

Conference Summaries

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Risk Communication and Medical Decision Making

Gerd Gigerenzer, PhD

Gerd Gigerenzer, PhD, director of the Max Planck Institute for Human Development in Berlin, Germany, discussed practical solutions for addressing a significant barrier to shared decision making: statistical illiteracy.

Introduction

- Dr. Gigerenzer began with an H.G. Wells quote. The science fiction writer predicted, “If we want efficient citizens in a modern technological society, we need to teach them three things: reading, writing, and statistical thinking.”
- Defining statistical thinking as “a reasonable way to deal with uncertainties and risks,” Dr. Gigerenzer posited that in the Western world we have taught most citizens reading and writing but have fallen short with statistical thinking.
- Dr. Gigerenzer cautioned that if patients and doctors do not understand risk, then shared decision making is of little value. “Until physicians, patients, and politicians understand health statistics,” he asserted, “informed decision-making will remain science fiction.”
- Dr. Gigerenzer highlighted the adverse effects of confusion about health statistics with a medical example.
 - In 1995, the news media in the United Kingdom reported that the risk of thromboemboli among women who took third generation oral contraceptive pills was 100 percent higher than the risk among women taking other oral contraceptive pills.
 - The reports were associated with a discernable increase in unwanted pregnancies and abortions in England and Wales. Researchers estimated that there were approximately 13,000 more abortions than before the media report.
 - In truth, the absolute risk associated with the third generation pill was increased from 1 in 7,000 women to 2 in 7,000 women.
 - Had absolute risk been reported, the women might have better understood the risk, and the resultant panic and abortions would have been avoided.

Collective Statistical Illiteracy

- According to Dr. Gigerenzer, collective statistical illiteracy is largely caused by unwitting or intentional non-transparent framing of information and a lack of efficient training in risk communication in medical schools and the educational system in general. Dr. Gigerenzer posited that we teach the mathematics of certainty (for example, geometry and trigonometry) but not uncertainty.
- The simple solution is to teach and implement transparent risk communication.

Evidence of Statistical Illiteracy Among Politicians

In an October 2007 radio advertisement, former New York Mayor Rudy Giuliani said his chance of surviving prostate cancer was 82 percent in the United States but only 44 percent in the UK under socialized medicine. For Giuliani, these health statistics meant that he was lucky to be living in New York and not in York, since his chances of surviving prostate cancer appeared to be twice as high. This was incorrect and misleading.

- Explanation:
 - Mortality rates in the US and UK are similar, but survival rates differ because of lead time bias and over-diagnosis bias.
 - In contrast to the US, few men in Europe are screened for prostate cancer; thus a man who is destined to die of the disease at age 70 might be diagnosed at age 67 in Europe but age 60 in the US, where screening is more common.
 - The age at which he dies is similar, but the five-year survival rate is greater in the US because the cancer is detected earlier, on average, than in the UK.

Evidence of Statistical Illiteracy Among Physicians

- To assess statistical literacy among physicians, Dr. Gigerenzer and Dr. Odette Wegwarth conducted a study of 31 urologists.
 - When provided with survival rates, 71 percent recommended PSA screening; when given mortality rates, only 10 percent recommended screening.
 - Furthermore, when asked, 84 percent were not familiar with lead time bias.
- In another study, Dr. Gigerenzer assessed whether a group of 160 gynecologists were able to explain the significance of a positive screening mammography test.
 - The physicians were given the following facts: mammography has a sensitivity of 90 percent; the test has a 9 percent false positive rate; and the prevalence of disease is one percent.
 - They were asked, "If a woman has a positive mammography, what is the chance she actually has cancer?"

Initially only 21 percent provided the correct answer (10 percent), and the majority gave estimates over 80%.
 - After being taught to transform conditional probabilities (i.e., sensitivity and specificity) into natural frequencies, 87 percent answered the question correctly.
 - To transform into natural frequencies: consider 100 women; of these one has cancer and will probably test positive; of the 99 who do not have cancer, approximately 9 will test positive; thus, 10 will test positive, only one of whom has cancer.
- In a third study, Dr. Gigerenzer evaluated 150 German gynecologists to assess their understanding of relative risk reduction.
 - The physicians were asked the following question, "Mammography screening reduces mortality from breast cancer by about 25 percent. Assume that 1,000 women age 40 and over participate in mammography screening. How many fewer women are likely to die of breast cancer?"
 - Only 66 percent of the gynecologists were able to identify the correct answer (1).

Evidence of Statistical Illiteracy Among Patients

- Dr. Gigerenzer was involved in a large study of citizens in several European countries to assess what women know about the benefits of breast cancer screening with mammography and what men know about prostate screening with PSA testing.
 - For example, the women were asked, “Of 1,000 women who participate in screening how many fewer will die of breast cancer compared with women who do not participate?” The actual answer is about one; women in many countries responded with numbers that were 100 or 200 fold higher.
 - Specifically, 92 percent of women and 89 percent of men overestimated the reduction in cancer-specific mortality by one order of magnitude or more, or did not know.
 - Researchers found that the only informational source associated with improved understanding was the information provided by health insurance agencies; internet use and more frequent consulting of physicians were not associated with greater understanding.

The Exploitation of Statistical Illiteracy

According to Dr. Gigerenzer, some institutions take advantage of collective statistical illiteracy to further a specific agenda.

- *Example from drug advertising:* a Lipitor print ad stated that the drug cuts the risk of stroke by nearly half. This assertion is based on relative risk reduction; the reduction in absolute risk is only 1.3 percentage points (from 2.8 percent to 1.5 percent). The confusion associated with relative risk can create unwarranted enthusiasm for treatment.
- *Example from promotion by a medical center:* A print piece from M.D. Anderson, the prestigious cancer center, compared the survival rates for prostate cancer for patients treated at M.D. Anderson with the average US mortality rates. The use of these two uncorrelated figures is a clear case of misleading information creating unwarranted enthusiasm for the medical center.
- *Example from promotion by a foundation:* A large cancer research foundation in Germany published pamphlets on screening mammography that were misleading. They provided little information on the harms of the test and used relative risk reduction and survival rates to quantify the benefit. The fact that screening did not improve overall mortality was not mentioned. In addition, the pamphlets did not provide any information on the significance of a positive test.

This framing of the evidence was aimed at increasing participation rates, not at informing the public.

- A 2007 analysis in *Medical Care* by Sedrakyan and Shih assessed studies published in three prestigious medical journals (*British Medical Journal*, *Journal of the American Medical Association*, and *The Lancet*) between 2004 and 2006. Their analysis found that in one out of three cases mismatched framing was used (generally the use of relative risks, or “big numbers,” for benefits of treatments and absolute risks, or “small numbers,” for harms. Dr. Gigerenzer sees the use different “currencies” to describe the benefits and harms associated with a treatment as an ethical issue—an attempt to mislead the reader.
- He suggested that one strategy for dealing with the exploitation of statistical illiteracy is to play on organizational leaders’ concerns about reputation. When speaking on the topic of statistical illiteracy, Dr. Gigerenzer highlighted the pamphlets from the German health foundation as an example of misleading information. Simultaneously, he offered to help foundation staff revise the pamphlets; eventually the staff agreed and the pamphlets were revised.
- Dr. Gigerenzer suggested that another possible strategy is to focus on the moral issues involved with misinformation. He believes that misinformation as a moral issue is an approach that could support the promotion of shared decision making.

Dr. Gigerenzer concluded by returning to H.G. Wells, suggesting that if we want citizens who are efficient in a modern technological society, we need to ensure that all individuals, including doctors and politicians, have a minimum understanding of statistical thinking.

References cited by Dr. Gigerenzer:

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