Managing risk in statistics - "Relative Risk"

Durrheim DN, MBChB, MPH&TM, DrPH
Anton Breinl Centre, School of Public Health and Tropical Medicine, James Cook University, 4811, Australia.
Ogunbanjo GA, MBBS, MFGP (SA), M Fam Med, FACRRM, FACTM
Department of Family Medicine and Primary Health Care, Medunsa, South Africa.

Correspondence: Prof GA Ogunbangjo, Email: gboyega@interkom.co.za
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Introduction

To determine how a disease is being transmitted, identify high-risk groups in the community requiring special prevention measures and to elucidate the most important factors contributing to disease causation, it is essential to move beyond counts of disease occurrence. As discussed in a previous article in this series, it is necessary to transform these tallies into incidence rates (or risk), that is, divide the number of new occurrences of disease by the population at risk in that geographical location during the specific time-period of interest. However, to determine a particular risk-factor's (or "exposure's" in statistical jargon) importance, one needs to go one step further. That crucial step is to compare the risk of disease occurrence in those people *"exposed"* to the particular risk factor of interest with the risk of disease occurrence in those people *"not exposed"* to that factor. This can be done either by dividing the risk in those exposed with the risk in those unexposed to that factor i.e. relative risk, or subtracting the risk in those unexposed from the risk in those exposed i.e. attributable risk. We will focus on relative risk in this article and attributable risk in a subsequent article. *(SA Fam Pract 2003;45(8):44-45)*

RELATIVE RISK

This is the **ratio** of the risk in the *exposed* group to the risk in the *unexposed* group. If the risk in the exposed and unexposed groups is the same, then, by division, it is obvious that the relative risk is 1. On the other hand, if the risk is greater in the exposed group, then the ratio will be greater than 1 and obviously harmful, while if the ratio is smaller than 1, it is most probably a beneficial factor in the exposed group.

Monkeypox, and smallpox, are both currently very topical and so we will use a monkeypox example to illustrate the concept of relative risk. In an outbreak of monkeypox in Zaire (now the Democratic Republic of Congo), **147** people contracted the monkeypox virus from monkeys.[1] In an effort to determine how likely monkeypox was to be transmitted from infected people to their *contacts,* information on monkeypox cases that had no contact with monkeys but developed disease following contact with primary human cases (secondary cases), was collected. Forty-seven (**47**) secondary cases resulted. All alert readers will not be satisfied with these counts of cases; you will want to know how many people were exposed through contact with monkeypox patients while they were infectious. Careful investigation determined that primary cases had contact with **739** people outside their homes and **834** in their homes while infectious, resulting in a total of **1573** cases. Thus the risk in people exposed to infectious patients was (47/1573)*100 = **2.99 secondary cases per 100 people exposed**. Most secondary cases (**n=36**) were family members or other individuals living in the same house as the primary cases (**11** non-household secondary cases (47 - 36), and so it appeared that *close contact* was an important risk factor. To quantify this risk, investigators needed to determine the risk in household contacts and compare it with the risk in all other contacts of primary cases (non-household contacts). This they did as follows:

- **Risk in household contacts:** (36/834)*100 = 4.32 secondary monkeypox cases per 100 exposed.
- **Risk in non-household contacts:** (11/739)*100 = 1.49 secondary monkeypox cases per 100 exposed.

The **"relative risk"** is calculated by dividing the risk in those *exposed* to the risk-factor under consideration (household contact) by the risk in those *not exposed* to that risk-factor i.e. 4.32/1.49 = 2.9. What does this mean in clinical practice? The risk of developing monkeypox in people exposed to primary cases in the household is **2.9** times greater than amongst those exposed outside the household. It is possible to fit confidence intervals to the relative risk and this will be tackled in a future article in this series. But what is clear is that household members are at considerably greater risk.

As indicated earlier relative risk determination can also guide targeting of prevention measures to those community members at greater risk. A good example of this is found in South Africa where resources available for malaria control in Mpumalanga were reduced and so it was decided that indoor spraying with residual insecticide should be targeted to highest risk

communities. The availability of a Malaria Geographical Information System, which relates each malaria case to the specific community where transmission occurred, proved valuable in stratifying malaria risk. The malaria control programme found that the malaria risk rose sharply towards the Mozambican border. When the malaria risk within 5 km of the border was compared with the risk in the remainder of the malaria-risk area, a relative risk of 4.12 (95% Confidence Interval = 3.88–4.46) was calculated.[2] This finding allowed development of a targeted approach to control with routine spraying restricted to settlements within 5 km of the border.

In conclusion, *relative risk* is an estimate of the ratio of the risk in the exposed group to the risk in the unexposed group, and it allows the clinician to determine how a disease is being transmitted, identify high-risk groups in the community requiring special prevention measures and identify the most important factors contributing to disease causation.❐

References

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