

Weakness in Numbers

The Challenge of Numeracy in Health Care

Health literacy is the ability to complete basic reading and numerical tasks required to perform in the health care environment.¹ The specific aspect of literacy that involves solving problems requiring understanding and use of quantitative information is sometimes called numeracy. Numeracy skills include understanding basic calculations, time and money, measurement, estimation, logic, and performing multistep operations. Most importantly, numeracy also involves the ability to infer what mathematic concepts need to be applied when interpreting specific situations, and to use this information to problem solve. Clinicians, clinical care researchers, patient educators, and patients seem to have paid less attention to the numeracy component of health literacy. However, several trends in health care, including patient self-management and patient participation in decision making, strongly argue in favor of change. Two papers published in this issue of the *Journal of General Internal Medicine*^{2,3} motivate this exploration of the role of numeracy in health care, using the case of diabetes as an example.

Numeracy and Self-management

Diabetes is a chronic condition that requires effective problem-solving skills, increasingly involving use of quantitative information. Consider the patient with diabetes who is managing her metabolic control with exercise and diet. She needs to be able to read food labels and understand their content. But this exercise is not just one of reading comprehension: calculating the number of calories and carbohydrates consumed may involve calculation and application of serving sizes, or estimation of serving size consumed. Now consider another patient with diabetes on multiple daily injections of insulin counting carbohydrates to match his diet to the dose of insulin self-monitoring blood glucose levels and making insulin dose adjustments to prevent hypoglycemia, and noting trends that should lead to program changes. This patient needs to apply a host of numeracy skills, many involving complex or multiple steps. To perform self-monitoring the patient must be able to determine if a certain value is within goal parameters, and to assess trends of glycemic control over time. Making any insulin changes will require the patient to add or subtract units or make proportional changes, keeping in mind activity and food intake.

Patients with diabetes face many mathematic challenges and need to apply numeracy-related problem-solving skills when learning self-management, when using the tools and devices available to support this activity (e.g., glucose meters, log books, insulin syringes or pens, insulin pumps), and when trying to understand the instructions that health care professionals offer. Seen this way, diabetes patients are dramatically challenged in their numerical skills. One could also see that poor numeracy could seriously limit the ability of such patients to achieve their own goals of diabetes control.

In this issue of *JGIM*, Seligman et al.² used the short version of the TOFHLA test to detect diabetes patients with limited health literacy and then alerted the physicians in the intervention arm of this situation without providing any spe-

cific training to address literacy. As a result, clinicians notified of the patient's literacy status reported greater use of recommended strategies to accommodate to literacy limitations (picking them from a list of such strategies in a postintervention survey) than clinicians who were not notified. However, self-efficacy and AIC did not change significantly. While the lack of improvement in these measures may be related to inadequate study power or limited measure responsiveness, the inability of the physicians to apply appropriate literacy-oriented interventions may also be a contributing factor.

Unfortunately, the short version of the TOFHLA used in this study measures reading comprehension and does not include the numeracy questions that were part of the original TOFHLA.⁴ The developers of the full TOFHLA have noted that the numeracy component may be more important for common patient tasks than reading comprehension.⁵ So, the results may also reflect the insufficiency of strategies recommended for patients with limited reading literacy to accommodate patients who also have inadequate numeracy. Furthermore, the extent to which these accommodation strategies can assist patients with adequate reading literacy but poor numeracy remains unknown.

Numeracy and Participatory Decision Making

Patients interested in participating in decision making may want to understand and use evidence-based probabilistic information. Such information, often in the context of a decision aid,⁶ takes the form of baseline risk estimates, risk reduction with one or many interventions, risk increase for side effects of such interventions, simultaneous consideration of potential risks and benefits of several alternatives, each one with its associated risk information, and the uncertainties in relation to applicability of the information to the individual and of the lack of precision of the quantitative information itself. Difficulties also include the appreciation of risk, particularly when it refers to uncommon events.⁷ In this issue of *JGIM*, Woloshin et al.³ report that, at least preliminarily in a group of community volunteers, patients are largely interested in having access to statistical information about their conditions. Unfortunately, even in this group of highly interested people who also feel quite confident of their statistical skills, their ability to understand probabilistic information was limited and was not related to their reported confidence.

We have evaluated both statistical numeracy and diabetes numeracy in patients with diabetes.⁸ We were able to document that these domains are different (diabetic patients without literacy concerns had limited statistical numeracy [e.g., 8 in 10 patients incorrectly answered at least 1 of the 3 Schwartz-Woloshin⁹ statistical numeracy scale questions], and somewhat limited diabetes numeracy [e.g., 1 in 10 had trouble understanding glucometer data; 4 in 10 had trouble matching insulin dosing to carbohydrates ingested]). Thus, patients with diabetes, even those without important literacy limitations, may have important numeracy limitations that

limit their ability to understand and use risk information in order to participate in decision making.

The Road Ahead

Under-recognition of numeracy may be caused in part by the lack of measurement tools that assess the multiple domains of numeracy (not just statistical numeracy) while being sensitive to the health care context in which patients are likely to need these skills (condition-specific numeracy). It seems plausible that some of the strategies to accommodate patients with limited literacy, such as incorporating family members with better skills, will also be effective for patients with limited numeracy. Indeed, it is not uncommon to see spouses doing the calculations for the patient in our intensive diabetes control classes. However, investigators need to conduct research to identify and develop specific tools that can convey quantitative information with less demand on numerical skills. For instance, over 90% of patients, many with limited education and low scores on the Schwartz-Woloshin statistical numeracy scale, were able to accurately compare risks of an adverse outcome with 2 interventions when we offered graphs with ordered faces to express those risks.¹⁰ Further work to help health professionals effectively support patients with numeracy limitations in both self-management and decision making is also necessary.

Just like literacy, addressing numeracy may favorably change current inequity in health care, as the average patient with low socioeconomic status and limited education seems to be at a particular disadvantage when it comes to handling quantitative information.⁸ Is self-management only for the privileged? Is participation in decision making only for the well educated? The work of researchers like that published in this issue of *JGIM*, new funding opportunities to conduct research in this area,¹¹ and efforts to develop and implement innovative solutions, offer hope.—**Victor M. Montori, MD, MSc**, *Mayo Clinic College of Medicine, Rochester, MN, USA*; and **Russell L. Rothman, MD, MPP**, *Vanderbilt University Medical Center, Nashville, TN, USA*.

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