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Risk literacy

Improving risk literacy in surgeons

Rocio Garcia-Retamero[a,b,*], Edward T. Cokely[b,c], Barbara Wicki[d], Alexander Joeris[d]

[a] Department of Experimental Psychology, University of Granada, Spain
[b] Max Planck Institute for Human Development, Berlin, Germany
[c] National Institute for Risk & Resilience, and Department of Psychology, University of Oklahoma, Norman, OK, USA
[d] AO Clinical Investigation and Documentation, Zurich, Switzerland

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ABSTRACT

Objective: To effectively practice evidence-based medicine, surgeons need to understand and be able to communicate health-relevant numerical information. We present the first study examining risk literacy in surgeons by assessing numeracy and surgical risk comprehension. Our study also investigated whether visual aids improve risk comprehension in surgeons with limited numeracy.
Methods: Participants were 292 surgeons from 60 countries who completed an instrument measuring numeracy and evaluated the results of a randomized controlled trial including post-surgical side-effects. Half of the surgeons received this information in numbers. The other half received the information represented visually. Accuracy of risk estimation, reading latency, and estimate latency (i.e., deliberation) were assessed.
Results: Some surgeons have low numeracy and could not correctly interpret surgical risks without additional support. Visual aids made risks transparent and eliminated differences in risk understanding between more and less numerate surgeons, increasing the amount of time that less numerate surgeons spent deliberating about risks.
Conclusions: Visual aids can be an efficient and inexpensive means of improving risk comprehension and clinical judgement in surgeons with low numerical and statistical skills.
Practice implications: Programs designed to help professionals represent and communicate health-relevant numerical information in simple transparent graphs may unobtrusively promote informed decision making.

1. Introduction

To effectively practice evidence-based medicine, physicians need to interpret and communicate numerical information about risks and benefits of different medical treatments, screenings, and lifestyle choices [1–6]. Many physicians recognize the relevance of numeracy for decision making and clinical practice [7,8]. Unfortunately, the literature examining the consequences of individual differences in numeracy in physicians is limited. This is due in part to a belief that physicians' extended education will sufficiently prepare them for dealing with basic numerical concepts [9]. However, results from preliminary studies suggest that many physicians fail to understand health-relevant numerical information, which reduces their risk literacy (i.e., the ability to accurately interpret and make good decisions based on information about risk) [3]. For instance, a systematic review conducted by Anderson and Schulkin [9] indicates that 53–75% of physicians samples are not able to correctly answer simple questions assessing understanding of basic probabilities, indicating that their ability to transform these probabilities into frequencies and percentages is limited (see also [10–15]). Recent research also indicates that compared to more numerate physicians, less numerate physicians often fail to make accurate diagnostic inferences based on the results of screening tests and struggle to efficiently evaluate health insurance plans [13,14,16].

Having adequate levels of numeracy is likely to be especially important for surgeons who often provide patients with comprehensive numerical information about their conditions, including risk factors, clinical features, treatment options, surgical complications, expected outcomes, and side effects with life-threatening consequences [17,18]. Research suggests that patients tend to benefit when surgeons understand risks, as well-informed surgical

* Corresponding author at: Facultad de Psicología, Universidad de Granada, Campus Universitario de Cartuja s/n, 18071 Granada, Spain/Center for Adaptive Behavior and Cognition, Max Planck Institute for Human Development, Lentzeallee 94, D–14195 Berlin, Germany.
E-mail address: rretamer@ugr.es (R. Garcia-Retamero).

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patients who are involved in decision making with their surgeons have less postoperative pain and have quicker recoveries [19,20].

In this paper we present the first investigation of the extent to which numeracy affects risk comprehension in surgeons. Our purpose was threefold. First, we assessed numeracy and risk literacy in a diverse group of 292 practicing surgeons working in 60 different countries. These surgeons were asked to provide estimates of the risk of post-surgical side-effects based on published results of a randomized controlled trial. Second, we investigated whether using *transparent* visual aids improved surgeons' risk comprehension. Transparent visual aids are simple graphical representations of numerical expressions of probability about health [21–23], and clarify key data and data structures like set-subset relations conferring considerable benefits when communicating complex information [13,24–28]. Accordingly, we hypothesized that visual aids would be especially helpful for less numerate surgeons as they might have more problems understanding numerical risks (H_1). Third, we investigated changes in surgeons' risk comprehension processes. People with higher numeracy are often more willing to carefully consider information about risks [29], and tend to spend more time deliberating during problem solving than those with lower numeracy. As a result, they also tend to avoid errors and make better decisions [30]. We hypothesized that visual aids would improve risk comprehension in less numerate surgeons by increasing the likelihood that they would spend more time carefully deliberating during their risk estimates (H_2).

2. Methods

2.1. Participants

This study was part of the project "Risk Literacy for Health" funded by the AO Foundation. Our participants were a large, diverse sample of 292 active surgeons from 60 countries, who attended the AO Foundation Courses in Davos (Switzerland) in December 2012. To be eligible for recruitment, surgeons had to speak English fluently. They were approached during the course break by five trained assistants who described the purpose of the study and answered related questions. Seventy-nine percent of the approached surgeons were eligible and agreed to participate in the study. Those who refused mentioned one or more of the following reasons: busy schedules and/or respondent burden.

2.2. Materials and procedure

Surgeons completed a two-part computer-based questionnaire. In the first part, they provided demographic information. They also completed the Berlin Numeracy Test (3)—a validated, psychometric research instrument designed to measure numeracy and predict risk literacy in educated samples from diverse countries. There are several versions of the Berlin Numeracy Test designed for use with various samples (e.g., general populations, college students, medical professionals). In this study, we used an adaptive computerized version of the test because it estimates numeracy from answers to only 2–3 questions in 2–3 min. Previous research shows that the instrument is internally consistent, predicting answers to ecologically valid probabilistic medical decisions better than a wide range of other intelligence, numeracy, and cognitive ability tests [31]. The Berlin Numeracy Test has been psychometrically evaluated for use in 15 countries and has been used for research in more than 60 countries [32,60]. The Cronbach alpha coefficient in the current study was .84.

In the second part of the questionnaire, surgeons were presented with a scenario describing the results of a randomized controlled trial testing side-effects of a new type of anesthesia in patients who underwent surgery. The task involved realistic risk information taken from a published study [33] that was selected to be representative of the types of information that practicing surgeons would routinely encounter and evaluate in due course of continuing medical education and professional development. Surgeons were provided with the specific information about the risk of suffering postoperative deep vein thrombosis in two randomly selected groups of 100 patients who underwent total hip replacement. In that published study, one group of patients was allocated to general anesthesia while another group of patients was allocated to the new type of anesthesia. The new type of anesthesia had a relative risk reduction of 25%.

Surgeons were randomly assigned to one of two information format conditions. In the numerical condition, they were told: "Of the patients allocated to general anesthesia, 27 suffered postoperative deep vein thrombosis. Compared to the group allocated to general anesthesia, 7 fewer patients suffered postoperative deep vein thrombosis in the group allocated to the new type of anesthesia." In the visual condition, surgeons received the same information. This information, however, was represented via an icon array (i.e., a graphical representation consisting of a number of circles symbolizing individuals at risk; Fig. 1).

The dependent variables included [1] estimations of risk reduction [2], total time spent reading the scenario describing the results of the randomized controlled trial (i.e., reading latency), and [3] total time spent deliberating during risk estimation (i.e., estimate latency). Surgeons were asked to infer the percentage of risk reduction among the number of patients who suffered deep vein thrombosis when the patients were allocated to the new type of anesthesia. Possible answers to this question were 0%, 25%, 50%,

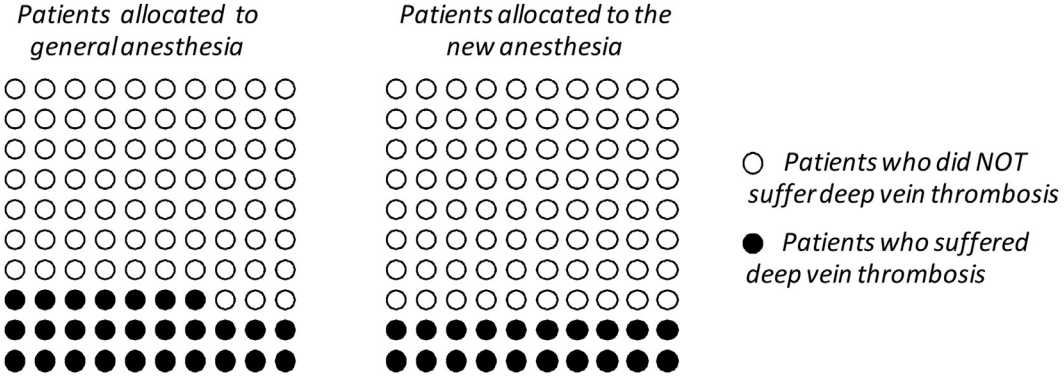

Fig. 1. Icon array representing numerical information about risk reduction.