Supporting Information of

Excess Relative Risk as an Effect Measure in Case-Control Studies of Rare Diseases

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S6 Exhibit. A proof that if the exposure under study is only associated with a specific disease entity, excess relative risk (ERR) for the exposure and this disease entity will be greater than that for the exposure and the disease as a whole.

Assumed that the disease under study is composed of two disease entities \( D_I \) and \( D_{II} \) and that the exposure under study \( E \) has no effect whatsoever on the occurrence of \( D_{II} \), that is, 
\[
\Pr(D_{II} = 1 | E = 1) = \Pr(D_{II} = 1 | E = 2).
\]
We see that the excess risk ratio quantifying the relation between \( E \) and \( D \) (the \( D_I \) and \( D_{II} \) combined) is less than that between \( E \) and \( D_I \):
\[
\frac{\Pr(D = 1 | E = 1) - \Pr(D = 1 | E = 2)}{\Pr(D = 1 | E = 2)} = \frac{[\Pr(D_I = 1 | E = 1) + \Pr(D_{II} = 1 | E = 1)] - [\Pr(D_I = 1 | E = 2) + \Pr(D_{II} = 1 | E = 2)]}{\Pr(D_I = 1 | E = 2) + \Pr(D_{II} = 1 | E = 2)} < \frac{\Pr(D_I = 1 | E = 1) - \Pr(D_I = 1 | E = 2)}{\Pr(D_I = 1 | E = 2)} = \text{ERR}_I.
\]