

Those troublesome fractions

MEDICINE AND NUMBERS

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The health service is awash with numerical information, and a good understanding of numbers is important for making the right decisions for both your own health and that of others. However, some figures are more difficult to understand than others.



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The brain has an innate understanding of basic mathematics – most mammals know how many offspring they have. But while most people can learn about quantities and how to count, ratios are more challenging. This is perhaps not very surprising. While dividing one number by another gives a new, meaningful number, you cannot divide one word by another word to arrive at a new meaning, or divide a cat by a moose to get a new animal. Understanding ratios is a surprisingly advanced intellectual exercise.

Two levels of numeracy

Numeracy is the ability to understand, analyse and make sense of numerical information, and can be divided into two levels (1). The first level involves basic principles such as quantities, number lines and measurement, while the second level includes ratios, such as proportions and percentages. This second level is difficult for many people to grasp.

In 2014, Norwegian researchers tested numeracy and various cognitive abilities in 202 study participants. They also examined how participants made health-related decisions involving mathematical and statistical information, such as estimating risk and weighing up probabilities against each other (2). The study found that a high intelligence level was no guarantee of proficiency in numeracy. Then again, the ability to estimate probabilities is not measured in IQ tests (3). Numeracy is an independent construct that impacts on our decision-making.

From numbers to words

Our trouble with numbers can be observed in most doctor's practices. Many doctors – a presumably intelligent group of people – are often more comfortable with communicating medical information to patients using qualitative rather than quantitative data (4). And this is just as much due to the doctors' own lack of confidence regarding numbers as for the benefit of patients (4).

One problem is that we humans have difficulty assessing the importance of the denominator in fractions (5), and create mental approximations of the essence of the numerical information. We translate '10 out of 100' as 'some', while '80 out of 100' becomes 'many'. We replace the relative with the absolute, and numbers with words. We pull information from the second level of numeracy down to the first level. By doing so, important parts of the information can get lost in the process.

Unfortunately, it is at level two that most statistics and probabilistics are found, and thus also many of the figures that form the basis for important decisions about health and society.

Rainy weather

In a study, residents of four European cities and New York were asked what a '30 % chance of rain tomorrow' meant (6). Two-thirds of Americans chose the alternative 'It will rain on 30 % of days like tomorrow' – which is the correct answer – while only a scant third of Europeans chose this. The most popular answer among the Europeans was that it would rain for 30 % of tomorrow. One respondent even thought it would be 'absurd' if the weather forecast were to refer to a percentage of number of days – which it does.

The participants may have known what 30 % meant in a purely numerical sense, but they did not understand how to interpret it.

When numbers meet people

The health service is awash with statistical summaries, from simple counts to probabilities and advanced risk calculations. The fact that fractions and other ratios are inherently difficult for the human brain to comprehend, makes statistics difficult to understand – regardless of a person's intelligence level or education. Such numbers thus need to be communicated carefully, whether to patients or next of kin, researchers or other healthcare personnel.

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Publisert: 3 June 2024. Tidsskr Nor Legeforen. DOI: 10.4045/tidsskr.24.0213

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