

Modestly-weighted logrank test: basic tutorial

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Installation

You can use `devtools::install_github()` to get the package from GitHub:

```
install.packages("devtools")
library(devtools)
install_github("dominiczmagirr/modestWLRT")
```

Load packages

```
library(dplyr)
library(ggplot2)
library(modestWLRT)
```

Simulate example data set

You can use the function `delayed_effect_sim` to simulate an example data set from a 2-arm RCT. Survival times on the control arm are exponentially distributed with median `med_c`. Survival times on the experimental arm follow a 2-piece exponential distribution: from time zero up to time `delay` the event rate is `rate_e_1`; thereafter the event rate is `rate_e_2`. Patient recruitment times follow a simple power distribution:

$\text{pr}(\text{recruited before } t) = (t / \text{rec_period})^{\text{rec_power}}$, for t in $(0, \text{rec_period})$.

Data cut-off happens at time `max_cal_t`, and any patients still alive have their survival time censored.

```
example_data = delayed_effect_sim(n_c = 10,
                                  n_e = 10,
                                  rec_period = 12,
                                  rec_power = 1,
                                  med_c = 15,
                                  rate_e_1 = log(2) / 15,
                                  rate_e_2 = 0.03,
                                  delay = 6,
                                  max_cal_t = 36)
```

```
example_data
#>   time event   group
#> 1  4.24 TRUE  control
#> 2 33.20 FALSE  control
#> 3 19.05 TRUE  control
#> 4 25.98 TRUE  control
#> 5  1.55 TRUE  control
#> 6 27.51 FALSE  control
#> 7 18.85 TRUE  control
#> 8  0.52 TRUE  control
```

```
#> 9 3.43 TRUE control
#> 10 27.37 FALSE control
#> 11 1.37 TRUE experimental
#> 12 34.76 FALSE experimental
#> 13 5.25 TRUE experimental
#> 14 34.87 FALSE experimental
#> 15 25.41 FALSE experimental
#> 16 7.06 TRUE experimental
#> 17 10.71 TRUE experimental
#> 18 30.48 FALSE experimental
#> 19 6.66 TRUE experimental
#> 20 13.37 TRUE experimental
```

Risk table

The function `get_risk_table` takes a data frame produced from `delayed_effect_sim` (or a data frame of the same form) and turns it into a risk table. This tells you how many patients were at risk / had an event / censored on each arm, at each event time.

```
example_risk_table = get_risk_table(example_data)
```

```
example_risk_table
#>      t n_e d_e n_c d_c n d l l_c l_e
#> 1 0.52 10 0 10 1 20 1 0 0 0
#> 2 1.37 10 1 9 0 19 1 0 0 0
#> 3 1.55 9 0 9 1 18 1 0 0 0
#> 4 3.43 9 0 8 1 17 1 0 0 0
#> 5 4.24 9 0 7 1 16 1 0 0 0
#> 6 5.25 9 1 6 0 15 1 0 0 0
#> 7 6.66 8 1 6 0 14 1 0 0 0
#> 8 7.06 7 1 6 0 13 1 0 0 0
#> 9 10.71 6 1 6 0 12 1 0 0 0
#> 10 13.37 5 1 6 0 11 1 0 0 0
#> 11 18.85 4 0 6 1 10 1 0 0 0
#> 12 19.05 4 0 5 1 9 1 1 0 1
#> 14 25.98 3 0 4 1 7 1 6 3 3
```

Calculate weights

From the risk table, you can calculate the scores / weights from a modestWLRT. The argument `delay` is used to specify how long the scores are kept constant. See the paper

<http://arxiv.org/abs/1807.11097>

for details.

```
modest_weights = add_weights(example_risk_table,
                             method = "fixed_c",
                             delay = 12,
                             plot_weights = TRUE)
```

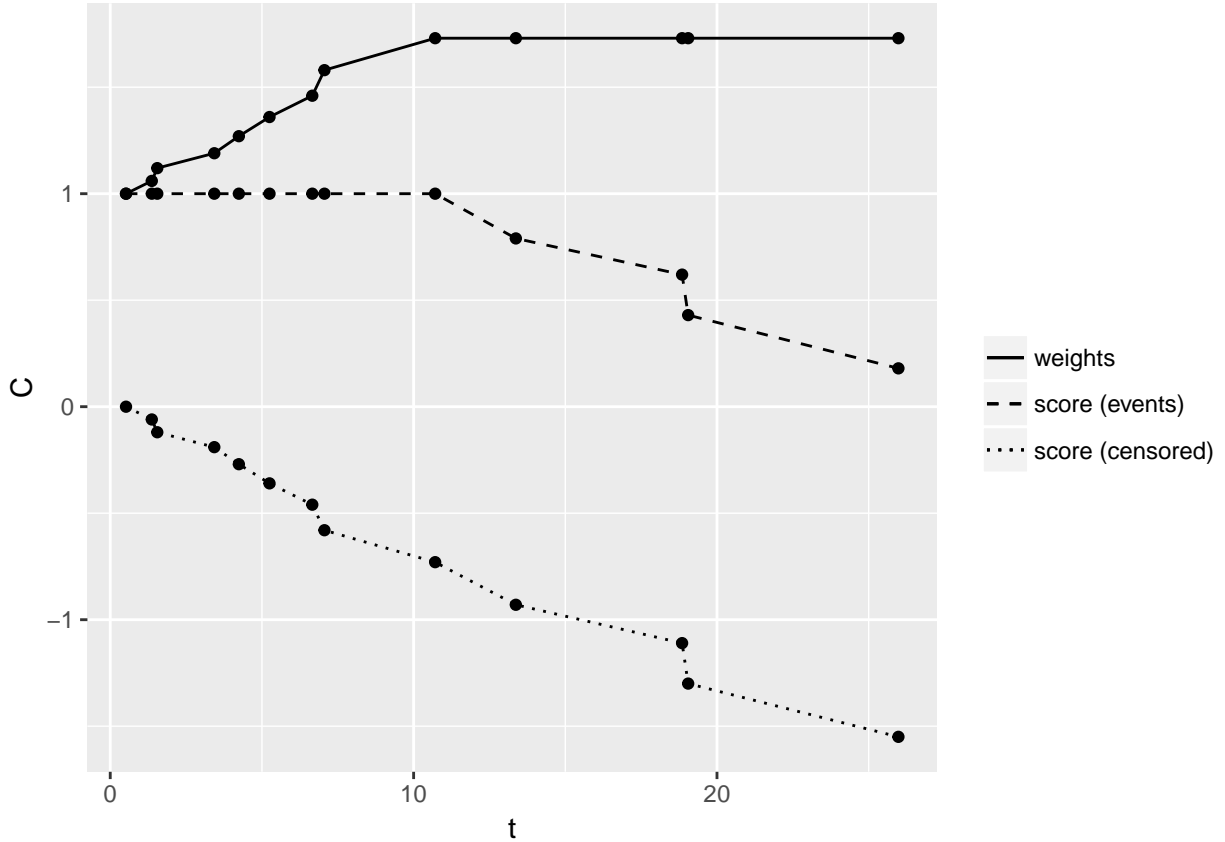


Figure 1: Scores/weights from a modestWLRT.

```
modest_weights$risk_table
#>      t n_e d_e n_c d_c n d l l_c l_e c w C
#> 1  0.52 10  0 10  1 20 1 0  0  0 1.00 1.00  0.00
#> 2  1.37 10  1  9  0 19 1 0  0  0 1.00 1.06 -0.06
#> 3  1.55  9  0  9  1 18 1 0  0  0 1.00 1.12 -0.12
#> 4  3.43  9  0  8  1 17 1 0  0  0 1.00 1.19 -0.19
#> 5  4.24  9  0  7  1 16 1 0  0  0 1.00 1.27 -0.27
#> 6  5.25  9  1  6  0 15 1 0  0  0 1.00 1.36 -0.36
#> 7  6.66  8  1  6  0 14 1 0  0  0 1.00 1.46 -0.46
#> 8  7.06  7  1  6  0 13 1 0  0  0 1.00 1.58 -0.58
#> 9 10.71  6  1  6  0 12 1 0  0  0 1.00 1.73 -0.73
#> 10 13.37  5  1  6  0 11 1 0  0  0 0.79 1.73 -0.93
#> 11 18.85  4  0  6  1 10 1 0  0  0 0.62 1.73 -1.11
#> 12 19.05  4  0  5  1  9 1 1  0  1 0.43 1.73 -1.30
#> 14 25.98  3  0  4  1  7 1 6  3  3 0.18 1.73 -1.55
```

```
modest_weights$p
```

Test statistics

Given the risk table with the corresponding weights, it is simple to calculate the standardized weighted logrank statistic. Larger values of Z correspond to longer survival times on the experimental arm.

```
get_zs(modest_weights)
#> [1] 0.1515743
```