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The Importance of Memory in Informed Consent for Surgical Risk

Carotid endarterectomy involves, as do many surgeries, considerable risk. The potential complications are serious and the surgery is commonplace. Patients' understanding of inherent risks and benefits is especially important when the surgery is performed to prevent stroke. Patients must therefore consent to a risky procedure to avoid an event that has not yet occurred. Remarkably, very little research has been undertaken to evaluate patients' ability to recall information that they have received about the risks and benefits of surgery. The paper by Lloyd et al. is a notable exception.[1] Beyond the work of Lloyd et al., there is a burgeoning literature on false memory, which suggests that ordinary processes of remembering produce fundamental distortions in patients' memory for information crucial to informed consent. Our aim is to draw out the key theoretical principles and findings from this research to guide future studies of the role of these memory distortions in the process of informed consent.

Although clear communication of risks is a necessary precondition for accurate patient perceptions, it is not sufficient. As Lloyd et al.[1] state, the question is the following: "Can people recall the risks associated with each treatment option that they were told by the surgeon?" Memory research over the past decade has shown that people encode separate verbatim memories of quantitative information, such as probabilities as well as gist (or approximate) memories, and that decisions are based on the gist memories rather than verbatim ones.[2-5] Verbatim memories represent the facts and details of information as it was presented, but they fade rapidly; gist memories, which reflect understanding and interpretation, endure.[6] Another threat to accurate memory, forgetting, will cause some patients to deny that they were given pertinent information to begin with.[7,8] Techniques of presentation and questioning can sometimes cue these fragile verbatim memories.[9] However, verbatim and gist memories are separate and independent, so that predictable contradictions are likely to be elicited from patients about the information that was presented to them. (Naturally, the role of memory in informed surgical consent has important legal implications in the area of malpractice; see Brainerd et al.[10]) In short, patients are likely to forget exact information that they have been told, even if understood at the time. Even if patients could remember exact information, they are likely to base decisions on independent gist representations.

If patients' decisions hinge on gist representations, we should ask where these gist representations come from and whether they can be influenced to ensure informed consent. Research indicates that gist representations reflect understanding, which varies greatly with education, experience, and development.[11] Fuzzy-trace theory provides an explanatory framework within which these claims about verbatim and gist memories have been tested and formalized in mathematical models.[3,4,12-14] The appendix provides a brief summary of developments in memory research leading up to fuzzy-trace theory.

The Lloyd et al.[1] data are mainly consistent with fuzzy-trace theory's prediction that decisions between risky options will reflect ordinal distinctions between options (more vs. less risk), although more direct evidence for this claim is needed. Relevant predictions from fuzzy-trace theory come primarily from two theoretical principles: the fuzzy-processing preference and task calibration. *Fuzzy-processing preference* means that patients seek the least precise distinction of quantity that permits discrimination between options, beginning with categorical distinctions (no risk vs. some risk; certainty vs. uncertainty). A few patients seemed to stop right there: in 7 out of 128 numerical responses, patients suggested that there was either no risk (0%) or absolute certainty (100%)

in their chances of suffering a stroke. Although this result is clearly indicative of a fuzzy-processing preference (similar to the categorical distinctions applied in framing tasks[6,14]), the authors are correct that fuzzy-trace theory predicts that when both options involve uncertainty or risk, task calibration usually operates to move levels of representation to slightly finer, ordinal levels of distinction (i.e., lower vs. higher; more vs. less), relative to the other magnitudes in the decision options. However, fuzzy-trace theory also predicts differences in levels of understanding and consequently in gist representations, based on education, age (e.g., children's understanding relative to adults'), and other individual differences.[11,15] Whether the differences observed by Lloyd et al.[1] can be attributed to lack of understanding, forgetting, or other sources requires further investigation.

Lloyd et al.[1] provide an excellent description of an accurate gist representation of relative risk at the beginning of their article: "If they do not proceed with the operation, they face a significant risk of stroke in the future. . . . If they choose to undergo the operation, they face a small" risk of stroke as a result of the operation and a "reduced risk of stroke in the following 3 years" (p. **QQ-MDM9-1**). Thus, patients who remembered the ordinal qualitative gist (but not necessarily the correct numbers) should give numerical estimates that obey the ordinal pattern outlined by the authors: surgery, postsurgical risk, and no surgery. Most patients, 70%, apparently obeyed this ordering and thus encoded and retained the correct gist of the presented information. Even if those patients could not recall the numbers precisely, it could be argued that the basic tenets of informed consent were satisfied. However, patients who failed to order the risks correctly or, at least, to encode that the combined risk of either an operation or a stroke afterwards is smaller than the risk of stroke without the operation did not provide sufficient evidence of informed consent.

In other words, our thesis is that qualitative gist representations of risk estimates can be better indicators of informed consent than quantitative representations that are numerically closer to presented risk estimates. First, gist representations indicate how patients understand presented numbers, for example, whether they have appropriate interpretations of risk magnitude: does the patient understand that the risk of a stroke without surgery is considerable? Second, and the Lloyd et al. data are instructive here, is that quantitative representations can be closer to numerically correct values and yet miss the crucial gist of the information. For example, if patients give the risk of stroke as 0% for the operation, even though it is only 2 points off the true value, saying that there is no risk at all is a fundamental misunderstanding. Thus, based on prescriptive considerations ("correct" understanding), an estimate of 0% risk associated with the operation reflects a lower level of understanding than an estimate of 5%, even though the latter differs by more points from 2%. From the perspective that patients should realize that they are undertaking a risk with surgery, the gist-inconsistent risk estimate seems a more serious violation of informed consent.

It is important to maintain the hoary distinction between description and prescription.[16] Descriptively, gist is a qualitative representation of risk based on subjective perceptions, and numerical risk estimates are known to differ in subjective magnitude across individuals. Thus, 22% (the estimated risk of stroke without surgery) might be considered large by some individuals, moderate by others, and so on, based on their level of knowledge and understanding of the nature of these risks. Gist, as a reflection of subjective understanding, has been shown to vary with differences in knowledge, such as those that presumably exist between patients' and physicians' understanding of the same options. Prescriptively, physicians may wish to inculcate a particular representation of options that they feel is accurate or to revise what they consider to be misunderstandings in patients' gist representations to satisfy informed consent. (The usual caveats apply about unwarranted imposition of physicians' preferences on patients.) Finally, we must remind ourselves that the vagaries of verbatim and gist memories do not affect the patient alone: false memory also appears to affect physicians in training[17] and in carrying out their clinical duties.[18]

APPENDIX

A Brief History of Key Theoretical Assumptions in Recent Research on Memory

1. Verbal learning tradition: Memory is reproductive (a tape recorder whose fidelity decays or is interfered with over time). Countered by evidence for (re)construction.
2. Cognitive tradition: Memory is (re)constructive. Memory reflects understanding, inference, and schemas. Countered by evidence that the methodology of experiments was flawed and that predictions of constructive memory theories were disconfirmed (for reviews, see Alba and Hasher[19]; Reyna and Brainerd[20]).
3. Contemporary theories: Global memory models (see Clark and Gronlund[21] for a review) are formalized and make precise quantitative predictions. Fail to encompass evidence for dual-memory systems and the growing literature on false memories (but see Shiffrin and Steyvers[22]).
4. Dual-process models of memory: Process dissociation framework (recollection vs. familiarity).[23,24] Encompasses some evidence for dual-memory systems but initially does not apply to false memories. Also has mathematical, methodological, and substantive (i.e., does not distinguish between memory for actual experience and reconstructive memory) shortcomings (see Brainerd et al.[13]).
5. Fuzzy-trace theory: Reconciles cognitive and verbal learning literatures by predicting when memory is reproductive (verbatim based) and when it is reconstructive (gist based). Encompasses evidence for dual-memory systems and the growing literature on false memories. Addresses mathematical, methodological, and substantive shortcomings of earlier research. Only mathematical model of false memory that has been evaluated for goodness of fit to data.

Note: Dual-memory processes have been variously described as, for example, recollection versus familiarity, explicit versus implicit, or verbatim-based identity versus gist-based similarity judgments.

VALERIE F. REYNA

ALLAN J. HAMILTON
Departments of Surgery and Medicine and Department of Surgery
University of Arizona

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