Journal of Infectious Diseases and Patient Care

Mini-Review

WRJIDPC-24-003

Risk Management: Absolute and Relative Risk Reduction Implications for Community Infectious Disease Control and Patient Treatment in the General Practitioner's Office

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Citation: Turabian JL (2024) Risk Management: Absolute and Relative Risk Reduction Implications for Community Infectious Disease Control and Patient Treatment in the General Practitioner's Office. J Infect Dis & Pati Care 1: 3.

Received date: December 02, 2024; **Accepted date:** December 09, 2024; **Published date:** December 31, 2024

Description

Suppose you buy a new washing machine. The manual tells you that the new machine is covered by a warranty for the first year. The manual also says that, on average, 10% of machines will need service in the first year. So, the absolute risk of the machine needing service in the first year is 10%. The risk of needing service in the first year drops to 8% if you use powdered laundry detergent instead of liquid laundry detergent. So, the absolute risk of needing service in the first year drops by 2% if you use only powdered detergent. The 2% is the difference between your initial 10% absolute risk of needing service and the 8% absolute risk if you use only powdered detergent (10%-8%=2%). You could say that using only powdered detergent reduces the absolute risk by 2%. The 2% drop in absolute risk is, however, a 20% decrease in relative risk because you divide 2% by 10% (0.02÷0.10=0.20, or 20%). In other words, relative to the absolute risk of 10%, the absolute risk of 8% is 20% lower. You could say that using only powdered detergent results in a 20% reduction in relative risk. Bottom Line: Although the relative risk drops by 20% if you use only powdered detergent, the absolute risk dropped by only 2% (8% *vs.* 10%) [1].

Absolute risk is the probability that a subject has of suffering an event over a certain time: it is the measure of the risk that a given situation will occur. Referred to a given field, such as the field of cancer, absolute risk is the probability that a person, who does not have a specific type of cancer at a certain age, will develop that cancer in a given time; For example, a 35-year-old woman with no known risk factors for breast cancer who lives to age 90 has an absolute risk of developing breast cancer over her lifetime of about 13%, meaning she has a 1 in 8 chance of developing breast cancer. It also means that the chance that she will never develop breast cancer is about 87%, or 7 in 8 [2].

How is absolute risk reduction calculated: The absolute risk reduction is the opposite difference of attributable risk: Control group minus treated group. Absolute risk reduction estimates the real decrease in adverse outcomes among patients receiving a certain treatment and is calculated simply by subtracting the absolute difference in risk between the control group and the treated group: Absolute risk=number of events in the treated or control group)/ (number of people in that group).

Absolute risk reduction=Absolute risk of events in the control group: Absolute risk of events in the treatment group.

Thus, absolute risk reduction it is calculated as the arithmetic difference between 2 event rates: The event rate in the control group minus the event rate in the intervention group.

For example: In a randomized, double-blind clinical trial, the incidence of first esophageal variceal bleeding was compared between patients treated with ß-blockers versus placebo [3]. In the first group, esophageal variceal bleeding occurred in 2/51 (4%) and in the second group, 11/51 (22%). The relative risk reduction is 22%-4% / 22%=82%. This result means that patients receiving beta-blockers with esophageal varices are 82% less likely to develop esophageal variceal bleeding compared to those with esophageal varices and taking placebo. As can be seen, this measure does not clearly perceive the true impact that could be had when such results are applied to our patients, since it compares the risk of events between patients with treatments and those with placebo, that is, it illustrates the benefit of the treatment in relative terms. In daily practice, what is really desired to be determined is the outcome in treated patients, that is, the absolute risk reduction. In the previous example it would be: 22%-4%=18%. This result is interpreted as follows: Patients with esophageal varices who receive beta blockers reduce the risk of esophageal variceal bleeding by 18% or, in other words, for every 100 patients with cirrhosis and esophageal varices treated with beta blockers during the study period, 18 esophageal variceal

bleeding are avoided compared to those that would have been avoided if placebo were used. This measure expresses the consequences of giving this treatment [4].

The relative risk compares the frequency with which the damage occurs between those who have the risk factor and those who do not. Relative risk is more correctly thought of as a "risk ratio" because of the nature of the mathematical relationships involved [5]. When comparing two groups, absolute risk is thought of as the difference between two risks, whereas relative risk is the ratio of two risks. Absolute risk can indicate the magnitude of risk in a group of people with a certain exposure, but because it does not take into account the risk of disease in unexposed subjects, it does not indicate whether the exposure is associated with an increased risk of disease.

Although scientific papers often provide results indicating their statistical significance, they less often provide data on their clinical significance. The absolute risk reduction calculation is probably one of the most useful and intuitive data in this regard [6]. Absolute Risk Reduction is most useful for understanding the individual benefit of an intervention. Relative Risk Reduction is often used in marketing or the media because it tends to produce a larger, more eye-catching number. However, absolute risk reduction can provide guidance on the benefit that an individual patient can expect [7]. Nearly all popular media reports, and many in the medical literature, present risk results as relative risk reductions rather than absolute risk reductions. Why? Most likely it has to do with perceived impact on readers; that is, relative risk reductions often make data appear more impressive than they actually are [8-10]. If relative risks tend to overestimate the effect, in many situations the absolute risk provides a better representation of the real situation, and also from the patient's point of view, absolute risks often provide more relevant information [11]. And not only is this biased impact perceived by the public, but a similar effect has been reported in the interpretation of risk data by primary care physicians [12].

And what implications does this risk management have for infectious diseases? For example, in Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infection, it may be more intuitive to give the results of the intervention (vaccination and natural immunity from having passed the infection) in the form of absolute risk reduction.

Measuring the absolute risk reduction and the number of people to be treated or vaccinated are more suitable for prioritizing the vaccination of vulnerable populations than relative measures, such as relative risk reduction [13]. Vaccination efficacy, estimated by the absolute risk reduction rate, may vary in population subgroups with different background risks [13]. Thus, the potential benefits (absolute risk reductions) are greater in patients at high risk of adverse events than in those at lower risk [14]. In any case, the absolute risk reduction should be interpreted in the context of the baseline risk [15].

When a patient is considering undergoing a preventive service such as a vaccination, the relevant information to guide a decision includes the probability of risk and benefit. Some have argued that all patients considering preventive services should be given this information in the form of absolute probabilities, presented numerically or graphically. This claim is based on the concern that not giving patients this type of risk information violates the ethical principle of respect for autonomy, since without this information patients cannot make a fully informed decision [11]. Any quantitative data can be described in many ways, and research shows that the focus of that information has significant effects on patient understanding [16,17].

While randomized controlled trials and population-based evaluations do not routinely report absolute risk reduction, their primary measure of effect for vaccine effectiveness is relative risk reduction. Some researchers have subsequently calculated absolute risk reduction using data from large studies, but none have assessed the metrics in subpopulations, including socioeconomic groups, with different baseline risks of disease [13].

For 2021, news reports generally described percentage reduction in disease burden as a way to demonstrate a covid-19 vaccine's efficacy, such as 50%, 75%, or 90%. They often reported a relative reduction in risk, which tends to be a higher and more impactful number than the same effect described as an absolute risk reduction. Clinical trials for the Covid-19 vaccines reported impressive efficacy in preventing symptomatic disease: 95% relative risk reduction for the Pfizer-BioNTech vaccine and 94% for the Moderna vaccine, 67% for Johnson and Johnson/Janssen, and 675 for AstraZeneca-Oxford. But these figures did not imply that 94%-95% *etc.* of people were protected from the disease with these vaccines, which is a common misconception among patients and even some healthcare professionals. This means that the number of cases of Covid-19 disease would be reduced by 94%-95% compared to what would occur without vaccination. If the absolute risk reduction were calculated in the same population of these clinical trials, the reduction provided by the vaccines would be much less striking: 0.84% for the Pfizer-BioNTech vaccine (0.88% in the placebo group minus 0.04% in the vaccinated group) and 1.23% for the Moderna vaccine (1.31% minus 0.08%), 1.2% for Johnson and Johnson/Janssen, and 1.3% for AstraZeneca-Oxford [18-20].

In a systematic review for 2021, vaccination in people who have recovered from covid-19 provided an extremely small absolute risk difference for preventing subsequent SARS-CoV-2 infection. At that time, the authors concluded that the net benefit is marginal in absolute terms. Therefore, vaccination of people who have recovered from covid-19 should be subject to clinical criteria and individual preferences [21]. This does not mean at all that vaccines are not effective or necessary (this would be a totally different debate) but that displaying and communicating the data in one way or another can provoke different reactions in the recipient of the information. In addition, knowing the absolute risk value also allows us to know the efficacy of the vaccines in greater detail and estimate the number of people

who must be vaccinated to prevent one more case of covid-19. For example, with these data for the context of 2021, we would have to vaccinate 199 people with Pfizer-BioNTech to avoid one new case of Covid-19 and 81 people with Moderna to avoid one new case *vs.* 78 with Astra-Zeneca. In any case, this analysis cannot be carried out without knowing both relative and absolute values of the risk reduction [1].

In summary, one of the most intuitive ways of describing the risks and benefits of a medical intervention is absolute risk reduction, and this has implications for the management of infectious disease control in the community and in the general practitioner's consultation with individual patients. However, such absolute measures of possible benefit are rarely given to patients. Research confirms that patients are more likely to accept a preventive intervention when its benefit is described in terms of relative risk reduction rather than absolute risk reduction. Clinicians can learn about and apply study results to individual patients by calculating risk differences if the individual risks of the relevant events (with and without treatment) are known or can be estimated. Presenting results as risk differences makes the benefits and adverse effects of the treatment or intervention easier to compare.

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