowledge gain is beneficial, over and above intuition using limited data. Many interventions have therefore contained strategies or exercises for so-called ‘value’ or ‘preference’ clarification. A distinction between ‘implicit’ and ‘explicit’ deliberation methods has been proposed [29]. Examples of explicit are utility measurement methods such as time trade-off or standard gambles that place numerical estimates on the future value of outcomes. Implicit methods suggest that people evaluate the options and their attributes informally using exercises to stimulate deliberation by using check-lists, balance-sheets or doing a series of discrete tasks prior to making a decision, such as head-to-head comparison across corresponding attributes of competing options. More recently, the interactive abilities of web-based tools offer heuristic-based stepwise visualization of a deliberation process [30].

**Outcome measures:** Theories were also assessed in terms of outcome measurement specification, acknowledging the unresolved debate in this area about whether to focus on process or whether to measure decision outcomes, despite concerns about post hoc assessment and the stochastic problem – that bad outcomes, by chance, can follow good decisions [7,31].
Method
The research involved the following stages:

1. Selecting and describing theories
We reviewed the literature about decision-making theories and models described since the 1940s [16,17,19,27,28]. We did not aim to be comprehensive, rather we paid particular attention to those theories that had most relevance to the design of DESIs. We restricted our analysis to a limited number of theories based on the following principles: (1) importance as major theoretical development; (2) applicability to decisions made by individuals in real-world settings with regard to information sources and professional advice; and (3), use, or at least, reported use, in existing DESIs. We did not consider theories, which had never been used to develop DESIs, as far as could be determined from existing theoretical reviews of DESIs [18,19]. We did not include theories which in our view were not relevant and applicable to the development of DESIs for patients. Because DESIs aim to facilitate decision making between two or more options but do not intend to encourage or sustain behaviour change, we did not examine theories or models of behaviour change.

2. Analysis and synthesis
Two psychology doctorate candidates (MS, MA-D), health psychologist (JB) and one clinician (GE), organized a series of seminars, one per included theory. For each decision theory, we selected the most cited articles, which most fully described the theory and its application (as cited). Ahead of seminars, agreed articles were circulated for pre-reading. Three tasks were undertaken in each seminar.

The main principles and theoretical predictions of each theory were clarified. Each theory was analysed in terms of its relevance to information and deliberation components of DESIs. Box 1 outlines the characteristics of the two core components. Finally, we analysed how each theory would lead to the specification of a theory-relevant outcome measure. Discussions were audio-taped:

transcripts were reviewed during a synthesis phase to support the operationalization steps.

Results
The first section of the results provides a brief outline of the eight selected theories or models, followed by a description of how each theory would potentially determine the design of components and outcome measurements. The second section is a synthesis of the main results indicating areas of where we think we have achieved progress and highlight areas where further work is required.

Eight theories or models were selected for detailed analysis. They cover developments over the last 60 years and address new and controversial developments in the field. In order of publication these were: (1) the EU theory (1944) [32]; (2) the conflict model of decision making (1977) [33]; (3) prospect theory (1979) [34]; (4) fuzzy-trace theory (1991) [35]; (5) the differentiation and consolidation theory (1992) [36]; (6) the ecological rationality theory/fast and frugal heuristics model (1996) [37]; (7), the rational–emotional model of decision avoidance (2003) [38]; and finally, (8) the Attend, React, Explain, Adapt model of affective forecasting (2003) [39]. We noted two trends over the last half-century (see Fig. 1). First, there has been a shift away from unbounded rationality models and second, there is increasing interest in the role of emotion as an essential, and beneficial part of decision making.

Section 1: An overview of eight decision-making theories, derived components and outcome measurements

1. Expected utility theory [32]
Decision making is based on a numerical quantification of utilities for outcomes and the probabilities of those outcomes occurring. The product of each probability and utility provides a set of EUs. For each decision theory, we selected the most cited articles, which most fully described the theory and its application. Ahead of seminars, agreed articles were circulated for pre-reading. Three tasks were undertaken in each seminar.

Von Neumann & Morgenstern (1944) [32]
Expected Utility Theory

Kahneman & Tversky (1979) [34]
Prospect Theory

Svenson (1992) [36]
Differentiation and Consolidation Theory

Janis & Mann (1977) [33]
Conflict Theory of Decision Making

Rayna & Brainerd (1990) [50]
Fuzzy-Trace Theory

Antonsev (2003) [38]
Rational–emotional Model of Decision Avoidance

Wilson & Gilbert (2005) [39]
AREA Model of Affective Forecasting

Figure 1 Selected decision theories, 1940–2008. AREA, Attend, React, Explain, Adapt.
Information components

This theory relies on numerical estimates of outcome probabilities and utilities. However, the theory itself does not specify details on how to provide, present or format information about probabilities and outcomes. The theory does not provide any guidance about information component design, although there is an underlying premise that information should be complete. The difficulties that accompany this premise (what is necessary and sufficient) are not addressed.

Deliberation component

The theory has been operationalized using a tree metaphor, where a series of branches arise from a decision node, each branch presenting an outcome with an associated probabilities and utilities. The process of deliberation is externalized because it is made by utility calculations that are made independently of typical deliberation processes using abstract methods such as time trade-off or standard gambles.

Outcome measurement

Given that decision analysis methods indicate a ‘best decision’, researchers often measure the degree of match (or mismatch) between the choice determined with and without EU methods. However, this outcome is a measure of the validity of a decision analysis process. A more valid (and theory-derived) outcome measurement would be a measure of a ‘good decision’ under this logic, i.e. one that mirrors a combined input of knowledge and values at the point of decision making, although this measurement basis risks circularity.

2. The conflict model of decision making [33,44]

This model was developed by studying attitude change and cognitive dissonance, because of the perceived failure of rational models. They noted the tension between the desire to terminate deliberation in order to avoid anxiety and stress versus worrying that making a rash decision could lead to feelings of regret. The theory suggests that a decision process has five stages: (1) problem appraisal: a provocation suggests losses if a decision is not made; (2) appraisal of alternatives: attempts are made to avert or minimize potential losses; (3) the evaluation of alternatives: decision strategies (minimization of losses or satisficing) are used to assess the advantages and disadvantages of options; (4) commitment: a process of consolidation begins by disclosing the decision to others and the development of resistance to negative feedback; and (5) adherence: this continues by the use of bolstering techniques and the denial of alternative options.

Information component

According to this model, information should be organized to: (1) provide clarity about the nature of the decision and why the status quo is questioned; and (2) accentuate the differences between alternatives, giving attention to loss avoidance. The model emphasizes the role of losses more than gains in decision making.

Deliberation component

The model emphasizes anticipated gains and losses for (a) the self and (b) significant others, as well as the anticipated approval or disapproval from (a) self and (b) significant others. These are specified because their comparison is most likely to give rise to decisional conflict. Deliberation tools designed to accomplish these comparisons would involve assessing each option (at a global level) in terms of one’s own approval or disapproval, i.e. which option, A or B or C, has the highest approval and gives rise to the least conflict at a personal level and second, which option gives rise to the least conflict when evaluated form the perceived and anticipated perspective of others. Deliberation tools could be potentially conceptualized as balance sheets of approval or disapproval weights attributed to either option, according to anticipated gains or losses on specified attributes.

Outcome measurement

This theory has led to the development of a widely used scale Decision Conflict Scale [45]. The measurement is typically applied shortly after a decision-making process. There is debate about this measure, partly because of concerns that it is not a pure measure of conflict and secondly because high conflict scores do not necessarily indicate a problematic process, given that difficult decisions might be expected to lead to cognitive dissonance.

3. Prospect theory [46–48]

Kaheman and Tversky [46–48] noted that humans systematically fail to match the assumptions of EU models. Humans make use of heuristics, such as the influence of loss or gain frames and the impact of recently appraised information. According to prospect theory, decision making is divided into an early editing phase (preliminary analysis, framing and perception of options) and a subsequent evaluation phase where the option with the highest perceived value is chosen. The theory notes how individuals perceive consequences in terms of change from perceived reference points or anchors: having different anchors leads to different decisions. Decision making is therefore influenced by (1) framing of information (gains versus losses) and by (2) the certainty effect, that individuals are generally more risk-averse when facing losses versus gains.

Information components

This theory has had a significant impact on information presentation and design, especially on the importance of framing, such as the use of language (talking of deaths versus survivors), of numbers (numbers of deaths versus numbers of survivors) and diagrammatic representations (mortality charts versus survival charts). It has been argued that framing effects can be minimized by using visual diagrams showing affected and non-affected icons, because they simultaneously illustrate gain and loss frames [49]. In addition, the theory demonstrates how reference or anchor points are important so the need to provide both absolute (population-level) and relative risk (comparator-level) data is also widely recognized.
Deliberation components
Although prospect theory has been instrumental in guiding information representation and risk communication, it does not address deliberation processes. A potential contribution would be to use interactive visual displays to allow sequential frame comparisons in order to make the potential impact of information framing on option evaluations more explicit and salient.

Outcome measurement
Improved risk understanding and more accurate risk perceptions would be expected if this theoretical framework was used to design information components. A valid outcome measurement would therefore include a context-specific measure assessing an understanding of the relevant probabilities.

4. Fuzzy-trace theory [50–53]
Reyna and Brainerd [50–53] described a theory of reasoning and memory that divides information processing into three stages: representation, retrieval and processing. It is proposed that people represent information with varying precision, from exact verbatim representations (including surface qualities and contextual details) to vague gist (a fuzzy mental representation of the general meaning or experience). Because of memory limitations, people do not retrieve all information stored in memory coherently. Verbatim representations fade and people engage in simplified reasoning at the least precise level of information encoded in memory, i.e. gist.

Information component
According to this theory, gist is more important than verbatim information in decision-making situations. It is not clear whether or not it is possible to facilitate gist representations by providing individuals with pre-formatted gist-like summaries (descriptive or visual). To operationalize this theory, it would be logical to represent information in comprehensible simple chunks (e.g. using summaries or visual metaphors) so as to facilitate gist representation. Alternatively, gist-enhancing presentations might be given priority over more detailed information, which could be placed in secondary locations.

Deliberation component
This theory does not specify a process for decision deliberation and assumes that the decision-making process is implicit and contingent on the process of retrieving and comparing gist.

Outcome measurement
This theory would predict that providing information that leads to improved gist formation would lead to improvements, perhaps in the speed and quality of decision making by reducing decision burden and cognitive loads.

5. Differentiation and consolidation theory
In this theory, Svenson postulates that decisions are made by gradually differentiating and consolidating competing options until one alternative emerges as superior and able to withstand future threats and doubts [36]. Decisions are made by undertaking pre-decisional work, called differentiation, where competing options are considered using a range of strategies to judge options and their attributes in terms of their attractiveness and importance. Optimal differentiation is considered to require a compensatory strategy, so that initial preferences are reconsidered on the basis of more information. Non-compensatory strategies, like the conjunctive, disjunctive, satisficing and lexicographic rules, describe approaches where options are rejected rapidly, without much, if any, consideration. A conjunctive strategy involves making choices by identifying the option that has all, or most, of the attributes that are considered important. A disjunctive strategy involves making choices by prioritizing on the basis of only one or two highly ranked attributes. The lexicographic strategy involves determining choice on the basis of the presence or absence of the most highly ranked attribute.

If an option is not superior to existing conditions, the status quo is maintained. Post-decisional work, called consolidation, is used to guard against future doubt. The cognitive effort is motivated by three different types of involvement: value-relevant, impression-relevant and outcome-relevant involvement. Value-relevant involvement is motivated to act in accordance with their personal values and attitudes. Impression-relevant involvement is concerned with how ‘significant others’ will view decisions. Outcome-relevant involvement refers to focusing more on future outcomes. The theory predicts that the employment of sufficient restructuring minimizes or prevents the occurrence of regret and cognitive dissonance.

Information component
This theory proposes that decision makers review as much information as is feasible, adopting a compensatory approach. Information should be organized in order to facilitate differentiation. The theory does provide specific guidance on how information should be presented, although a recognized illustration is to organize data about different options into head-to-head comparison [54].

Deliberation component
The decision strategies described by Svenson resemble many of the heuristics described by Gigerenzer’s group [55]. Svenson’s preferred differentiation and consolidation approach is compensatory using the additive or additive-difference rules for making comparisons. The additive rule compares options in terms of their attractiveness and importance. The additive-difference rule requires a comparison at the level of attributes, made easier by creating tables which allow head to head comparison of attributes [54]. Designing deliberation methods to accomplish these processes would require iterative phases of information appraisal and comparisons and enabling assessment from multiple ‘involvement’ perspectives.

Outcome measurement
This theoretical approach would require a measurement of regret and cognitive dissonance.
6. Ecological rationality model (fast and frugal heuristics) [37,55]

This model postulates that decision making is based on bounded rationality: that people make decisions under the constraints of limited time, knowledge and computational ability using an ‘adaptive toolbox’ [56]. The adaptive toolbox is a Darwinian inspired idea that conceives of the mind as a modular system composed of heuristics that exploit information available in the environment. The heuristics are fast, frugal and simple because they evolved on the basis of limited computational ability operating in time-scarce contexts. There is evidence that decision making based on heuristics is as accurate, or even more accurate, than decisions based on optimization methods, e.g. regression analyses [55]. However, it should be noted that much of the work reported is based on studying inferences rather than preferences [55]. The recognition heuristic is proposed as one of the most simple rules. The search for information is limited – no recall or further search is attempted and a decision is based on only one piece of information, i.e. recognition. The strategy avoids conflicts and removes the need to make trade-offs between attributes and is an example of ‘one-reason decision making’. Other examples are directed searches for the most highly valued attribute (take the best), or a search at random for any attribute that discriminates between two options (minimalist). Although it is documented that humans use heuristics, there is concern that we should not rely on these rules of thumb for important decisions, stemming from the tradition of viewing heuristics as errors and that more deliberative efforts should be used, especially when facing decisions in novel situations.

Information component

The model does not prescribe how information should be designed or structured. Information provision could be regarded as non-compensatory: a decision-maker makes use of available data, data that is itself a valid predictor of good decisions. An example would be basing a decision about a choice of treatment on recognition, e.g. your knowledge that many others have chosen the treatment is used as the basis for the decision. While the ecological approach has validity for when we have experience, perhaps the approach has less validity when we face novel situations and lack contextual data. The fast and frugal approach model is not clear on the role of information in such situations although there is evidence that information structures, which bear closer resemblance to the structure of naturally occurring information, are more easily understood.

Deliberation components

The theory proposes that we select heuristics based on the decision task, that operate by using information search and stop rules, and decisions are made when critical thresholds are achieved. Heuristics often use ranking or tallying methods that assume the decision maker will appraise information with respect to importance or relevance but that as soon as a satisfactory level of decision is achieved, no further will be undertaken. It could be conjectured that component design, based on the ecological model, would emulate heuristics by making their deliberative mechanisms visible, using strategies such as ‘tallying’ (assigning and summing attributes as ‘for’ or ‘against’ a decision option) or the ‘take the best’ heuristic where attributes are ranked, and their contribution to determining a decision considered in sequence. We do not know whether such explicit operationalization would undermine the effectiveness of heuristics.

Outcome measurement

Proposed outcome measures would be the efficiency of decision making, decreased decisional burden, tempered by an evaluation of ‘good’ decision making [55].

7. Rational–emotional model of decision avoidance [38]

The rational–emotional model proposes that decision avoidance is motivated by the need to regulate negative emotions. These negative emotions are either anticipatory, e.g. being afraid, unsure, or worried, or anticipated, once a decision is made, e.g. guilt, regret, remorse. It is postulated that decision avoidance (or deferral) can achieve this goal. Negative anticipatory emotions arise mainly because of selection difficulty, that is, the extent to which an individual is having difficulty deciding which of the options best meets their goals. When the best option is clear, people do not feel compromised. However, if options concurrently have highly negative and highly positive attributes, or when all attributes are negative, then trade-offs lead to distress. Decision avoidance or postponement is adopted in the hope that other solutions will appear. Anticipated regret mainly arises when people feel that by actively making a decision they will be responsible for a negative outcome, particularly when the negative outcome is irreversible. On the whole people tend to associate action with more regret than inaction. The rational–emotional model would be most useful in contexts where avoidance is expected, for example where selection difficulty is high or if the situation is highly emotional.

Information component

This model hinges on whether indecision can be justified on the basis of the costs of acting or deciding too soon. Information should therefore be structured so as to highlight the advantages and disadvantages of avoiding or postponing decisions, e.g. an inability to take advantage of favourable terms or the risk that opportunities may be short-lived. It would also be relevant to provide information on the advantages and disadvantages of active versus passive decision making since avoidance may lead to loss of agency and to more regret in the long-term.

Deliberation component

Given its focus on explaining ‘decision avoidance’, the model does not provide any guidance on how to operationalize deliberation processes. It is also generally assumed that the task of interventions is to support active decision-making process rather than to support avoidance or deferral. Therefore, an appropriate design for a deliberation component in this model would be to suggest methods where the factors that are most likely to lead to decisional deferral or avoidance are actively considered and not dismissed. For example, portrayals of other people facing similar decisions and who explain the importance or value of protecting oneself
from post-decisional regret relative to the costs of avoidance. Other strategies could include asking the decision maker to consider the attitudes that lead to indecisiveness contrasted against the potential relief that may arise from resolution.

Outcome measurement
Measurements aligned with this model would assess whether decision avoidance is aligned with their well-considered goals.

8. Attend, React, Explain, Adapt Model of affective forecasting [39]
This model postulates that decision making is influenced by predicted emotional reactions to future events, so called ‘affective forecasts’. However, the intensity and duration of emotional reactions to future events can be significantly overestimated (i.e. impact bias) by an overestimation of the intensity and duration of emotional reactions. The model provides a number of explanations for impact bias. First is focalism, a tendency to underestimate the extent to which other external events will influence thoughts and feelings; second is immune neglect, a failure to anticipate how quickly making-sense of and coping with novel negative events occurs; third is adaptation neglect, the failure to anticipate adaptation to an affective response after one or more exposures to a stimulus. As decisions in health care contexts often hinge on an individual’s perceived ability to adapt to highly threatening health events, DESIs could be designed to help people overcome forecasting errors, i.e. recognize that affective forecasting is often biased and therefore work to minimize this influence.

Information component
Operationalizing this model would require information to raise awareness about biases in emotional forecasting and to correct perceived inability to adapt and cope with forecasted negative affect.

Deliberation components
The model suggests that forecasts about the most important, self-relevant outcomes of each option need to be based on experience of the relevant emotional consequences and that this experiential simulation is part of the necessary deliberative process. Gaining personal experience of future events is impossible so attempts to minimize bias (over or underestimation) needs to be based on simulation or based on the vicarious experience of others. Methods such as imagining a range of possible futures might be helpful. Narrative formats, accounts from people who have already experienced the relevant future states are possible methods of enhancing the deliberative process. One approach is the use of audio-visual material e.g. portraying life after a stroke or the state of a patient who has severe dementia [57]. Debate exists about how to achieve a balanced use of simulations and narratives [58].

Outcome measurement
Measures aligned with this model would assess the impact on anticipated (forecasts) affect versus reported emotional consequences and whether more realistic appraisals of affective forecasts influences decision making.

Section 2: Synthesis
(1) The lack of an encompassing theory
We have realized that most work to date in decision-making theory has focused on explaining or describing how humans approach decision making rather than on how tools could be designed to help humans make decisions. Additionally, no one theory is able to provide a framework that is comprehensive enough to address all the design requirements for DESIs that aim to support patients’ decision making. This was particularly true when we think of the need of patients faced with complex decisions, often in discussion with many others, and distributed over time in health care contexts [59]. We conclude that decision-making theories to date focus on cognitive aspects and do not encompass the task of supporting people to make decisions, in collaboration with others, in real-world contexts. In summary, we do see a role for existing theories and models in the design of decision support components that address cognitive tasks. However, we also see a need for a middle-range theory [60] that will address when and how specific tools fit the wider social world where they are used and negotiated.

(2) Impact on the design of information and deliberation components
The selected theories and models were not explicit about how their propositions could be operationalized into decision support components and it was a challenge to undertake this step. Prospect theory, in attempting to explain human departure from the predictions of EU theory, has influenced information design, particularly regarding the influence of frames and reference points. Fuzzy-trace theory postulates how, as we retrieve data from memory, we rely on gist representations, and has had limited impact on intervention design. Conflict theory, the deliberation and consolidation theory and the ecological validity model share similar constructs. These frameworks are becoming increasingly influential in the development of decision support [19,61]. Two recent described models, the rational–emotional decision avoidance model and the affective forecasting model, are also highly relevant. They signal, respectively, the tendency to postpone decisions and to make systematic errors when forecasting affect. Given the increasing understanding that emotion plays a fundamental role in achieving efficient decision making [62–64], these two models will need to be operationalized into both information and deliberation components and reflected eventually in quality standards [58,65].

(3) Specification of theory-relevant outcome measures
We note a dearth of theory-specific measures in this research field, although a number of measures exist that address decision-related issues, e.g. the decision conflict scale [45], a decision satisfaction scale [66] and a decision regret scale [67]. Further validation work is required to enhance their psychometric properties, particularly in terms of construct validation [68,69]. Important contributions are the informed choice measure [70] and the concept of
measuring decision quality [71], although debate remains whether the focus should be on decision process or on the outcomes of decisions [7–9,31].

Discussion

Principal findings

The key findings of this study are the realization that most theoretical work has focused on explaining or describing how humans approach decision making rather than on how tools could be designed to help humans make decisions. The focus of most theories has been on cognitive process, at the level of the individual decision making. While this is still relevant for patients making decisions, there is also a need for a theoretical framework that addresses the wider context. Decision support materials for patients – leaflets, websites, videos and so on – are only one part of a DESI. How the decision is made visible, by who and how the supporting interactions with both professionals and others are integrated, are crucial elements of a decision support model. Further work is required to develop this framework.

Given this principal finding, it is not surprising that a large theory–practice gap exists. The deliberative processes that support decision making remain poorly understood and it may be too early to propose interventions which aim to improve the process. Optimization-based normative theories are viewed as not adding value to the process. Other, more descriptive theories bring us closer but have not considered how to systematically improve the process of decision making. In this context therefore, we have made tentative suggestions about how to address the theory–practice gap as we strive to design better decision support components but we accept the need for further work.

Strengths and weaknesses of the study approach

This review takes a systematic approach to bridge a theory–practice gap in the design of decision support for patients and is we think one of the first to try and address this issue in such depth. A limitation is our selection of theories and models undertaken. We acknowledge that there are other relevant theories but we defend our decision in terms of the criteria used and because this enabled an in-depth analysis.

Results in context

Assessing the detailed role of theory in the design of interventions to support patient decision making is a new endeavour [72] and we did not find previous attempts to undertake this type of analysis. We recognize there has always been an acknowledgement that theory is important [17], yet few interventions are explicit about the operationalization process [19]. We have acknowledged the debate around outcome measurements [8,9,70,73], and note that Elwyn, Sepucha and Ubel have raised the possibility of new approaches in this field [6, 7,71].

Implications

There is a need to undertake more empirical work to test theory-based decision support design. There may even be a need to consider a middle level theory, one that provides an overarching model for the goal of decision support. It may be important to ask whether or not we are able to disentangle information provision from deliberation strategies – they may be inextricably linked? We also need to consider the contribution of emotion to decision making: how to harness the vicarious experience of others and ask if it is legitimate to consider a ‘feeling as knowing’ approach, harnessing the impact of narratives, and if so, how? In the practical world of those who develop DESIs, initiatives such as the International Patient Decision Aids Standards Collaboration will continue to influence the standards set for the design of DESIs. However, this work also points to the need to link practice to theory so that we better understand how to make progress.

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References


