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Probability

Probability refers to the measurement of the chance or likelihood that some uncertain event will occur. Probabilities are commonly used with respect to health risks and can be expressed in a variety of ways. According to the National Cancer Institute, 12.7% of women born today will be diagnosed with breast cancer at some point in their lives. Or, 87.3% of women will never receive that diagnosis. Similarly, women have a 1 in 8 lifetime risk of breast cancer which also means that 7 of every 8 women will never have breast cancer. If we look at decades of life, the chance of being diagnosed with breast cancer from ages 30-39 is 1 in 233, while the chance is 1 in 27 for a woman aged 60-69. These are population averages. The risk for an individual woman is affected by family history, reproductive history, race/ethnicity, alcohol use, exercise, and other factors. Furthermore, a woman at high risk may not get breast cancer, whereas a woman at low risk may.

One of the important reasons for discussing the probability or risk for any illness, injury, or premature death is to affect behavior. It is hoped that persons at risk for an illness or injury will take steps, as they are possible, to lower risk. More broadly, across the population, there are a number of specific behaviors that have been clearly established to lower any person's risk for illness, injury, or premature death. A common example is seat belt use. According to the National Highway Traffic Safety Administration, the proper use of lap and shoulder belts decreases the risk of fatal injury to front seat passenger car occupants by 45% and the risk of moderate to critical injury by 50%. Public health efforts and legislation to

increase use have been highly successful. Seat belt use in 2006 was 81% whereas it was only 14% as recently as 1984. But what about the 19% who still don't use seat belts?

The manner in which a probability estimate is expressed clearly affects our perception and understanding. Lifetime risks look different to us than risks in shorter time frames (see breast cancer example above). For a house located on a piece of property that has a flood every hundred years on average, does it seem riskier to live in the house if the flood probability is expressed as 1% every year, or 33% within 40 years? Most people perceive the second expression of probability (i.e., probability for a longer time period) to be riskier.

Other factors affect our perceptions of probability. Memory is one of these. In most cases, high frequency events are remembered as more probable. However, very visible or highly emotionally charged events become more available in memory, and thereby can affect perceptions of probability. Media coverage of airliner crashes (and the number of injuries or fatalities in such occurrences) affects perceptions of probability, so that many people erroneously believe that it is more dangerous to fly than to drive a car. This is why sometimes we do more to avoid low probability risks than we do for higher probability risks. Psychologist Gerg Gigerenzer of the Max Planck Institute for Human Development estimates (using analysis of traffic fatality data) that from October 2001 to September 2002, 1500 more Americans died in automobile accidents than would have otherwise been expected. This is because more people were driving their cars rather than flying to avoid the lower probability risk of death from airline terrorist attack. These traffic fatalities represent approximately six times the number of airline passengers who actually died on 9/11/01. These tragic deaths are an indirect toll of 9/11, and they certainly illustrate the behavioral impact and cost that perceptions of probability can have.

Personal experience also affects how we view probability, so that an individual who had a friend die in an automobile accident because of wearing a seat belt may conclude that it is safer to not wear a seat belt. Furthermore, feeling good now typically takes precedence over being healthier (or alive) later. A fair-skinned person may perceive

that getting a suntan today is more important than avoiding sun exposure to reduce the risk of skin cancer years from now.

Perception of risk and probability is a complicated matter, affected by emotional factors, cognitive tendencies, and experience. Translating perception of risk to risk-reducing behavior is even more multifaceted. On a population level, understanding these factors is important for public health professionals in their efforts to affect the behavior of large groups of people. On an individual level, it is helpful to recognize that using probability (statistical) data to make behavioral choices typically gives us the best chance of reducing risk and maintaining quality health.

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