

## Information Representations to Boost Statistical Literacy

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The shift from a paternalistic to an informed decision making approach in healthcare necessitates that patients be provided with information about the benefits and harms of health interventions in formats that are comprehensible and enable them to make health decisions. On the one hand, this means that people's statistical illiteracy should not be exploited with nontransparent communications about health risks, or the implications of medical tests. Instead, information representations need to be transparent and enable people to adequately evaluate the information without confusing or misleading them. Accordingly, we must consider not only how information representations can be communicated more or less transparently and can build on people's cognitive competencies, but also we must consider the environment in which these communications are situated (e.g., medical reporting, pharmaceutical advertising). Thus, this also means that we need to provide people with the necessary statistical literacy skills to recognise and overcome misleading or ambiguous information representations.

The talk illustrates how information representations can boost statistical literacy in the health domain, although similar approaches can and have been applied in other areas (e.g., law). In each case, I will demonstrate how apparent biases or statistical illiteracies found in studies on both lay people and health professionals can be overcome by altering the format in which information is represented. As an initial example, I will review work on how probabilistic inferences can be improved when information is presented in natural frequencies (joint frequencies obtained through a natural sampling process) as opposed to conditional probabilities. This example will illustrate how proponents from different theoretical perspectives came to make competing claims about people's statistical competencies (e.g., base-rate neglect) based on different information representation formats. From this, I demonstrate how people can be taught the skills and knowledge to overcome confusing information representation formats, showing how simple boosts can build competencies that can be transferred and applied in other contexts.

As a second example, I will discuss work on risk communication formats and the many different ways that information can be represented to confuse or mislead people, or to manipulate (e.g., over- or underemphasise) health risks. For example, I illustrate how statistical presentation formats can be used to disguise the magnitude of benefits and harms through mismatched framing: relative risks emphasise benefits in large numbers and absolute risks de-emphasise harms with small numbers). I introduce the Fact Box, a simple decision tool aimed to boost people's ability to compare benefits and harms of health interventions by incorporating transparent and balanced information representation formats that build on what we know about people's statistical competencies. I will also illustrate how potential biases (e.g., denominator neglect) can be overcome with visual representation formats. The underlying theme will centre on finding the right match between people's abilities and external representations of information.

The talk concludes with a discussion of avenues for implementing these boosts, for example, incorporating statistical literacy competencies in school and university curricula, or encouraging journal editors to promote transparent statistical reporting in academic publications. I highlight some of the efforts (and the challenges faced) to promote these *statistical literacy boosts* (Hertwig & Grüne-Yanoff, manuscript under review) to governments, health insurances, and medical organisations.