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Understanding patients' decision-making strategies in hospital choice: Literature review and a call for experimental research

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Abstract: Insights from psychology and cognitive science have, as yet, barely entered hospital choice research. This conceptual article closes this gap by reviewing and conceptually framing the current literature on hospital choice and patient information behavior and by discussing which tools are needed to advance scientific methodology in the study of patient decision-making strategies in hospital choice. Specifically, we make a call for more experimental research in hospital choice in order to complement existing theories, methods, and tools. This article introduces computerized process-tracing tools in hospital choice research, and also outlines a hands-on example, to provide a basis for future research.

Subjects: Behavioral Sciences; Consumer Behaviour; Experimental Design & Research Methods; Health and Social Care; Healthcare Management; Marketing; Psychological Methods & Statistics

Keywords: health care; health psychology; literature review; patient decision-making; hospital choice; process tracing; information display matrix (IDM); computerized process-tracing tools

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PUBLIC INTEREST STATEMENT

Patients often have to select a hospital for elective surgery or other medical treatment, and this choice is not an easy decision. As laymen, patients often use decision strategies that support simplification of the decision process. By analyzing what is already known about patient decision-making strategies in the scientific literature, this study summarizes the important decision strategies, usually effort reduction processes, which patients apply when choosing a hospital. Importantly, the scientific tools to investigate these behavioral schemes in experimental settings are lacking. Therefore, we propose to use experimental research tools, such as computerized process-tracing, to investigate patients' decision strategies. To facilitate future experimental research, this study also outlines a hand-on example.

1. Introduction

The topic of hospital choice has received significant academic attention in health care marketing and related research fields for more than 30 years, and its study has long been dominated by traditional economic theories and methodology (e.g. Akinci, Healey, Tengilimoglu, & Parsons, 2004). However, during the past decade, it has been increasingly argued that a more cognitive perspective should complement the traditional economic view, thereby facilitating insight into patients' hospital choice (e.g. Frank, 2004). Specifically, knowledge from psychology and cognitive science may serve as a vital basis for a better understanding of hospital choice preferences and underlying cognitive mechanisms. Patients' decision-making strategies in hospital choice are largely unknown today, and hence, little is known about how people acquire and use information in hospital choice. Moreover, the determinants of the application of specific decision-making strategies in hospital choice settings are not well understood either (Damman, Spreeuwenberg, Rademakers, & Hendriks, 2012). Gaining deeper understanding of patients' decision-making strategies, however, could challenge existing theoretical frameworks, question existing assumptions in health care politics, reform marketing strategies of health care providers, and also improve patients' autonomy for optimal decision outcomes (Victoor, Delnoij, Friele, & Rademakers, 2012).

Against the background of this increasing importance of psychology and cognitive science in the research field of hospital choice, the present article has the goal to review and integrate insights from health care management, marketing science, and cognitive psychology in order to advance hospital choice research on both a theoretical and methodological basis. Specifically, we address three major research questions:

(1) Which theoretical framework can be used to advance hospital choice research?
(2) What do we know about patient decision-making, especially regarding patient information behavior and relevance of decision criteria, in hospital choice?
(3) Which methodological tools are needed to advance the scientific understanding of patients' decision-making strategies in hospital choice?

Answers to these questions are given by reviewing and conceptually framing the current literature on hospital choice and patient information behavior. Based on review, we make a call for more experimental research in the field of hospital choice. Analyses of the current literature revealed that many studies are purely conceptual in nature, and those studies that are empirical usually used surveys and interviews. It follows that experimental research deliberately manipulating independent variables (e.g. amount of information or decision complexity) to study the resulting effects on dependent variables (e.g. information acquisition patterns or decision-making strategies) is rare. Rather, research based on self-reported data dominates. While this existing stream of research has contributed to scientific progress in the field, a new perspective is advantageous to stimulate future research and to foster knowledge development in the field of hospital choice.

Specifically, we outline the potential of computerized process-tracing (CPT) tools for the study of patient decision-making strategies in hospital choice. Such software tools, to the best of our knowledge, have not been used in hospital choice research so far, despite their well-known importance in the investigation of people's decision-making strategies in experimental settings, a fact that explains their enormous relevance in cognitive psychology and behavioral decision-making (Schulte-Mecklenbeck, Kühberger, & Ranyard, 2011a). Hence, we argue that these tools should become part of the researcher's toolbox in the field of hospital choice.

This paper is structured as follows. In Section 2, we describe the theoretical background to experimentally study patient decision-making strategies by introducing the adaptive decision-making framework by Payne, Bettman, and Johnson (1993), and illustrate how it applies to the hospital choice context. In Section 3, we provide a literature review on patient information behavior and decision criteria for hospital choice. In Section 4, we describe foundations of CPT tools, and we outline

how such tools can be used to study patients' decision-making behavior in hospital choice scenarios in the context of laboratory experiments. Subsequently, we analyze existing CPT tools. Moreover, as a complement to this section, we provide a concrete research example in the Appendices A and B, based on an extensive review of decision attributes relevant in hospital choice. Finally, in Section 5, we conclude the paper.

2. Theoretical background

2.1. Adaptive decision-making as theoretical foundation for the application of experimental research in hospital choice

Modern cognitive psychology acknowledges that human resources such as time, knowledge, and computational power are limited. Following bounded rationality theory, therefore, patients have only limited information processing capabilities. Thus, they are generally not able to process all information available and cannot act with perfect rationality in decision-making situations, in the sense that their choice is based on an optimal combination of probability and utility evaluations (Simon, 1959, 1990). Following Simon's (1959) satisficing approach, individuals rather settle for making a choice that is good enough to meet their predefined aspiration level. Thus, patients typically apply choice heuristics, defined as "strategies that guide information search and modify problem representations to facilitate solutions" (Goldstein & Gigerenzer, 2002, p. 75), to cope with difficult decisions, especially under uncertainty (Kahneman, Slovic, & Tversky, 1974). Generally, this "heuristics approach" explains that people do not always base their decisions on probability evaluations; rather, people have a variety of intuitive strategies, such as cognitive shortcuts, for solving decision-making problems (Griffin, Gonzalez, & Varey, 2001; Kahneman et al., 1974). Among these heuristics are, for example, the fast and frugal heuristic (Gigerenzer & Goldstein, 1996; Goldstein & Gigerenzer, 2002), and the adaptive decision-making model (Payne et al., 1993). Those heuristics stress the adaptive and goal-driven nature of judgment and decision processes (Griffin et al., 2001).

As the aim of this research is to elucidate which distinctive patient decision-making strategies occur within the hospital choice context, in this article we draw upon the *adaptive decision-making model* developed by Payne et al. (1993). Within this seminal framework, people are described as actors who flexibly adjust their information processing and decision effort as a function of the complexity of information and the context within which decisions are made (Bettman, Johnson, & Payne, 1991). Thus, decision strategy selection is predominantly influenced by characteristics of the decision problem (e.g. complexity), characteristics of the decision-maker (e.g. experience), and social context variables (e.g. need to justify a decision).

Within this framework, *decision strategy* is defined as a "sequence of mental and effector (actions on the environment) operations used to transform an initial state of knowledge into a final goal state of knowledge where the decision-maker views the particular decision problem as solved" (Payne et al., 1993, p. 9). Decision strategies, therefore, include the sub-processes of information acquisition, evaluation, and choice (Payne et al., 1993). Patients have a repertoire of heuristics available in their set of decision strategies, which they assess on their advantages (or benefits) and disadvantages (or costs) in light of their individual goals and constraints. However, according to the adaptive decision-making model, individuals will always use the heuristic anticipated as "best" for the choice task with regard to a maximum of accuracy and a minimum of effort as they intelligently trade off accuracy and effort evaluations when making a decision (Payne, Bettman, Coupey, & Johnson, 1992; Payne et al., 1993). Besides these two meta-goals (accuracy and effort), recent evidence has shown that decision strategy selection is further influenced by people's tendency towards minimization of negative emotions and maximization of justifiability (Bettman, Luce, & Payne, 2012). Importantly, this theoretical approach of heuristic decision-making has been previously transferred to medical decision-making (Marewski & Gigerenzer, 2012), substantiating the notion that this framework, generally, is useful in the field of health care. Moreover, the adaptive decision-making model is the conceptual basis of several algorithms underlying CPT tools (see Section 4).

2.2. Applying the adaptive decision-making model to the hospital choice context

According to the adaptive decision-making model, scholars need to consider several determinants of strategy selection before empirically investigating hospital choice scenarios. Important determinants of decision strategy selection in the hospital choice context are: the *decision problem*, the *decision-maker*, and the *social context* in which the patient is embedded (see Figure 1). Only by understanding these factors, human decision behavior can be interpreted (Bettman et al., 1991; Payne et al., 1993).

First, the *decision problem* must be understood. A decision problem is mainly characterized by task variables (e.g. time pressure, the number of alternatives, or the plethora of information describing those alternatives) and context variables (e.g. similarity of alternatives, reference points, and framing) (Payne et al., 1993; Pfeiffer et al., 2014). Like many other health-related choice problems, the selection of a hospital represents a highly complex decision task due to the interaction of multiple situational variables (Lubalin & Harris-Kojetin, 1999; Pierce, 1996; Pierce & Hicks, 2001; Victoor et al., 2012). Complexity in decision-making is essentially determined by the number of alternatives available (Payne, 1976). However, the number of accessible health care providers for patients may vary depending on the health care system and other factors (e.g. geographic aspects). Nevertheless, many consumer-driven health care systems exist in provision-oriented countries where patients enjoy comparatively smooth access to providers, and where universal health service coverage exists (Wendt, 2009). Moreover, decision complexity may stem from a high number of relevant attributes (i.e. decision criteria) (Payne et al., 1993). Here, extant research on hospital choice has examined a multitude of attributes, all of which may have impact on patients' hospital selection (Victoor et al., 2012). However, a comprehensive overview is missing in the literature, and hence we provide a corresponding discussion in Section 2.4 where we describe a list of decision criteria in hospital choice. These criteria form the basis for experimental research based on CPT tools (see Section 3).

The *characteristics of the decision-maker* must also be considered when studying decision strategy selection in hospital choice. Here, the patient's cognitive ability, knowledge, and expertise are key factors (Bettman et al., 1991). Moreover, socio-demographic and disease characteristics have also been shown to affect hospital preference formation (Victoor et al., 2012).

In general, patients are limited in their role as decision-maker. First of all, health care services are credence goods as patients are usually not able to accurately judge the quality of the treatment they receive (Kahn et al., 1997). Blatant information asymmetries between patients and medical professionals exist that lead to a principal-agent constellation between the two parties (Gafni, Charles, & Whelan, 1998). In order to reach optimal outcomes, policy makers currently pursue a shift from traditional paternalistic choice models towards enhanced patient autonomy and engagement in shared decision-making (Coulter, 2010; Elwyn, Edwards, Kinnersley, & Grol, 2000). However, not all patients want to be equally involved in shared medical decision-making together with the health

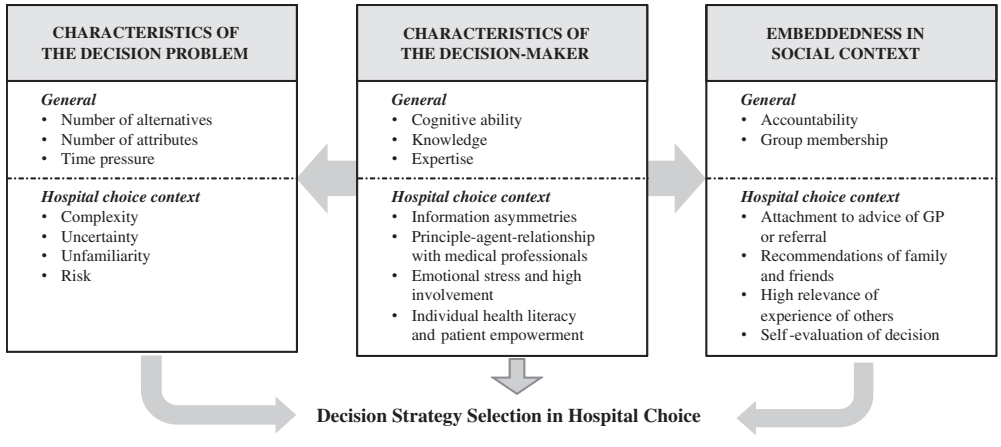


Figure 1. Determinants of decision strategy selection in the hospital choice context.

care professionals (Flynn, Smith, & Vanness, 2006; Rosén, Anell, & Hjortsberg, 2001). Secondly, situational properties emerging from the health care context turn patients into idiosyncratic decision-makers (Berry & Bendapudi, 2007; Crié & Chebat, 2012). The infrequent necessity for medical service is mostly unplanned and brings patients into a position of high involvement, high stress, and high emotional vulnerability (Kahn et al., 1997; Pierce & Hicks, 2001). Sometimes, patients even experience fear or anxiety (Frank, 2004; Tang, 2012). Thirdly, the concepts of health literacy and patient empowerment are both crucial to the individual capability of health-related decision-making as they influence the way patients understand and handle information (Schulz & Nakamoto, 2013). Yet, these factors have only recently begun to become the subject of scientific investigation. A recent study indicates that lower levels of individual health literacy and patient activation are associated with less-active provider choice (Rademakers, Nijman, Brabers, de Jong, & Hendriks, 2014).

Hospital choice, importantly, is not performed in a vacuum, but is also influenced by numerous *social factors* (Bettman et al., 1991). In their framework, Payne et al. (1993) refer mainly to the concept of accountability (i.e. the need to justify the decision to others) and group membership constraints. However, with regard to hospital choice the patient needs to be regarded within the context of all relevant others, including general practitioners, family, and friends. Commonly, patients generally rely significantly on the advice of general practitioners as the role between the patient and the caregiver is strongly intertwined (Kahn et al., 1997; Victoor et al., 2012). Likewise, people tend to highly value the experience of other patients (de Groot et al., 2012) and the recommendations of relatives and acquaintances (Leister & Stausberg, 2007). Thus, the processes of self-evaluation and the evaluation of significant others are of importance in the hospital choice context (Bettman, Luce, & Payne, 1998; Payne et al., 1993).

3. Literature review on patient decision-making strategies

3.1. Patient information behavior

Studying decision-making strategies of patients implies a solid understanding of their information acquisition and information processing behavior. Even though the literature on the topic of health information behavior and health communication is extensive (Kreps, 2012), our study has a focus on patient information behavior in the context of hospital choice. In this specific domain, research is much more limited. Major empirical and conceptual research results in this domain are summarized in the following.

Patients have a multitude of information channels at their disposal. Especially in today's digital world, patients increasingly search the Internet for relevant information on health care providers (Aase & Timimi, 2013; Drevs & Hinz, 2013; Huesch, Currid-Halkett, & Doctor, 2014). Even though online media are becoming increasingly important, they cannot fully substitute personal information exchange in health communication (Baker, Wagner, Singer, & Bundorf, 2003; Cline & Haynes, 2001). Thus, patients' hospital information behavior can be split into formal (mostly impersonal) and informal (mostly personal) sources.

Formal information sources cover all available data in public on providers such as comparative reports or performance data published on the Internet, hospital quality reports, or information in other media outlets (e.g. newspapers). Interestingly, evidence indicates that performance information that is publicly available has only limited influence on provider choice, a fact that has been demonstrated in the UK (Dixon, 2010; Laverty, Dixon, & Millett, 2013), in Germany (de Cruppé & Geraedts, 2011), and in the Netherlands (de Groot, Otten, Smeets, & Marang-van de Mheen, 2011). Research also shows that patients rarely use formal information sources on hospitals because they have difficulties in understanding the information provided, are not interested in the nature of the information, lack trust in the underlying data, or have problems to access the sources (Damman, Hendriks, Rademakers, Delnoij, & Groenewegen, 2009; Hibbard, Slovic, & Jewett, 1997; Marshall, Shekelle, Leatherman, & Brook, 2000). Overall, formal information sources do not represent the primary information base for patients.

Patients often rely on information from informal, usually personal contacts, and experiences. For example, de Groot et al. (2011) showed that even patients who were already familiar with comparing hospitals still mostly relied on their own and other people's knowledge rather than on information which is publicly available. Generally, the main sources of information used in hospital choice are the patient's own experiences, advice of the general practitioner (GP), and recommendations from the immediate social environment such as family and friends (Dealey, 2005; Laverty et al., 2013; Moser, Korstjens, van der Weijden, & Tange, 2010b; Victoor et al., 2012). In this context, it is important to note that several studies report that the GP is seen as the most trustworthy source of information with great influence on decision-making (Dixon, 2010; Hesse et al., 2005; Wilson, Woloshin, & Schwartz, 2007). In particular, elderly persons value the GP's advice (Schwartz, Woloshin, & Birkmeyer, 2005). Other studies indicate that personal experience is a highly valuable information source, predominantly because it is, at least sometimes, the only available reference for patients (Moser et al., 2010b; Victoor et al., 2012).

Moreover, Jung, Feldman, and Scanlon (2011) stress the influence of satisfaction with previous hospital stays on future hospital choice. However, the experience-based information provided by other patients is also an esteemed benchmark in hospital selection (de Groot et al., 2012). Narrative, anecdotal information can even reinforce the effect of performance data (Huppertz & Carlson, 2010). Hence, the entire social network of patients is considered to be a reliable information source (Moser, Korstjens, van der Weijden, & Tange, 2010a; Victoor et al., 2012). This social influence extends its significance towards the phenomenon of hospital reputation. Considered as a general quality indicator (Drevs, 2013), hospital reputation can be one of the main reasons for hospital choice (Dijs-Elsinga et al., 2010; Jung et al., 2011).

Our analyses suggest that the concepts of trust and patient skills play a vital role in patient information behavior. Whereas trust in comparative consumer information (e.g. reports on the Internet) proves to be rather low, patients place more trust in information from peers (Moser et al., 2010b). Overall, physicians remain the most trustworthy source of health information even if the source credibility of online media is increasing (Erdem & Harrison-Walker, 2006; Hesse et al., 2005). Considering the difficulties involved in acquiring and processing hospital information, the multidimensional concept of trust is a decisive mediator in hospital choice. Information sources linked with multiple positive attributes, such as accuracy, knowledge, and concern with public welfare, lead to more patient trust (Frewer, Howard, Hedderley, & Shepherd, 1996).

After patients have accessed an information source, they need to be able to evaluate the information provided. This skill is mainly determined by health literacy and patient empowerment (Zwijnenberg et al., 2012). For example, patient information and processing behavior varies with the individual capability of handling different types and quantities of health-related information (Hibbard & Peters, 2003) and the individual active or passive orientation towards the health topics (Dutta-Bergman, 2004).

3.2. Review of decision criteria and patient decision-making strategies for hospital choice

In this section, we discuss crucial decision criteria for hospital choice. Based on these findings, important decision strategies are portrayed. Based on a comprehensive literature review, Victoor et al. (2012) distinguish three categories of provider characteristics: structure variables (e.g. type and size of the provider), process variables (e.g. waiting time), and outcome indicators (e.g. mortality rates). As a major conclusion of their study, Victor and colleagues write that "whether and how patients choose a provider and their eventual choices are determined by the interplay between patient and provider characteristics" (Victoor et al., 2012, p. 11).

Research also indicates that patient and provider characteristics relate to each other. For example, research shows that a preference for short waiting times is correlated with lower education (de Groot et al., 2012) and masculinity (Birk, Gut, & Henriksen, 2011). Other studies show that age, as well as social status, affect whether patients bypass the nearest local hospital (Roh & Moon, 2005;

Varkevisser & van der Geest, 2007). Besides these social-demographic variables, the importance that patients attach to different preference variables also depends on their disease characteristics and their knowledge, attitudes, and beliefs (Victoor et al., 2012).

Several provider characteristics (e.g. quality of care) cannot be judged accurately by most patients. This leads to the usage of proxy variables to assess providers fit for individual needs (McCullough & Dodge, 2002). As patients find it hard to assess a multitude of potentially relevant factors, they develop a tendency to use more intuitive decision-making patterns and tend to apply decision heuristics, instead of more formal decision algorithms such as the expected utility model (Boyce, Dixon, Fasolo, & Reutskaja, 2010; Lubalin & Harris-Kojetin, 1999). Hibbard et al. (1997) elucidate that patients give more weight to precise and concrete variables, such as costs or location, and less weight to "fuzzy" variables, such as vague quality indicators. Thus, patients base their choice on a limited amount of information rather than all data available (Hibbard et al., 1997; Victoor et al., 2012). As a result of this simplification strategy, patients are likely to overvalue single, easy-to-understand information cues when choosing a hospital, and hence are likely to select one dominant choice factor that is easily assessable to them, even though this information may even be inaccurate (Lubalin & Harris-Kojetin, 1999). These mental shortcuts, or intuitive heuristics in decision-making, reduce the demand on the patient's cognitive capacity (Shah & Oppenheimer, 2008).

Based on the presented evidence and reasoning processes, we hereafter assume that patients in a hospital choice context predominantly use decision heuristics. However, it is unclear which exact heuristics are effectively applied. As both the theoretical and empirical work on the phenomenon of decision heuristics is extensive and conceptually overlapping, Shah and Oppenheimer (2008) propose an *effort reduction framework* for studying heuristics, which complements the adaptive decision-making model developed by Payne et al. (1993). Shah and Oppenheimer note that all decision-makers employ heuristics to reduce cognitive effort. Accordingly, they suggest that people make use of five distinct effort reduction principles: (i) examining fewer information cues, (ii) reducing the difficulty associated with retrieving and storing the cue values, (iii) simplifying the weighting principles for information cues, (iv) integrating less information, and/or (v) examining fewer alternatives. Overall, integrating existing knowledge about consumer choice theories, patient information behavior, and decision criteria for hospital selection, we argue that patients are likely to use these effort reduction mechanisms in hospital choice tasks. It follows that patients seldom use highly formalized decision strategies, such as the multi-attribute utility model or similar decision strategies where a decision-maker chooses the alternative with the highest weighted overall utility score, defined as the sum of the weighted attribute values (for a review, see Riedl, Brandstätter, & Roithmayr, 2008). Some scholars even argue that patients simply rely on "default" health care provider options (Bryant, Bown, Bekker, & House, 2007). Moreover, research shows that patients presented with simple information formats comprehended that information better and are more active in using these information cues (Peters, Dieckmann, Dixon, Hibbard, & Mertz, 2007).

Altogether, our discussion of related work suggests that one goal of patients during the decision-making process in hospital choice is to reduce information complexity and cognitive effort. It follows that patients are more likely to apply decision strategies which are characterized by properties that are related to low levels of information complexity and cognitive effort. Based on a review of decision strategies by Riedl et al. (2008), who investigated 13 widely known decision strategies, Table 1 defines and classifies these strategies. We use the following two properties (formulated as questions) for classification.

- Property 1: Does the application of the strategy imply that information on attribute values of the decision alternatives is ignored?
- Property 2: Does the application of the strategy imply quantitative or qualitative reasoning?

Strategies that involve adding, subtracting, and/or multiplying values, as well as counting, are considered to be quantitative, while strategies that simply compare values are regarded as

Table 1. Decision strategies and two important properties

Decision strategy	Property 1 Values ignored?	Property 2 Quantitative (QN) or qualitative (QL)?
(1) **ADD:** The additive difference strategy compares two alternatives at a time, attribute by attribute. Then the differences across the attributes are added to provide a single overall difference score across all attributes for that pair of alternatives. The winner is then compared with the next alternative, and so on. The chosen alternative has won all comparisons.	NO	QN
(2) **DIS**: The disjunctive strategy first sets cut-off points on the attributes and then looks for the first alternative that is at least as good as the cut-off value on any attribute.	YES	QL
(3) **DOM:** The dominance strategy chooses the alternative that is at least as good as every other alternative on all attributes and better on at least one attribute.	NO	QL
(4) **EBA:** The elimination-by-aspects strategy eliminates alternatives that do not meet the cut-off value for the most important attribute. This elimination process is repeated for the second most important attribute. Processing continues until a single alternative remains.	YES	QL
(5) **EQW:** The equal weights strategy chooses the alternative with the highest overall utility score that is defined as the sum of an alternative's attribute utilities. In contrast to MAU (see number 10 below), EQW simplifies decision-making by ignoring attribute weights.	NO	QN
(6) **LEX:** The lexicographic strategy selects the alternative with the best value on the most important attribute. If there is not one but two or more alternatives with a best value, LEX selects the option with the best value on the second most important attribute, and so on.	YES	QL
(7) **LIM:** The least important minimum heuristic first determines the worst value of each option and then chooses the alternative with the least important worst value.	NO	QL
(8) **LVA**: The least variance heuristic chooses the alternative with the lowest variance across the attribute values. LVA makes sense only for decision situations in which no dominant alternative exists.	NO	QN
(9) **MAJ:** The majority strategy chooses the alternative with the highest number of dominant attribute values.	NO	QN
(10) **MAU:** The multi-attribute utility model chooses the alternative with the highest weighted overall utility score that is defined as the sum of the weighted attribute utilities.	NO	QN
(11) **MCD:** The majority of confirming dimensions strategy involves processing pairs of alternatives (like ADD). The values for each of the two alternatives are compared on each attribute. The alternative with the majority of winning attribute values is retained and is then compared with the next alternative. The process of pairwise comparison stops if all alternatives have been evaluated and the winning alternative has been identified.	NO	QN
(12) **REC:** The recognition heuristic chooses the alternative with the best value on the attribute *name recognition*. REC can be considered as a special case of LEX, because REC selects the alternative with the best value on the most important attribute (i.e. *name recognition*). If there is not one but two or more alternatives with a best value, REC selects the alternative with the best value on the second most important attribute, and so on.	YES	QL
(13) **SAT:** The satisficing heuristic considers alternatives sequentially, in the order in which they occur in the choice set. The value of each attribute for a particular alternative is considered to see whether it meets a predetermined cut-off (aspiration) level for that attribute. If any attribute fails to meet the level, the alternative is rejected, and the next alternative is considered. The first alternative that satisfies the aspiration level for each attribute is chosen.	YES	QL

Notes: Definitions of decision strategies and classification of properties 1 and 2 taken from Riedl et al. (2008, pp. 796–798). ADD: additive difference strategy, DIS: disjunctive strategy, DOM: dominance strategy, EBA: elimination-by-aspects strategy, EQW: equal weights strategy, LEX: lexicographic strategy, LIM: least important minimum heuristic, LVA: least variance heuristic, MAJ: majority strategy, MAU: multi-attribute utility model, MCD: majority of confirming dimensions strategy, REC: recognition heuristic, SAT: satisficing heuristic.

qualitative. Strategies which (i) ignore attribute values (thereby not processing all available information), and (ii) are based on qualitative reasoning, imply lower levels of information complexity and cognitive effort than strategies which do not have these two attributes. The classification in Table 1 shows that five strategies are characterized (i) by not processing all available information (i.e. YES in the second column) and (ii) by using qualitative reasoning (i.e. QL in the third column), namely the disjunctive strategy (DIS), elimination-by-aspects (EBA), lexicographic strategy (LEX), recognition heuristic (REC), and satisficing heuristic (SAT).

Figure 2 presents a summary of our discussion, and serves as a theoretical basis for the sections to follow. In particular, we make a call for experimental research in the field of hospital choice. Almost all papers discussed in the preceding paragraphs are either conceptual in nature or used surveys and interviews as data collection methods. This state is problematic because both theory and practice would benefit greatly from experimental studies in which researchers deliberately manipulate independent variables (e.g. decision complexity, operationalized via the number of alternatives and attributes) in order to study the resulting effects on dependent variables (e.g. decision-making strategies used to select a hospital) and to understand mediating mechanisms (e.g. information acquisition patterns). Findings based on experimental research could be used to validate existing research findings which were derived through application of other methods. In particular, it could be assessed whether results based on self-reports collected in field settings are similar to future findings based on behavior data collected in laboratory environments. Generally, while having contributed to scientific progress, previous research has largely neglected consideration of internal validity of research findings defined as an attribute of research studies which reflects the extent to which a causal conclusion is warranted. Self-reports predominantly reflect people's beliefs, and hence causal conclusions about reality based on self-reported data should always be validated based on other sources of data, such as observation of behavior.

Against this background, in Section 4, we describe CPT tools. These tools are computer programs designed to study people's decision behavior, including information acquisition and integration. Thus, the tools constitute a way to observe, supported by computer technology, patient's decision-making strategies in hospital choice in a laboratory setting. To the best of our knowledge, CPT tools have not been used so far in hospital choice research. Because such tools offer enormous potential for the study of patient decision-making, we make a call for the application of CPT tools in future research.

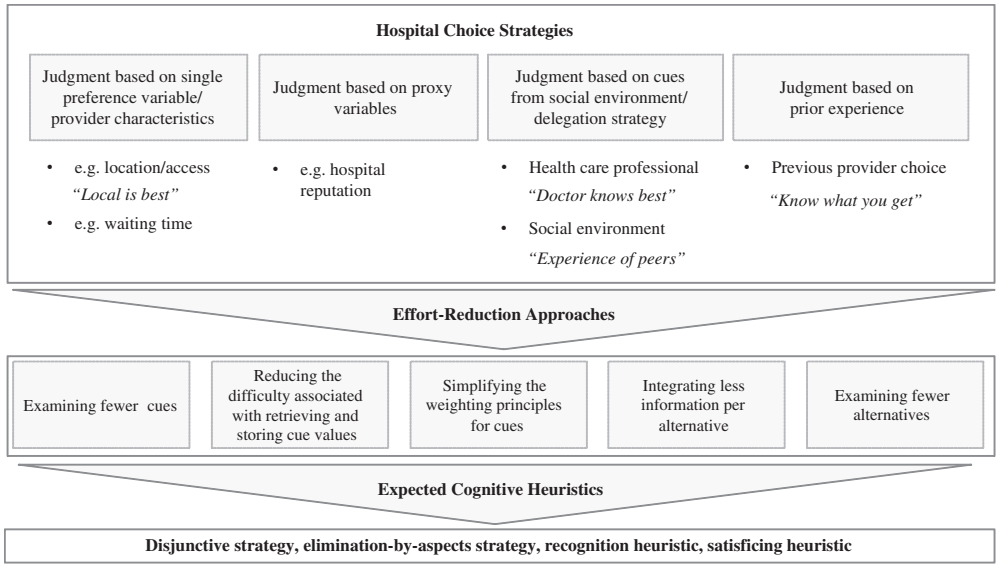


Figure 2. Expected cognitive heuristics in hospital choice derived from evidence of hospital choice strategies.

4. Experimental research in hospital choice with computerized process-tracing (CPT) tools

4.1. Introduction to CPT tools

Recently, Scammon et al. (2011, p. 19) emphasized the necessity for a better understanding of how people such as health care consumers integrate information from various sources and how patients make trade-offs between information. However, there is scant work addressing this issue and proposing research methods to conduct corresponding studies in health service research.

We surmise that one major reason for this research deficit is health service researchers' missing awareness of the availability of CPT tools. These tools are designed to reveal human information acquisition and decision behavior in experimental decision-making situations. More specifically, the aim of process tracing is to investigate human information acquisition behavior and to reveal the cognitive processes which lead to a final decision or solution when facing a decision problem (Riedl et al., 2008; Svenson, 1979).

Process tracing, in general, involves techniques used to trace the decision process by collecting data during a decision task. These techniques can provide insight into the cognitive activities that occur between the onset of a stimulus (i.e. a decision problem) and the resulting choice (e.g. Cook & Swain, 1993). Among the most important techniques which are in use in contemporary research are (i) verbal protocols (e.g. Ericsson & Simon, 1980; Payne & Ragsdale, 1978), (ii) eye-tracking (e.g. Pfeiffer et al., 2014; Russo & Rosen, 1975), and (iii) computer-based analysis of information behavior (e.g. Johnson, Payne, Schkade, & Bettman, 1986; Riedl et al., 2008). In this article, we focus on the third category only, namely CPT tools. Readers interested in verbal protocols and eye-tracking are referred to the scientific literature.[1]

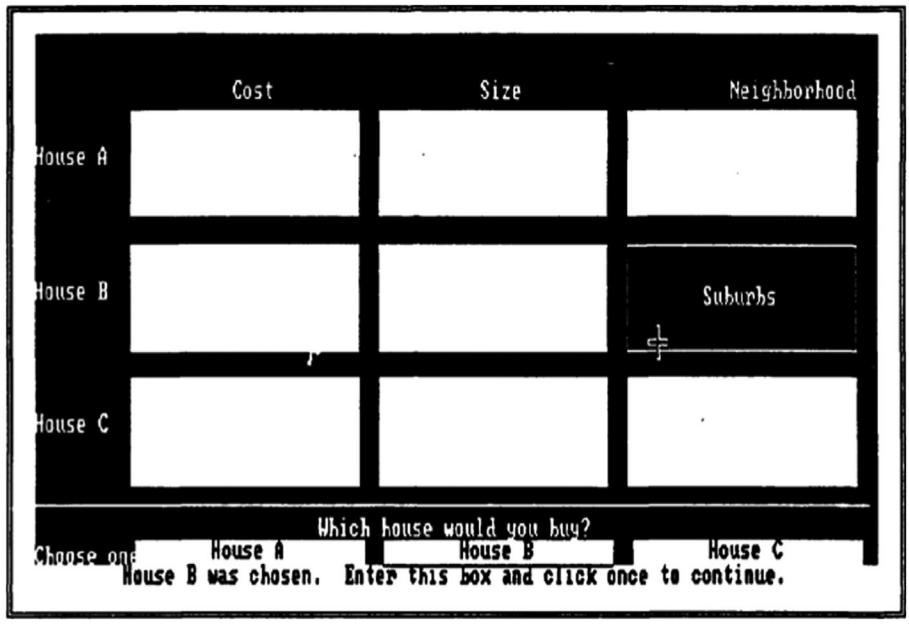
In a typical CPT tool decision experiment, a subject faces an "alternatives × attributes" decision matrix on a computer screen (the matrix is usually referred to as information display matrix [IDM]). In most studies, stimuli are attribute values that are presented in the cells of the matrix (Ford, Schmitt, Schechtman, Hults, & Doherty, 1989; Riedl et al., 2008). At the beginning of a choice experiment, all cells in the matrix are closed. To arrive at the final decision, a subject has to open cells of the matrix, either by clicking on it or by moving the cursor over the cell. While the participant opens a new cell, the previously opened cell automatically closes. Hence, during a typical CPT tool experiment, there is always only one cell opened at a time. After the final response has been given by the subject (either the selection of one preferred alternative or a rank order of alternatives), a computer algorithm analyzes the subject's information acquisition behavior, and based on this analysis, the researcher can infer participants' cognitive processes and thereby the decision strategy used. Thus, CPT tools can be used to experimentally study health care consumers' decision strategies in hospital choice scenarios. In 1986, Johnson et al. introduced the first CPT tool called "Mouselab" (Johnson et al., 1986) which represents the conceptual foundation of all other CPT tools. A screenshot of this IDM-based tool is shown in Figure 3.

The screen shows a 3 × 3 decision matrix, where the subject has to choose one house out of three available alternatives on the basis of three attributes. In this experiment, the alternatives are presented row-wise ("House A," "House B," and "House C") and the attributes column-wise ("Cost," "Size," and "Neighborhood"). A click with the mouse pointer on a particular cell opens it and reveals the hidden information (see "Suburbs" in Figure 3). Moreover, there are three cells below the decision matrix, one for each alternative. When the subject has examined as many information items as necessary to make a decision, a click on one of the three cells ("House A," "House B," and "House C") indicates the final decision, that is the preferred house. Figure 3 illustrates that the subject, in this example, has chosen "House B."

While a subject clicks on the various information items on the screen, the computer program automatically traces every click of the subject, thereby generating an individual clickstream pattern. Based on this clickstream data (i.e. information acquisition behavior and final choice), along with

Figure 3. IDM Mouselab screenshot.

Source: Johnson et al. (1986, p. 8).



Display Example 2: Sample Matrix Schema

information on the alternatives and attributes which is specified by the researcher before the experiment, computer programs determine a number of metrics, which, in turn, provide evidence for the application of different decision strategies. Example metrics are (sorted by the date of their publication): decision time (Hogarth, 1975); proportion of information searched, search index (SI), and variability in the amount of information searched per option (Payne, 1976); reacquisition rate (Jacoby, Chestnut, Weigl, & Fisher, 1976); variability in the amount of information searched per attribute and a contingency measure (Klayman, 1982); total amount of processing, total amount of time spent on the information in the boxes, and average time spent per item of information acquired (Payne et al., 1993); a strategy measure (Böckenholt & Hynan, 1994); a multiple-step transition index (Ball, 1997); and ratio of option-wise transitions to attribute-wise and mixed transitions, ratio of time spent on options, correlation between attribute rank and number of boxes opened for each attribute, and rank order of options (Riedl et al., 2008). Further details on metrics, as well as an example algorithm of the CPT tool DecisionTracer, are provided in Riedl et al. (2008).

4.2. Analysis of CPT tools

We reviewed the scientific literature to identify CPT tools. The search was conducted during fall 2015. Data sources included the following Internet databases: ACM, EbscoHost, IEEE, and Social Science Citation Index. To identify relevant articles, we used the words "computerized process tracing," "process tracing," and "information display matrix" which we filtered by title and by topic. Altogether, we identified 12 tools, and papers on these tools were published in the period from 1988 to 2012. Importantly, to be included in further analyses, a tool had to meet two criteria: (1) the tool has to be matrix-based (IDM), and (2) the tool has to be available and technologically usable (i.e. not outdated due to old-fashioned operating systems on which the program runs). The following eight tools did *not* meet one or both criteria: Mouselab (Johnson et al., 1986) (1: yes, 2: no), SearchMonitor (Brucks, 1988) (1: no, 2: no), ISLab (Cook & Swain, 1993) (1: yes, 2: no), ComputerShop (Huneke, 1996) (1: no, 2: no), IScube (Tabatabai, 1998) (1: yes, 2: no), MouseTrace (Jasper & Shapiro, 2002) (1: yes, 2: no), WebDiP (Schulte-Mecklenbeck & Neun, 2005) (1: no, 2: yes), and Flashlight (Schulte-Mecklenbeck et al., 2011b) (1: no, 2: yes).

However, the following four tools met both criteria: IDM Visual Processor (Schmücker, 2002), MouselabWEB (Willemsen & Johnson, 2005), DecisionTracer (Riedl et al., 2008), and InterActive Process Tracing (Reisen, Hoffrage, & Mast, 2008). What all four tools have in common is that they

were developed to directly uncover the cognitive processes that take place between the onset of a decision task and the final choice of the decision-maker. Yet, the tools can be distinguished based on their individual features. Next, we describe a framework which serves as a conceptual basis to compare the four CPT tools. Based on this comparison, health service researchers and scholars from related fields (e.g. psychology) interested in studying people's decision behavior in hospital choice based on CPT tools can make an informed decision concerning whether or not to use a specific tool.

Researchers using CPT tools deliberately manipulate independent variables to study the effects on dependent variables. Moreover, moderator variables (altering the independent variables' influence on dependent variables) can be included into studies based on CPT tools.

The scientific literature reports on a number of variables which can be considered as independent variable candidates in process-tracing research (e.g. Bettman, Johnson, Luce, & Payne, 1993; Johnson & Payne, 1985; Payne et al., 1993). The candidates can be divided into two categories: task and context variables (see also Figure 1). Task variables refer to general structural characteristics of a particular decision problem, such as the number of alternatives or attributes available in a decision set, the response mode (i.e. either the selection of one preferred alternative or a rank order of alternatives), or time pressure. Context variables, in contrast, refer to the particular attribute values of the alternatives. Examples are the similarity of the attribute values across alternatives or the existence of a dominant alternative in the decision set (i.e. one that is at least as good as every other alternative on all attributes and better on at least one attribute).

The major dependent variables in process-tracing research are specific decision strategies (see, for example, the list in Table 1). However, it is also possible to use specific properties of decision strategies as dependent variables in process-tracing studies (Riedl et al., 2008). Research has identified several such properties (reviewed in Riedl et al., 2008). The characterization of a decision strategy and whether its underlying information search is alternative-based or attribute-based is among the most important properties, and research has developed formal metrics to assess, based on a specific information acquisition pattern in a IDM, whether search is more alternative or attribute based. In alternative-wise processing, the attribute values of a single alternative are considered before information about the next alternative is processed (e.g. a subject reveals information about "Cost," "Size," and "Neighborhood" for "House A" before continuing with "House B" or "House C," Figure 3, or "Access," "Reputation," and "Prior Experience" of "Hospital A" before considering "Hospital B"). In attribute-wise processing, the values of several alternatives on a single attribute are processed before information about a further attribute is processed (e.g. a subject reveals information about "Cost" for "House A," "House B," and "House C" before continuing with "Size" or "Neighborhood," Figure 3). Payne's (1976, p. 376) SI, among other metrics (Böckenholt & Hynan, 1994), provides a formal way to calculate the "direction of search" that can be either "interdimensional" (alternative-wise) or "intradimensional" (attribute-wise). Specifically, SI puts the number of alternative-wise transitions (r_{alt}) in relation to the number of attribute-wise transitions (r_{attr}). SI varies from −1 to + 1, with −1 indicating a completely attribute-wise search and + 1 indicating a completely alternative-wise search; SI = $(r_{alt}-r_{attr}):(r_{alt}+r_{attr})$. Researchers studying patients' decision-making behavior in hospital choice scenarios, along with underlying information acquisition patterns, would greatly benefit from tools which automatically calculate metrics such as the SI, or even provide information on the specific decision strategy used by a subject. Importantly, such tools generally provide not only information on metrics such as the SI, but also on more basic variables, such as amount of information searched (e.g. a subject who clicks on 7 out of the 9 cells in Table 3 before making the final choice would "produce" a value of 78% searched information) or total decision time (i.e. the time from the first click in the IDM until the final response). Thus, while the major dependent variables in process-tracing research are specific decision strategies and specific properties of decision strategies (e.g. direction of search, SI), it is also possible to investigate the effect of independent variables (e.g. number of alternatives) on basic variables such as decision time. The application logic of independent and dependent variables in an experiment based on a CPT tool is summarized through a flow chart, see Figure 4.

Figure 4 shows that a CPT tool directly allows for the consideration of independent and dependent variables in a decision-making experiment. The independent variables can be split into task and context variables. The ultimate dependent variables in process-tracing research are specific decision strategies (Riedl et al., 2008), and precursor elements are characteristics of human information acquisition behavior. These characteristics may also be used as dependent variables either directly (e.g. decision time), or indirectly via calculation of metrics (e.g. direction of search, SI). As shown, task and context variables may have an influence on the characteristics of human information behavior, and thus may also affect the use of specific decision strategies because algorithmic combinations of various metrics (which are, in turn, calculated based on characteristics of information acquisition behavior) have been shown to allow for precise identification of decision strategies (Riedl et al., 2008).

The following paragraph leads to a point-by-point feature analysis of the four identified CPT tools. This analysis is based on distinguishing features that can be split into two major categories: task factors and technology factors. Task factors refer to the general structural characteristics of a particular decision problem and correspond to task variables (e.g. number of alternatives, time pressure). Technology factors refer to the technology of a CPT tool and the general technical capabilities (e.g. online or offline, visualization capabilities, algorithmic capabilities). Based on these factors, we compared the four CPT tools that we identified in the pre-selection phase: IDM Visual Processor (Schmücker, 2002), MouselabWEB (Willemsen & Johnson, 2005), DecisionTracer (Riedl et al., 2008), and InterActive Process Tracing (Reisen et al., 2008). Our analysis of the four CPT tools shows the strengths and weaknesses of the individual tools (see Table 2).

Figure 4. Flowchart of a CPT experiment.

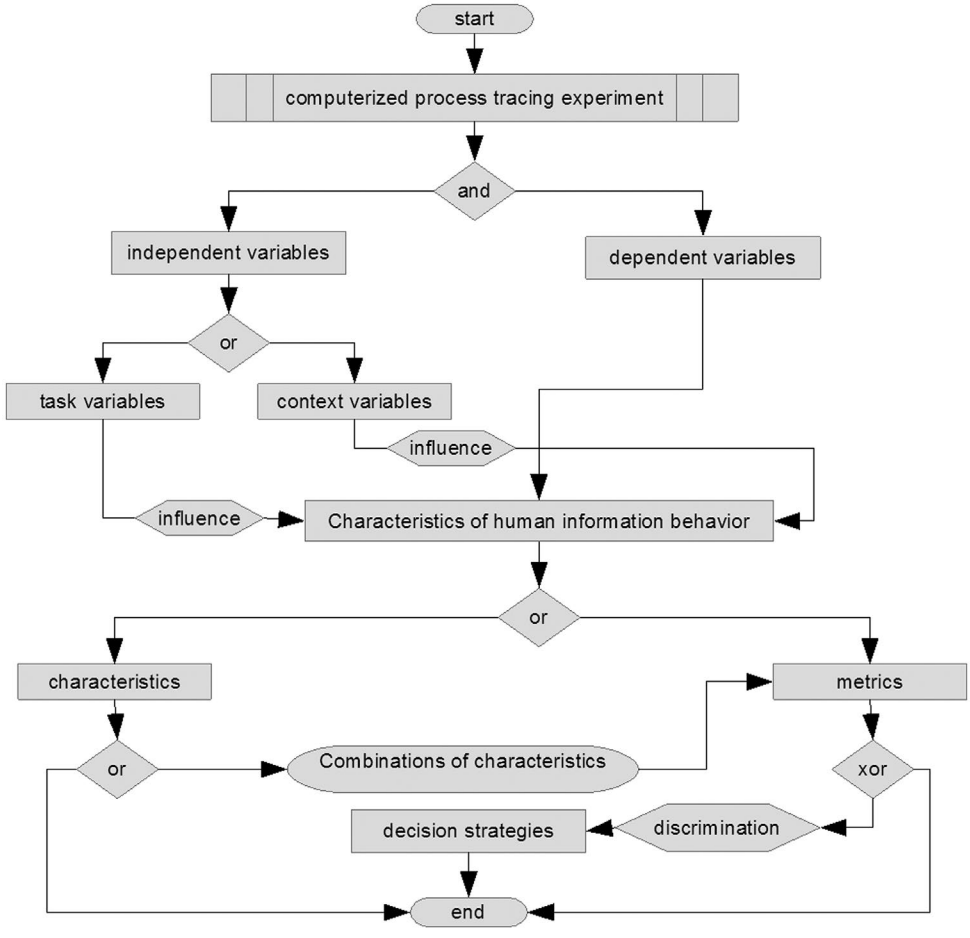


Table 2. Analysis of CPT tools

System features	Decision Tracer	IDM Visual Processor	InterActive Process Tracing	Mouselab WEB
Task factors				
Number of alternatives can be manipulated	■	■	■	■
Number of attributes can be manipulated	■	■	■	■
Time pressure is possible	■	■		■
Response mode				
Choice of preferred alternative	■	■	■	■
Ranking of alternatives	■			
Rejection of all alternatives			■	
Rotation of alternatives and attributes is possible	■			■
Randomization (alternatives, attributes) is possible	■	■		■
Color can be used	■	■	■	
Complete information is required		■		■
Format of information				
Quantitative (metric scale)	■	■	■	■
Qualitative (ordinal scale)	■	■	■	■
Picture		■		■
Film		■		
Sound		■		
Reacquisition of information is possible	■			
Simultaneous examination of info is possible	■			
A limit exists for acquired information items	■			
Technology factors				
The tool is Internet-based	■			■
Opening/closing of cell in the matrix				
Click	■	■		■
Mouse-over			■	■
Number of tasks in an experiment is limited		■	■	
Matrix visualization on the screen				
Size of the cells can be varied individually			■	■
IDM adapts itself automatically to the screen size	■	■		
Inscription of cells is possible	■			■
Screening phase is possible	■			
Weighting of attribute importance is possible	■		■	
Instruction pages before a decision task are possible	■	■		■
Practice sessions are possible	■	■		■
Messages are possible	■	■		■

Although all of these tools are designed to reveal human information acquisition behavior in experimental decision-making situations, a researcher should be aware of the fact that no tool dominates all other tools on the described factors. Thus, depending predominantly on the research scenario at hand (i.e. research questions and hypotheses to be tested), scholars interested in using a specific tool must make a deliberate selection. In order to equip health care marketing scholars with a blue print of a process-tracing experiment in the hospital choice context (independent from the specific CPT tool that is used for the study), in the Appendices, based on an extensive review of the literature, we provide a list

with relevant attributes, along with a detailed description of these attributes. Importantly, these attributes are the input for the preparation of an IDM in a decision experiment. Researchers are invited to select attributes from this list for their experiments, and we have made an attempt to provide a list which is as comprehensive as possible. However, this list does not claim to be exhaustive, as it cannot be ruled out that attributes which are not in our list turn out to be important in a specific research context.

5. Conclusion

The topic of hospital choice has received considerable attention in health care marketing. Increasingly, more often scholars apply a cognitive perspective, complementing the traditional view that considered patients as rational decision-makers. In this paper, we argued that knowledge from psychology and cognitive science may serve as a vital basis for a better understanding of hospital choice preferences and underlying cognitive mechanisms. Patients' decision-making strategies in hospital choice are largely unknown today, and hence little is known about how people acquire and use information in hospital choice. One potential reason for this research deficit is health service researchers' missing awareness of the availability of CPT tools. These tools make investigation of human information acquisition and decision behavior possible in experimental decision-making situations.

We addressed three main research questions in this article: (1) Which theoretical framework can be used to advance hospital choice research? (2) What do we know about patient decision-making, especially regarding patient information behavior and relevance of decision criteria, in hospital choice? (3) Which methodological tools are needed to advance scientific understanding of patients' decision–making strategies in hospital choice? To answer the first question, we introduced the adaptive decision-making model by Payne et al. (1993) and outlined its applicability to the hospital choice context. Regarding question 2, we reviewed the existing literature on patient information behavior and decision criteria. As a result, we outlined expected cognitive heuristics in hospital choice. With respect to question 3, we argued that CPT should become part of the health service researcher's toolbox. Specifically, we reviewed the scientific literature to identify CPT tools. Four tools were analyzed in detail: IDM Visual Processor (Schmücker, 2002), MouselabWEB (Willemsen & Johnson, 2005), DecisionTracer (Riedl et al., 2008), and InterActive Process Tracing (Reisen et al., 2008). All four tools have in common that they were developed to directly uncover the cognitive processes that take place between the onset of a decision task (presented in a matrix format, IDM) and the final choice of the decision-maker. Based on our comparison of the four tools, health service researchers and scholars from related fields (e.g. health marketing) can make an informed decision about whether or not to use a specific tool. Moreover, we provide a comprehensive Appendix in which we outline an IDM matrix example, as well as a concrete list of preference variables and attributes which have been identified as critical for hospital choice. Therefore, in this paper, we not only provided conceptual foundations of process-tracing research and related theoretical foundations, but also provided concrete information necessary for researchers to get started with corresponding experiments.

Despite our call for more experimental research in the field of patients' decision behavior in hospital choice settings, we note that experimental studies have limitations that must be taken into account, particularly if compared to the more traditional survey-based research stream. We point to the concept of external validity, defined as the extent to which the results of an (experimental) study can be generalized to other (real-life) situations. Obviously, human decision-making behavior in laboratory settings never equals behavior in real-life situations. Thus, results of laboratory experiments based on CPT tools must be interpreted carefully. Despite this general limitation of laboratory experiments, it is difficult to imagine that future results of CPT tools experiments will not contribute to a better understanding of decision-making in hospital choice scenarios. It will be rewarding to see what insight future research will reveal in this respect.

Finally, we would like to broaden the research perspective of this paper by emphasizing that the approach of this study can serve as blue print for scholars who aim at analyzing service provider selection processes from a psychological perspective. Decision-making strategies of service recipients in many other industrial sectors could be analyzed with CPT tools, including provider choice of financial service agents, or insurances and real estate brokers. Therefore, this research not only contributes to the advancement of health care research, but to service research in general.

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Competing interests
The authors declare no competing interests.

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Notes
1. A verbal protocol requires the subject to "think aloud" while facing a decision problem. The subject is asked to verbalize every single thought that comes into the mind during the decision process. With eye-tracking tools, it is possible to record people's visual fixations, eye-movements (saccades), and pupil dilation (often used as a proxy for emotions) during a decision task (further information on these two methods in the context of process-tracing research is available in Schulte-Mecklenbeck, Murphy, & Hutzler, 2011b).
2. *Weisse Liste* is a German health care information and provider rating website that also covers hospital rankings (Weisse Liste, 2013). *Weisse Liste* has a methodologically sound survey instrument to evaluate patient's experience of hospitals. This instrument is based on both public reporting and patient assessments. For more details on project *Weisse Liste* please see Fischer (2014).

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Appendices

The attributes in Appendix A were derived from a comprehensive literature analysis of patient information and decision behavior, and contain relevant formal and informal information cues a patient is likely to use when selecting a hospital. Appendix B discusses why the attributes presented in Appendix A are appropriate attributes for a decision-making experiment in a hospital choice scenario that is based in Germany. Moreover, based on a literature review, in Appendix B we discuss scientific literature related to the preference variables, attributes, and possible utility values. The cues are divided into two categories: Easily accessible formal information on provider characteristics and informal information originating from the patient's social environment.

Appendix A

Attributes for possible CPT experiment on hospital choice behavior

Preference variable	Attribute	Utility value				
		1 (very poor)	2 (poor)	3 (average)	4 (good)	5 (very good)
Formal information on provider characteristics						
Access	Travel time	8 h	4 h	2 h	1 h	30 min
Type	Ownership and affiliation	–	Religious, non-profit hospital	Public hospital	Non-profit hospital	For-profit hospital
Waiting time	Waiting time for diagnosis to surgery	5 months	4 months	3 months	2 months	1 month
Expertise and treatment quality	Number of cases (%)	1	2	5	10	20
	Academic status	–	Non-educational hospital	Academic teaching hospital	University hospital	–
	Hospital online ranking	35 out of 100	45 out of 100	55 out of 100	65 out of 100	75 out of 100
	Infection rate (%)	4.0	2.0	1.0	0.5	0.25
Informal information from the social environment						
Reputation	General hospital reputation	Very bad	Bad	Partly good/partly bad	Good	Very good
Physician	Recommendation of referring physician	Not advisable	Less advisable	Advisable	Highly advisable	Extremely advisable
Social environment	Experiences of family and friends	Very bad	Bad	Partly good/partly bad	Good	Very good
Prior experience	Personal prior experience with the hospital	Very bad	Bad	Partly good/partly bad	Good	Very good
Experience of others/patient satisfaction	Percentage of patients who would recommend this hospital (%)	68	75	82	89	96
	Patient satisfaction with medical care (%)	72	77	83	88	93
	Patient satisfaction with nursing care (%)	66	74	82	90	98
	Patient satisfaction with organization and service (%)	61	70	79	88	97

Appendix B

Reasoning and references for using attribute values and corresponding utility scores for possible CPT experiment on hospital choice behavior

Preference variable	Attribute	Reasoning and references
Formal information on provider characteristics		
Accessibility	Travel time	Impact on hospital choice • Accessibility is one of the most important determinants in patients' hospital choice (Adams, Houchens, Wright, & Robbins, 1991; Beukers, Kemp, & Varkevisser, 2013; Roh & Moon, 2005). • Proximity to the hospital can be measured through absolute "distances" or "travel time" needed to the facility. Previous research using cognitive interviews showed that patients find "travel times" easier to conceptualize than "distance" (Burge, Devlin, Appleby, Rohr, & Grant, 2004). Moreover, travel times take the patient's individual mobility into account. • Overall patients are averse to longer travel time and prefer a provider that is close by and not abroad (Burge, Devlin, Appleby, Rohr, & Grant, 2004; Dijs-Elsinga et al., 2010; Tai, Porell, & Adams, 2004). • "In summary, the evidence suggests that most patients will consider their local hospital as the leading candidate (the 'default'), but will bypass that hospital where the additional travel costs are outweighed by improvements in quality." (Dixon et al., 2010, p. 20). • Literature on hospital bypassing: Roh and Moon (2005), Akin and Hutchinson (1999) Varkevisser and van der Geest (2007), Varkevisser, van der Geest, and Schut (2012). Attribute values • Research from the UK indicates that two hours would be an acceptable travel time for most patients (Burge et al., 2004) (utility value = 3). Dixon et al. (2010) performed a discrete choice experiment concerning hospital choice and assumed a measure of 30 min to be a very good value (utility value = 5). Based on these values, the five-point utility value scale is completed through doubling the starting value.
Type	Ownership/affiliation	Impact on hospital choice • Hospital ownership and affiliation characteristics are likely to affect patient choice (Drevs, Tscheulin, & Lindenmeier, 2012; Geraedts, Schwartze, & Molzahn, 2007; Roh & Moon, 2005). • Hospitals are generally classified as for-profit, non-profit, or publicly owned institutions. Non-profit hospitals can either be affiliated to a charitable religious (e.g. Catholic or Protestant Church) or charitable non-religious organization (e.g. the Red Cross) (Statistisches Bundesamt, 2013). • "Non-profit hospitals are perceived as more trustworthy and warm but less competent than their for-profit competitors. With non-urgent care, analysis shows that only trustworthiness and competence influence patients' hospital evaluations" (Drevs et al., 2012, p. 1). Attribute values • For-profit hospitals are thus classified as best with regard to treatment competence and quality (utility value = 5). All other values are distributed accordingly with religious, non-profit hospitals as least competent (utility value = 1).
Waiting time	Waiting time from diagnosis to surgery	Impact on hospital choice • Most studies found a negative influence of the time spent waiting for treatment on patient choice (i.e. the longer the waiting times, the less likely hospital selection (Birk et al., 2011; Damman et al., 2012; Marang-van de Mheen et al., 2010; Victoor et al., 2012). • The importance might vary according to disease characteristics (Birk & Henriksen, 2006; Varkevisser & van der Geest, 2007), i.e. patient requiring complex medical treatments are willing to trade-off more. • "Some patients appeared to be willing to accept a long waiting time, if they were told exactly when they would undergo surgery. The results of this study question the validity of the conventional wisdom, that patients are willing to travel long distances in order to receive treatment with short waiting time" (Birk & Henriksen, 2006, p. 318). • Hospital waiting time performance appears to have a much stronger effect on patients' bypass decisions for neurosurgical services than for orthopedic services. Apparently, the valuation of shorter waiting time varies with types of hospital care. The importance of waiting time as a determinant of hospital bypass decisions seems to be more important for complex procedures (Varkevisser & van der Geest, 2007, p. 294). Attribute values • Germany does not oblige hospitals to report waiting times (Siciliani & Hurst, 2003) and minimizing waiting times is not an issue in German health policy (OECD, 2013). • However, waiting times for elective surgery are very low compared to other OECD countries (OECD, 2012, 2013): in Germany, people usually do not need to wait longer than 4 months for elective surgery (OECD, 2012). • Therefore, 4 months was set as poor, but just acceptable time frame (utility value = 2). All other attribute values were assigned in equal intervals of 1 month accordingly.

(*Continued*)

Appendix B. (*Continued*)

Preference variable	Attribute	Reasoning and references
Expertise and quality of treatment	Number of cases	Impact on hospital choice • The number of cases undergoing surgery within a hospital serves as a quality indicator although it is solely based on treatment volume. However, it is assumed that the more patients are treated routinely, the better the processes and the steeper the learning curve (Dietrich & Lindenmeier, 2009). • A systematic review supports that high treatment volume is associated with better outcomes across a wide range of procedures and conditions (Halm, Lee, & Chassin, 2002). • However, many studies report that data form public quality reporting initiatives, such as numbers of cases, is rarely used by patients (de Cruppé & Geraedts, 2011; Lubalin & Harris-Kojetin, 1999). Attribute values • Since 2005, hospitals in Germany are legally obliged to publish so-called "structured quality reports", which also contain information on the number of cases (G-BA, 2014). This policy initiative aims at providing patients with a decision aid that makes hospital quality more transparent and to enable improved decision-making. • Relevant information from the structured quality reports is summarized and easily accessible from the online information website Weisse Liste[2] • The attribute values for the share of requested surgery compared to all treatments conducted at the hospital are based on reporting from Weisse Liste.
	Academic status	Impact of hospital choice • Patients prefer a provider that is affiliated to an (academic) hospital and tent to select hospitals with teaching activities over those with no teaching activities (Adams et al., 1991; Jung et al., 2011). Attribute values • In Germany, the academic status of hospitals is "university hospital" (highest academic status), "academic teaching hospital", and "non-educational hospital" (lowest academic status). Thus, the utility values were distributed according to this trisection.
	Hospital rating	Impact on hospital choice • Hospital ratings, especially those available online, have become ubiquitous tools for patient decision-making as they conveniently summarize information on hospital quality (Drevs & Hinz, 2013; Huerta, Hefner, Ford, McAlearney, & Menachemi, 2014; Niehues, Emmert, Haas, Schöffski, & Hamm, 2012; Petersen, Kaminski, & Jackson, 2007). • Hospital rating websites can be considered as one major tool in the "health 2.0" movement and it would be extremely interesting to see which role they play compared to other available formal information. • However, the impact of hospital rating on patient choice is largely unexplored. Attribute values • In Germany, the landscape for hospital online rating sites is quite diverse and many websites offer different information formats based on different quality assessments (Emmert, Maryschok, Eisenreich, & Schöffski, 2009; Emmert, Sander, & Pisch, 2013). • In print, the most widespread hospital guide is the so-called "Focus Klinikliste" (Focus, 2012). Its display format assigns an overall evaluation score out of 100 points possible for each hosptial. • This specification is similar to the well-known US News and World Report that also provides on- and offline hospital ratings of US hospitals (e.g. Halasyamani & Davis, 2007; Sehgal, 2010). • Based on the "Focus Klinikliste" the best hospital for orthopedic treatment in Germany reached 75 out of 100 points (utility value = 5). The lowest score mentioned was 45 out of 100 points (utility value = 2). All other values were distributed accordingly in intervals of 10 points.
	Infection rate	Impact on hospital choice • Studies show that information about nosocomial infection rates potentially influences patient's hospital choice (Dixon et al., 2010; Merle et al., 2009; Vonberg, Sander, & Gastmeier, 2008). The lower the infection rate, the more likely the patient will consider choosing a specific hospital. • Moreover, the public release of hospital's nosocomial infection rates can be considered as part of the policy initiatives to promote more quality transparency in medical decision-making (McGuckin, Waterman, & Shubin, 2006). Attribute values • In Germany, data on health-care-associated infection (HCAI) is not disseminated publically. However, the KISS ("Krankenhaus-Infektions-Surveillance-System"), which is the German HCAI surveillance system, monitors certain indicators since 2007 (Haustein et al., 2011). • An initial KISS study discloses the distribution of average daily "methicillin-resistant Staphylococcus aureus" (MRSA) burden for 31 German hospitals (Chaberny, Sohr, Rüden, & Gastmeier, 2007). MRSA is a common measure for multi-resistant bacteria. • The highest reported number of MRSA-patients per 100 patient-days was 4,5 (utility value = 1). Therefore, attribute values were halved and thus scaled down until a very low level of 0,25 MRSA-patients per 100 patient-days was reached (utility value = 5) (Chaberny et al., 2007).

(Continued)

Appendix B. (*Continued*)

Preference variable	Attribute	Reasoning and references
Informal information from the social environment		
Reputation	General hospital reputation	Impact on hospital choice • Considered as general quality indicator (Drevs, 2013), hospital reputation can be one of the main reasons for hospital choice (Dijs-Elsinga et al., 2010; Jung et al., 2011; Shah & Dickinson, 2010). Attribute values • Hospital reputation is described on a 5-point scale as "very good" (utility value = 5), "good" (utility value = 4), "partly good/partly bad" (utility value = 3), "bad" (utility value = 2), and "very bad" (utility value = 1).
Physician	Recommendation of referring physician	Impact hospital choice • Several studies report that the GP/referring physician is seen as the most trustworthy source of information with great influence on patient decision-making (Dixon, 2010; Hesse et al., 2005; Wilson et al., 2007). Especially elderly persons value the GP's advice (Schwartz et al., 2005). Attribute values • Referring physician's recommendation is described on a 5-point scale as "extremely advisable" (utility value = 5), "highly advisable" (utility value = 4), "advisable" (utility value = 3), "less advisable" (utility value = 2), and "not advisable" (utility value = 1).
Social environment	Experience of family and friends	Impact on hospital choice • Family and friends are found to be a crucial source of information for patients when choosing a hospital (Dealey, 2005; Moser et al., 2010a; Laverty et al., 2013; Victoor et al., 2012.) Attribute value • Experiences of family and friends are described on a 5-point scale as "very good" (utility value = 5), "good" (utility value = 4), "partly good/partly bad" (utility value = 3), "bad" (utility value = 2), and "very bad" (utility value = 1).
Prior experience	Personal prior experience with the hospital	Impact on hospital choice • Some studies state that personal experience is a highly valuable information source as it is sometimes the only available reference for patients (Birk et al., 2011; Moser et al., 2010b; Victoor et al., 2012). Particularly, Jung et al. (2011) stress the influence of satisfaction with previous hospital stays on future hospital choice. Attribute value • Prior experience is described on a 5-point scale as "very good" (utility value = 5), "good" (utility value = 4), "partly good/partly bad" (utility value = 3), "bad" (utility value = 2), and "very bad" (utility value = 1).

Experience of others/patient satisfaction	Experience of others/patient satisfaction	Impact on hospital choice
		• Experience-based information of other patients is also an esteemed benchmark in hospital selection (de Groot et al., 2012).
		• Project Weisse Liste established a methodologically sound survey instrument to capture data on patient satisfaction with German hospital services as well as its multiple sub-dimensions (Weisse Liste, 2014).
		• As online data from Weisse Liste is easily accessible, this study uses the following dimensions provided there:
		  • Overall: Percentage of patients who would recommend this hospital
		  • Sub-dimensions:
		  • Patient satisfaction with medical care
		  • Patient satisfaction with nursing care
		  • Patient satisfaction with organization and service
		Attribute value
		• The attribute values for the patient satisfaction measures are based on reporting from Weisse Liste.
		• As Weisse Liste is providing measures of the German national average for each dimension, this average value is assigned an utility value of 3. This score is then reduced or increased with equal amounts in order to reach high or low levels of satisfaction.
		• Overall: Percentage of patients who would recommend this hospital—national average: 82%
		• Sub-dimensions:
		• Patient satisfaction with medical care—national average: 83%
		• Patient satisfaction with nursing care—national average: 82%
		• Patient satisfaction with organization and service—national average: 79%

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