RealRisk Mathematics

Let the baseline risk be r. The risk in the 'active' group, p, depends on the measure of change

- **Relative risk** RR**.** By definition, $RR = p/r$. So the final risk is $p = r \times RR$.
- **Percentage change** PC**.** The final risk is $r + r \times PC/100$.
- **Odds ratio** OR**.** By definition, $OR = \frac{p}{(1-p)} / \frac{r}{(1-r)}$. Solving gives $p = 1 - \frac{1}{(1+OR(1-r)/r)}$.
- **Hazard ratio** HR**.** By definition, $HR = h_1(t)/h_0(t)$, where $h_1(t), h_0(t)$ are the hazards in the 'active' and baseline groups respectively. Therefore $HR = H_1(t)/H_0(t)$, where $H_1(t), H_0(t)$ are the cumulative hazards. Now $H_1(t) = -\log S_1(t), H_0(t) = -\log S_0(t)$, where $S_1(t), S_0(t)$ are the survival probabilities. And so $HR = \log S_1(t) / \log S_0(t)$.

  For a specified follow-up time t, we have risks $p = 1 - S_1(t)$, $r = 1 - S_0(t)$, and so $HR = \log(1-p)/\log(1-r)$.

  Rearranging gives $p = 1 - (1-r)^{HR}$.