Conditional Power Calculations considering Cure Fractions
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Introduction
Conditional power calculations are a helpful aid within interim analysis of clinical trials when the aim is to decide whether a trial should be continued or stopped for futility.
This poster presents the exponential model as a reference model without any cure fraction and in contrast to this the so-called non-mixture models with exponential, Weibull type and Gamma type survival which consider such cure fractions.
The models will be applied to data out of the High-CHOEP trial of the DSHNHL study group (group leader Prof. Dr. Michael Pfundenschuh).

Exponential Model: No Cure Fraction

• survival function \( S(t) = \exp(-\lambda t), \lambda > 0 \)
• hazard function \( h(t) = \lambda \)
• hazard ratio \( \theta = \lambda_2 \lambda_1 \)

Non-Mixture Models: Cure Fraction

Exponential Survival

• survival function \( S(t) = e^{-\exp(-\lambda c t)}, \lambda > 0, c \in (0,1) \)
• hazard function \( h(t) = -\lambda c \exp(-\lambda c t) \)
• hazard ratio \( \theta = (\lambda_2/\lambda_1) \exp((-\lambda_2 - \lambda_1)/(\log(c_2)/\log(c_1))) \)
• proportional hazard assumption \( \lambda_1 = \lambda_2 \)
• modified hazard ratio \( \theta = \log(c_2)/\log(c_1) \)

Weibull type Survival

• survival function \( S(t) = e^{-\lambda c t^k}, \lambda > 0, k > 0, c \in (0,1) \)
• hazard function \( h(t) = -\lambda c k t^{k-1} \exp(-\lambda c t^k) \)
• hazard ratio \( \theta = (\lambda_2/\lambda_1)(k_2/k_1) \exp((-\lambda_2 - \lambda_1)/(\log(c_2)/\log(c_1))) \)
• proportional hazard assumption \( \lambda_1 = \lambda_2, k_1 = k_2 \)
• modified hazard ratio \( \theta = \log(c_2)/\log(c_1) \)

Gamma type Survival

• survival function \( S(t) = e^{-\Gamma(a)(\lambda c t^b)}, a > 0, b > 0, c \in (0,1) \)
• hazard function \( h(t) = -(b c t^{b-1} / \Gamma(a)) \exp(-\lambda c t^b) \)
• hazard ratio \( \theta = (\lambda_2/\lambda_1)(\Gamma(a_2)/\Gamma(a_1)) \exp((-b_2 - b_1)/(\log(c_2)/\log(c_1))) \)
• proportional hazard assumption \( a_1 = a_2, b_1 = b_2 \)
• modified hazard ratio \( \theta = \log(c_2)/\log(c_1) \)

Conditional Power Calculations

• \( H_0: \theta = 1 \) vs. \( H_1: \theta \neq 1 \)
• parameter estimation by maximum likelihood method for censored data
• \( \hat{\theta} = \hat{\lambda}_2/\hat{\lambda}_1 \) respectively \( \hat{\theta} = \log(\hat{c}_2)/\log(\hat{c}_1) \)
• test statistic \( W = \log \hat{\theta} \)
• conditional test statistic is asymptotically normal
• conditional power function can be approximated by the cumulative distribution function of the standard normal distribution