

Equivalent risk, different decision

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Abstract:

Background: The relative risk reduction (RRR), the absolute risk reduction (ARR), and the number needed to treat or screen (NNT) are measures usually used to communicate the advantages of medical screening. Properly informed decision-making requires an understanding of these statistics by both health professionals and patients. However, even when this knowledge holds, the perception of the benefits of these three measures may be distinct, since they are translated by numbers of different magnitudes. The objective of this study is to assess whether health professionals and patients understand or are influenced by the risk presentation format in the decision to screen.

Materials and Methods: A question from a questionnaire shared online assessed the impact of those statistics on health professionals and the general population.

Results: The results point to a greater impact when information is conveyed as the RRR. The overestimation of RRR is slightly more pronounced in health professionals. The NNT had the least impact and is possibly the least understood.

Conclusion: The different perception of benefits that arises from the risk format used, skew the decision-making process and may impact the health of patients. It is necessary to improve statistical education among health professionals and the general population.

Key Words: Informed decision-making; Relative risk reduction (RRR); Absolute risk reduction (ARR); Number needed to treat (NNT).

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I. INTRODUCTION

Health professionals and patients must correctly interpret numbers and statistics in healthcare so that an informed decision can take place. According to several authors, many physicians and patients do not understand what some health statistics mean^{1,2,3,4}. This problem is often created by the use of non-transparent information, whether intentional or not¹. This lack of statistical literacy can impact and have consequences not only on the decision and health of patients but may also affect the costs of health systems. Every treatment or medical procedure has risks and must be balanced against the benefits. People must understand the risks and benefits properly. But is this what happens?

The benefits of health screening processes are usually communicated using the relative risk reduction (RRR), the absolute risk reduction (ARR), or the number of people needed to treat to obtain a benefit (NNT). It is necessary to understand those three concepts properly to make an informed decision. The ARR is the percentage of patients who stop experiencing a particular event and do not require knowledge of the baseline risk. The RRR is the ratio between the ARR and the baseline risk. Without it, its value can be misleading and may lead to an overestimation of the benefits since it is generally translated by a large number. The NNT, which is the inverse of the ARR, is sometimes used, but this form of risk presentation is generally poorly understood². Some definitions of the terminology used in risk communication are clarified by Siwek and Newman⁵, to increase and assist in the informed decision process of patients. The following example allows a better understanding of these concepts:

A clinical trial with a new drug is being tested to prevent disease A. Two groups of 100 individuals each are built, one taking a placebo and the other taking an experimental drug to prevent disease A. In the placebo group four developed the disease, while in the experimental group, three developed the disease. The baseline risk is 4%, and the ARR is 4% minus 3% that equates 1% ($NNT = 1/0.01 = 100$). The RRR is the ratio between the AAR of 1% and the baseline risk of 4%, matching 25%. The RRR is much larger than the ARR and may have a larger impact on the perception of the benefits. For the same number of individuals contracting the disease, the RRR would not change if there were a different number of individuals in each group. Let's say that each group had 1000 individuals. The ARR would be much smaller, only 0.1% ($NNT = 1000$), but the RRR

would not change. The benefits would decrease, but they would not be captured by the RRR. Hence, the RRR may lead to an overestimation of the benefits. Concerning the NNT, in the first case, 100 people need to take the drug so one can achieve a benefit. On the contrary, in the second case, 1000 people need to take the drug so one can achieve a benefit (10 times more).

Sarfati et al.² showed that these three concepts are often misunderstood and that they can have a big impact on the decision. To do so, they conducted a survey in New Zealand, where respondents were selected by home telephone numbers chosen at random from a computer and received information about the benefits of three allegedly different screening tests for an unspecified cancer². In reality, the benefits were identical, except that they were passed on as the RRR, the ARR, and the NNT. Respondents were told that all three tests (supposedly different) were painless, simple, quick, and with no costs. They were asked to rate each test according to their willingness to perform it, on a scale of 1 to 5 Likert points, ranging from definitely not wanting to take the test until definitely wanting to take the test. About 80% of respondents said they were likely to accept the test (point 4 or 5 on the Likert scale) when the benefits were presented in terms of the RRR, dropping this percentage to 53% when the benefits were presented in terms of ARR and to 43% when benefits were presented in terms of the NNT. Only 29.7% of respondents did not change their responses to the three allegedly different tests.

II. MATERIAL AND METHODS

To investigate the extent to which these three concepts (RRR, ARR, and NNT) are properly understood by health professionals and patients and to what extent they can impact informed decision-making, an online question very similar to the one performed by Sarfati et al.² was placed on social media, but with the inclusion of an additional response option: 'I don't have enough data'. The question was available from January 2, 2019, till the end of the data collection on April 12, 2019. The question made was:

Consider the following information about the benefits of three different screening tests for a given cancer, where all three tests are painless, simple, quick, and with no costs. Rate each test according to your desire to perform it on a positive 5-point Likert scale (ranging from 1, which means definitely not wanting to take the test, to 5, which means definitely wanting to take the test). You have also the option to answer 'I don't have enough data'.

Test 1. If you do this test every two years, your chance of dying from this cancer will be reduced by about a third over the next 10 years.

Test 2. If you do this test every two years, your chance of dying from this cancer reduces by about three in every thousand, to about two in every thousand, in the next 10 years.

Test 3. If about one thousand people do this test every two years, one person will be saved from dying from this cancer in the next 10 years.

The difference to the question made by Sarfati et al.² is the option to answer 'I don't have enough data'. This option was added because test one is not equivalent to the other two since the baseline risk is not provided for the RRR. This fact was not taken into account by Sarfati et al.², but that does not invalidate the study performed and the conclusions drawn. Also, the respondents were split into health professionals and the general population, and the answers were compared.

III. RESULTS

Before accomplishing the collection of all the responses, a preliminary analysis of incomplete data with only 339 answers was carried out in Ferreira et al.⁶. When the data collection was over, the total number of responses obtained was 485. To analyze each test individually, levels one and two and levels four and five were grouped into 'I don't want to take the test' and 'I want to take the test', respectively. This was also done in Sarfati et al.².

For the general population, 66.1% said they wanted to take the test when the benefits were presented in terms of the RRR (test 1), decreasing this value to 51.3% for the ARR (test 2) and to 40.7% for the NNT (test 3). These differences were found to be statistically significant by the Cochran Q test ($p < 0.001$). About 6.3% in test 1, 15.9% in test 2, and 17.5% in test 3 had an indifferent opinion (point 3 on the Likert scale). These results seem to point to a greater impact on the decision in the general population when the benefits of the test are presented using the RRR. About 12.2% said that, for test 3 (NNT), they did not have enough data. When compared to the 7.9% value for test 2 (ARR), this shows the possible lesser understanding of the NNT.

For health professionals, 74.3% said they wanted to take test 1 when the benefits were presented by the RRR (higher than that obtained for the general population), decreasing this value to 54.4% in test 2 for the ARR and to 42.9% in test 3 for the NNT (values slightly higher than those obtained for the general population), differences statistically significant by the Cochran Q test ($p < 0.001$). As for the general population, a greater percentage of health professionals said they did not have enough data for test 3 (NNT) than for test 2 (ARR) (7.4% against 5.7%), which points to the possible lesser understanding of the NNT. However, for test 1 (RRR),

the percentage of health professionals who said they did not have enough data was greater than the percentage of the general population (13.2% versus 9.0%). Does this mean that health professionals know better that the baseline risk is missing?

Analyzing the responses to the three tests simultaneously, those who correctly understand the three concepts and are not influenced by the way the benefits are presented will answer 'I don't have enough data' for test 1 (RRR) and the same answer for the other two tests (correct answers). However, others will identify the tests as being the same and give the same response to the three tests (almost correct answers). The other answers show that at least one of the measures is not understood or that the way the benefits are presented affects the decision (wrong answers).

The rate of correct answers was higher in health professionals with 9.1% against 7.9% in the general population, but the rate of wrong answers was also higher in health professionals, with 57.8% against 50.8% in the general population. The rate of almost correct answers was higher in the general population (31.2% against 26.0% for health professionals). 7.1% of health professionals and 10.1% of the general population did not answer to at least one of the tests. The differences were not statistically significant ($\chi^2(3) = 3.545, p = 0.315$).

The software used was IBM SPSS 2005 (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.).

IV. DISCUSSION

The results obtained do not differ substantially from those obtained by Sarfati et al.². Thus, the results point to a greater impact on the general population and on health professionals, when information of the benefits is conveyed in the form of large numbers, that is, the RRR has the greatest impact on the decision, and is slightly more pronounced in health professionals than in the general population. This last result may be, at least in part, a consequence of the pressure exerted by medical advertising on health professionals. The presentation of results as the ARR showed a lower impact on the decision of screening. The NNT had the least impact and is possibly the least understood.

These values point to the need to strengthen statistical education among the general population, and, with particular emphasis on health professionals. Many years passed after the results obtained by Sarfati et al.² and very little seems to have changed.

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