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Risk Interpretation, Perception and Communication

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In a recent statistics editorial, I discussed the definition of a disease ‘risk’ and various ways of comparing risks across groups¹. Beyond the necessary statistical tools to estimate and compare risk, as health professionals we need to understand how physicians, counselors and the general public understand and interpret risk information. The success of scientific studies on risk factors and appropriate interventions depends upon a researcher’s skills in appropriately interpreting risk from data sources, communicating that risk effectively, and on consumers perceiving the information correctly.² In passing, note that researchers may use subtle alternatives to ‘risk’—for example, expected years of life lost, or quality of life measures—to quantify comparison of different exposure groups, concepts that may carry different implications and interpretation.

Size Matters

As discussed in my earlier editorial, it is important to stress the size of an underlying risk when making comparative statements, particularly when relative measures like the Relative Risk and Odds Ratio are used¹. There is extraordinary variation in how people perceive risks associated with various actions or exposures, and a considerable tendency to overestimate risks in many situations and occasionally to underestimate them.

Albeit self-evident, it is important to stress that ‘size matters’ when discussing risk.³ If I tell you that routinely eating a certain food doubles your intake of a certain toxin, your first question should focus on how much of the toxin you already consume. So it is with risk—doubling a very small risk might not cause much concern or necessarily induce significant lifestyle changes, whereas doubling a sizeable risk ought to stimulate discussion on how this increase in risk can be avoided.

Risk Interpretation

To emphasize the importance of understanding the level of risk, recall recent media accounts of the mortality effects of eating red meat⁴. It was widely reported, for example, that the (adjusted) mortality risk for males, aged 51–70 years, increased by 31% over 10 years of follow up when comparing the highest quintile of red meat eaters to the lowest quintile. Translating this difference into easily accessible information is important but requires additional information and calculation: in this case, the estimated (unadjusted) Excess Risk¹ of 0.11 over the ten years (or 0.011 per year) suggests that, amongst 100 high red meat consumers,

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approximately one less man (in this age group) would die per year if they all changed to the low level of red meat consumption. This manner of counting and describing risk is usually absorbed more easily.

Risk Perception

In every aspect of our lives we tolerate a certain level of risk in part because many fruitful activities necessarily involve the possibility of harm. You can avoid death from airplane crashes if you refuse to fly; for many, however, the low risks associated with flying are more than offset by the convenience, advantages and pleasure associated with travel. However, there is considerable research on how and why individuals fail to perceive or assess risks accurately. Of course, very small risks should rarely worry us particularly if avoidance significantly decreases the quality of our lives. This year, in the United States, more than 300 people will die in their bathtubs, and more than 300 from falling off ladders, at least if past causes of mortality hold true. However, this information will not prevent most of us from taking a bath or using a ladder, albeit after taking simple precautionary measures to mitigate even these low risks. On the other hand, ignoring what we eat and how much we exercise can significantly change our future well-being since risks of serious cardiovascular outcomes are considerably higher.

Individuals often tacitly estimate a risk by anchoring their estimate to a familiar outcome. While this is a common view of how individuals assess unfamiliar risks, it is also clear that we often make ineffective modifications when moving from an anchor to the “outcome” in question. Providing clear and useful contextual benchmarks for risk may be useful in communication. For example, in my classes, although students are well aware of the increased risk of infant mortality (death in the first year of life) as compared to the rest of childhood and young adulthood, very few can accurately quantify the actual size of the risk. I find it useful to point out that, for males, for example, mortality risk in the first year of life is roughly equal to one-year mortality for a 60 year old⁵. This observation benchmarks the risk into something more comprehensible without actually having to remember the actual size of the risk. Care must always be taken in choosing an appropriate and relevant risk comparison.⁶

Individuals tend to overestimate risks that they hear about more frequently. Thus we tend to exaggerate the risks of shark attacks because the latter are almost always widely reported in the press. This is an important current issue given that many individuals often assess the risks of surgical procedures, for example, by turning to internet sources where bad outcomes are much more likely to be reported than good ones.

Extensive literature on risk perception has also illuminated other natural tendencies: to underestimate risks associated with activities we enjoy while overestimating risks for those we dread; to overestimate risks we are involuntarily exposed to (e.g. pesticides in food, air quality) as compared to activities we choose. For example, individuals tolerate the risk associated with skiing while objecting to the potential adverse effects of food preservatives even though the risk of injury from skiing is roughly 1000 times higher.⁷ Finally, we tend to be risk averse when gains are involved and risk takers when we face losses (it won't happen to me). This latter issue is particularly relevant to health promotion messages that tend to focus on avoiding bad outcomes rather than promoting good results.

Communicating risk figures and comparisons

How then should we report risk information in scientific articles? Basing risk comparisons on counts rather than relative comparisons, as in the meat eating and mortality example above, is a good place to start since this information is usually better understood by general consumers.

Paradoxically, note that small increases in risk at an individual level can translate into important effects in large populations. For example, having an extra alcoholic drink a day is thought to raise a woman's risk of breast cancer by approximately 6%, perhaps not necessarily large enough to modify behavior. (To use the counting approach already noted, about an additional 1 in 200 women would suffer from breast cancer if they all increased their alcohol consumption by one drink per day.) On the other hand, at the population level, an increase—or decrease—of 6% in breast cancer incidence is an important effect. This raises challenges for health promotion efforts focused on individual behaviors.

Finally, it is extremely beneficial for health communicators to provide widely available assessments of risk. As an example, a recent report⁸ provided ten year mortality risks for men and women (smokers and non smokers separately) of all age categories. This simple information allows individuals to easily understand the various risks they face and use this information to make lifestyle choices. These charts exhibit certain facts clearly: for non-smoking men over 50 years of age, the risk of death from cardiovascular causes is more than threefold greater than the risk of death from the three major cancers (lung, prostate, and colon) combined: for example, at age 50, the ten year cause-specific mortality risks are 12 per 1,000 men for cardiovascular causes and 4 per 1,000 for the three primary cancers; at age 70, these same ten-year mortality risks are 105, and 28, per 1,000 for cardiovascular causes and the three cancers, respectively.

For male smokers however, the risk of death from lung cancer and other lung diseases is roughly the same as from cardiovascular causes. Again, at age 50, the ten year cause-specific mortality risks are 34 per 1,000 men for cardiovascular causes and 21 per 1,000 for lung diseases; at age 70, these same ten-year mortality risks are 126, and 158, per 1,000 for cardiovascular causes and lung diseases, respectively.

For non-smoking woman, on the other hand, cardiovascular and breast cancer mortality risks are about the same until post-menopausal ages (over 60) where cardiovascular risks completely overwhelm the risk of death from breast cancer. For example, at age 50, the ten year cause-specific mortality risks are 5 per 1,000 women for cardiovascular causes and 4 per 1,000 for breast cancer; at age 70, the ten-year mortality risks are now 60, and 9, per 1,000 for cardiovascular causes and breast cancer, respectively.

While we have used easily recognizable examples, the above ideas apply equally well to risks associated with ophthalmologic conditions and exposures.

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