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Absolute Versus Relative Risk: Can We Persuaded by Information Framing?

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ABSTRACT

For an informed consent, patients must be impartially informed about the advantages, disadvantages and alternatives of the intervention of interest. This data should be presented in a neutral manner and without preconception to respect the autonomy of the patient. One common pitfall in presentation of data in medical literature is unintentional and seldom intentional misuse of Relative Risk Ratios (RRR) instead of Absolute Risk Ratios (ARR). This study discussed the differences between absolute and relative risk ratios followed by current evidence on how physicians and patients can be persuaded to alter their decisions by framing the data into relative risks.

Key words: Information consent, relative risk ratio, absolute risk, ratio, information framing

INTRODUCTION

Mr. B a 65 year-old man with long history of diabetes mellitus and hypertension has been diagnosed with atrial fibrillation. Dr. L appropriately suggests that Mr. B should be anti-coagulated with warfarin. "Warfarin will reduce your annual risk of stroke by about 60%..... Bleeding is the main side effect but fatal bleeding stays well below 1% per year." Dr. L states.

Mr. B agrees to take warfarin. Two weeks after their conversation, Dr. L receives a phone call from Mr. B: " I am going to stop warfarin. My son who is a medical student tells me that my risk of stroke will be reduced by only 3% every year and risk of bleeding in my head increases by almost 200%."

For an informed consent, patients must be impartially informed about the advantages and disadvantages of the preventative, diagnostic or therapeutic options. In addition, patients should be able to comprehend these options and their outcomes to reflect and enact their individual values on the potential beneficial and harmful events.

Providing patients with unbiased information leads to truthful risk perceptions. Several Randomized Controlled Trials (RCTs) have shown that patients who receive decision aides with detailed description of outcome probabilities are more likely to have accurate risk perception especially if they are presented quantitatively (O'Connor *et al.*, 2009).

In general, two formats are used to describe the risk reduction in the medical literature: (1) Relative Risk Reduction (RRR) and (2) absolute risk reduction (ARR). The goal of this manuscript is to explain how to calculate RRR and ARR with an example on a risk-reducing drug and further I will elucidate if there is any evidence that use of RRR can manipulate the risk perception among the patients and physicians.

How to calculate and interpret the absolute and relative risk measures: In primary prevention, RCTs (Hart *et al.*, 1999), the rate of stroke among patients with atrial fibrillation who were not anticoagulated has been estimated to be approximately 4.6% per year. Rate of stroke in patients who received an adjusted dose of warfarin (i.e. international normalized ratio, 2.0-3.0) decreased to 2.0% per year. The rates of intracranial hemorrhage in warfarin and placebo arms were 0.3% and 0.1% per year, respectively.

Absolute Risk Reduction (ARR) is calculated by subtracting the event rate in the intervention arm from the placebo arm. In our example, the ARR equals $4.6 - 2.0\% = 2.6\%$ per year. Therefore, warfarin therapy reduces the annual risk of stroke by 2.6% in patients with atrial fibrillation.

With the same concept, absolute risk increase is calculated by subtracting the harmful event rate in the intervention arm from the placebo arm, which in our example is $0.3 - 0.1\% = 0.2\%$ per year. Hence, warfarin therapy increases the annual risk of stroke by 0.2% in patients with atrial fibrillation.

Relative Risk Reduction (RRR) is another conventional measure to report risk probabilities in medical literature. It is calculated by dividing the ARR by the baseline risk (i.e. event rate in the placebo arm). In our example the RRR per year is:

$$\frac{4.6\% - 2\%}{4.6\%} = 56.5\%$$

This means that warfarin therapy, compared to the baseline risk of stroke in patients with atrial fibrillation, reduces the annual risk of stroke by 52%. Unfortunately, in medical literature and pharmaceutical promotions “comparison with the baseline risk” is rarely mentioned, making it almost impossible to differentiate relative versus absolute risks.

Relative risk increase is rarely used to make treatment decisions as it produces overstated percentages due to rarity of adverse events. In our example, compared with the baseline risk of stroke in patients with atrial fibrillation, warfarin therapy increases the annual risk of intracranial hemorrhage by:

$$\frac{0.3\% - 0.1\%}{0.1\%} = 200\%$$

As a matter of fairness it is reasonable to address the adverse effects of a treatment in Relative risk increase if the therapeutic effect has been presented by RRR.

Does framing the data in RRR alter the perception of therapeutic effectiveness in patients? Griffith *et al.* (2009) recruited 113 participants between the age of 30 and 75 without a history of stroke, heart attack or congestive heart failure. Through a conjoint analysis, participants were given series of pairwise hypothetical interventions for heart disease prevention and were asked to choose their preference. Interventions had various attributes including ability to reduce heart attacks, side effects, ease of use and cost. “Ability to reduce heart attacks” was presented in RRR or ARR formats. Participants were randomized to receive the RRR or ARR version of the questionnaire. Irrespective to age and education level, those in the RRR arm were significantly more likely to consider the “ability to reduce heart attacks” as the most important attribute (59 vs. 33%; $p < 0.01$).

When data presented in RRR which is typically a significant percentage, participants downplay other attributes of the test. Similar results have been reported from other studies regarding the persuasiveness of RRR (Berry *et al.*, 2006; Gyrd-Hansen *et al.*, 2003; Hembroff *et al.*, 2004; Misselbrook and Armstrong, 2001).

Does framing the data in RRR alter the perception of therapeutic effectiveness in physicians? In Helsinki Heart RCT (Frick *et al.*, 1987), after five years of treatment with gemfibrozil, 2.73% of patients in the treatment arm experienced a cardiac event comparing to 4.14% in the placebo arm. Without mentioning the name of the trial or the medication, Bobbio *et al.* (1994) summarized the results of Helsinki Heart study in various formats and distributed it among 148 physicians. Physicians' willingness to prescribe the drug was 77% when the data was presented in terms of RRR while 24% were willing to prescribe the drug when data was expressed in terms ARR ($p < 0.001$). Influence of RRR on physician's perception of treatment benefits has been reported in several other trials (Bucher *et al.*, 1994; Cranney and Walley, 1996; Forrow *et al.*, 1992; Naylor *et al.*, 1992).

CONCLUSION

Exploitation of "information framing" is well-recognized in marketing (McGettigan *et al.*, 1999) and mass media (Entman, 2007). Perception of probabilities and outcomes predictably shifts when the same problem is framed in different ways (Tversky and Kahneman, 1981).

As for medical interventions when the results are presented in RRR rather than ARR, it appears that the enthusiasm for the intervention increases and both physicians and patients downplay other attributes of the test.

In our vignette, both Dr. L nor Mr. B's son were truthful about the scientific data that they provided to Mr. B. However, neither of them presented the data in a neutral manner and without preconception. Dr. L used RRR to emphasize on the therapeutic effects of warfarin while Mr. B's son used an opposite approach to persuade his father to stop the medication.

Taken together, the persuasive influence of RRR on decision making suggests that the benefits and the harms of the interventions to be communicated by ARR. This includes medical literature, pharmaceutical company promotions, patient education pamphlets, media reports and discussions between the physicians and patients. This concept should be reflected in the curriculum development of medical schools, schools of public health and continuing medical education (CME) programs.

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