# Making Sense of Statistics for Family Practitioners: "What is Odds Ratio?" 

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## Introduction

The Odds Ratio (OR) is frequently used in case-control studies. It is the ratio of the odds in favour of getting the disease if exposed, to the odds in favour of getting the disease, if not exposed. In other words, it is a measure of association which quantifies the relationship between an exposure and health outcome from a comparative study. For example, in measuring the efficacy of a therapy odds can be used to describe risk. Since, the odds of an event are the probability of it occurring compared to the probability of it not occurring. By dividing the odds of an event in the experimenta group by the odds in the control group you can measure the efficacy of the treatment. Also, odds ratios are usefu because they can be used in a metaanalysis to combine the results of many different trials into one overall measure of efficacy. If the experimental group has lower odds, the OR will be less than 1; if the control group has lower odds, the OR will be above 1 ; and if there is no difference between the two groups, the OR will be exactly 1 .

## Odds Ratio

As defined, OR is the ratio of the odds in favour of getting the disease, if exposed, to the odds in favour of getting the disease, if not exposed. To determine the Odds Ratio in a case-control study, it is important to ask two Important questions:

- What proportion of cases were ex posed and what proportion were not?
- What proportion of controls were exposed and what proportion were not?

To answer these questions, the $2 \times 2$ table will be used to explain the concept of Odds Ratio as follows:

|  | Exposed <br> + | Not exposed <br> - |
| :--- | :---: | :---: |
| Disease + | a | b |
| No disease - | c | d |

The exposure odds among cases (disease) is equal to the number of exposed cases divided by the number of unexposed cases (a/b). While, the exposure odds among controls (no disease) is equal to the number of exposed controls divided by the number of unexposed controls (c/d). Therefore, the odds in favour of getting the disease, if exposed, to the odds in favour of getting the disease, if not exposed is refereed to as the odds ratio:
$a / b \div c / d=a^{*} d / b^{*} c$
NB: When the disease is rare, the Odds Ratio (OR) approximates the Relative Risk (RR) i.e. ratio of the risk in the exposed group to the risk in the unexposed group.

The controversy that surrounded the use of hormone treatment for pre-menstrual syndrome is used to further illustrate the concept of odds ratio. Early October 2001, a number of international newspaper articles reported that progesterone was an ineffective treatment for premenstrual syndrome and one suggested that hormone treatment might make the symptoms worse. ${ }^{1-4}$ The information was based on a systematic review of published randomised placebo-controlled trials, which included 10 trials on progesterone therapy. The overall standardised mean difference for a reduction in pre-menstrual syndrome symptoms with progesterone suppositories or pessaries was 0.04 ( $95 \% \mathrm{CI}=0.03$ to 0.05 ) with an OR of $\mathbf{0 . 9 3}$ ( 0.91 to 0.95 ), which was slightly in favour of placebo. However, for oral micronised progesterone, the standard mean difference was -0.15 ( $95 \% \mathrm{Cl}=-0.17$ to -0.12 ) and the OR was 1.30 ( 1.25 to 1.36 ), which favoured the use of progesterone. Combining all the progesterone trials, the standardised mean difference was -0.028 (-0.017 to -0.0408 ), with an OR of $\mathbf{1 . 0 5}$ (1.03 to 1.08), in favour of progesterone. The
overall standardised mean difference for reduction in symptoms showed a slight difference between progestogens and placebo in favour of progestogens (-0.036, -0.059 to -0.014), the OR was 1.07 (1.03 to 1.11).

The authors concluded that although statistically significant reductions in symptoms were observed for progesterone and progestogens when compared to placebo, these improvements were not clinically significant. They stated that the evidence from these meta-analyses did not support the use of progesterone or progestogens in the management of premenstrual syndrome. ${ }^{5}$ Although statistically significant differences in the reduction of symptoms were found between the treatment and placebo groups, most of these differences were small, and were also not considered to be of any clinical significance. In conclusion, if the experimental group has lower odds, the OR will be less than 1 ; if the control group has lower odds, the OR will be above 1and if there is no difference between the two groups, the OR will be exactly 1 . Odds Ratios provide an estimate for the relationship between two binary variables and have a convenient interpretation in case-control studies. ${ }^{6}$

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