Summary of analysis for survival model meta-analysis

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Contents

1 Summary

This is a document that outlines analysis using survival models and meta-analyzing hazard ratios in the DataSHIELD platform.

2 Survival analysis in DataSHIELD

All code is available here:

- https://github.com/neelsoumya/dsBaseClient/tree/absolute_newbie_client
- https://github.com/neelsoumya/dsBase/tree/absolute_newbie
- https://github.com/neelsoumya/datashield_testing_basic/blob/master/development_plan.rmd
- https://github.com/neelsoumya/datashield_testing_basic/blob/master/development_plan.pdf
- https://github.com/neelsoumya/datashield_testing_basic/tree/master/gui/survival_models_gui

3 Model parameters

This report and the model has been run according to the following parameters.

Model	Exposure
Survival model	redmeat

4 Meta-analysis model summary

A summary of the meta-analyzed model is shown below.

```
##
## Random-Effects Model (k = 7; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0000 (SE = 0.0000)
## tau (square root of estimated tau^2 value):      0.0013
## I^2 (total heterogeneity / total variability):   68.93%
## H^2 (total variability / sampling variability):  3.22
##
## Test for Heterogeneity:
## Q(df = 6) = 17.5876, p-val = 0.0073
##
## Model Results:
##
## estimate      se       zval    pval   ci.lb   ci.ub
##   1.0024  0.0006  1696.8210  <.0001  1.0013  1.0036  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5 Cox model summary

A summary of the fitted Cox model for each study is shown below.

```
## Summary of Cox model .....

## $study1
## Call:
## survival::coxph(formula = formula, data = dataTable, weights = weights,
##     ties = ties, singular.ok = singular.ok, model = model, x = x,
##     y = y)
##
##   n= 834, number of events= 270
##
##             coef exp(coef) se(coef)     z Pr(>|z|)
## REDMEAT 0.003570  1.003576 0.001579 2.262   0.0237 *
## AGEBASE 0.039064  1.039837 0.008992 4.344  1.4e-05 ***
## GENDER0       NA        NA 0.000000    NA       NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##         exp(coef) exp(-coef) lower .95 upper .95
## REDMEAT     1.004     0.9964     1.000     1.007
```

```
## AGEBASE     1.040     0.9617     1.022     1.058
## GENDER0        NA         NA        NA        NA
##
## Concordance= 0.598  (se = 0.02 )
## Likelihood ratio test= 22.48  on 2 df,   p=1e-05
## Wald test            = 22.97  on 2 df,   p=1e-05
## Score (logrank) test = 23.22  on 2 df,   p=9e-06
##
##
## $study2
## Call:
## survival::coxph(formula = formula, data = dataTable, weights = weights,
##     ties = ties, singular.ok = singular.ok, model = model, x = x,
##     y = y)
##
##   n= 3152, number of events= 1294
##
##              coef exp(coef)  se(coef)      z Pr(>|z|)
## REDMEAT 0.0024237 1.0024266 0.0008344  2.905  0.00367 **
## AGEBASE 0.0394430 1.0402312 0.0036658 10.760  < 2e-16 ***
## GENDER0 0.1874405 1.2061585 0.0580663  3.228  0.00125 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##         exp(coef) exp(-coef) lower .95 upper .95
## REDMEAT     1.002     0.9976     1.001     1.004
## AGEBASE     1.040     0.9613     1.033     1.048
## GENDER0     1.206     0.8291     1.076     1.352
##
## Concordance= 0.615  (se = 0.01 )
## Likelihood ratio test= 132.3  on 3 df,   p=<2e-16
## Wald test            = 129.9  on 3 df,   p=<2e-16
## Score (logrank) test = 130.9  on 3 df,   p=<2e-16
##
##
## $study3
## Call:
## survival::coxph(formula = formula, data = dataTable, weights = weights,
##     ties = ties, singular.ok = singular.ok, model = model, x = x,
##     y = y)
##
##   n= 5698, number of events= 2401
##
##              coef exp(coef)  se(coef)      z Pr(>|z|)
## REDMEAT 0.0020253 1.0020273 0.0005615  3.607  0.00031 ***
## AGEBASE 0.0402877 1.0411102 0.0026936 14.957  < 2e-16 ***
## GENDER0 0.3332052 1.3954336 0.0437895  7.609 2.76e-14 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##         exp(coef) exp(-coef) lower .95 upper .95
## REDMEAT     1.002     0.9980     1.001     1.003
## AGEBASE     1.041     0.9605     1.036     1.047
## GENDER0     1.395     0.7166     1.281     1.520
```

```
##
## Concordance= 0.635  (se = 0.007 )
## Likelihood ratio test= 352.1  on 3 df,   p=<2e-16
## Wald test            = 344.4  on 3 df,   p=<2e-16
## Score (logrank) test = 349.5  on 3 df,   p=<2e-16
##
##
## $study4
## Call:
## survival::coxph(formula = formula, data = dataTable, weights = weights,
##     ties = ties, singular.ok = singular.ok, model = model, x = x,
##     y = y)
##
##   n= 2245, number of events= 762
##
##              coef exp(coef)  se(coef)     z Pr(>|z|)
## REDMEAT 0.0004296 1.0004297 0.0009821 0.437   0.6618
## AGEBASE 0.0292882 1.0297214 0.0038059 7.695 1.41e-14 ***
## GENDER0 0.2348292 1.2646927 0.0729980 3.217   0.0013 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##         exp(coef) exp(-coef) lower .95 upper .95
## REDMEAT     1.000     0.9996    0.9985     1.002
## AGEBASE     1.030     0.9711    1.0221     1.037
## GENDER0     1.265     0.7907    1.0961     1.459
##
## Concordance= 0.611  (se = 0.012 )
## Likelihood ratio test= 81.74  on 3 df,   p=<2e-16
## Wald test            = 77.92  on 3 df,   p=<2e-16
## Score (logrank) test = 78.59  on 3 df,   p=<2e-16
##
##
## $study5
## Call:
## survival::coxph(formula = formula, data = dataTable, weights = weights,
##     ties = ties, singular.ok = singular.ok, model = model, x = x,
##     y = y)
##
##   n= 2225, number of events= 804
##
##             coef exp(coef) se(coef)      z Pr(>|z|)
## REDMEAT 0.004798  1.004810 0.001098  4.370 1.24e-05 ***
## AGEBASE 0.052944  1.054371 0.004432 11.946  < 2e-16 ***
## GENDER0 0.459618  1.583468 0.096370  4.769 1.85e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##         exp(coef) exp(-coef) lower .95 upper .95
## REDMEAT     1.005     0.9952     1.003     1.007
## AGEBASE     1.054     0.9484     1.045     1.064
## GENDER0     1.583     0.6315     1.311     1.913
##
## Concordance= 0.656  (se = 0.011 )
```

```
## Likelihood ratio test= 181.5  on 3 df,   p=<2e-16
## Wald test            = 160.8  on 3 df,   p=<2e-16
## Score (logrank) test = 160.1  on 3 df,   p=<2e-16
##
##
## $study7
## Call:
## survival::coxph(formula = formula, data = dataTable, weights = weights,
##     ties = ties, singular.ok = singular.ok, model = model, x = x,
##     y = y)
##
##   n= 3471, number of events= 1521
##
##              coef exp(coef)  se(coef)      z Pr(>|z|)
## REDMEAT 0.0038167 1.0038240 0.0008181  4.665 3.08e-06 ***
## AGEBASE 0.0531791 1.0546185 0.0034303 15.503  < 2e-16 ***
## GENDER0 0.3523657 1.4224286 0.0550542  6.400 1.55e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##         exp(coef) exp(-coef) lower .95 upper .95
## REDMEAT     1.004     0.9962     1.002     1.005
## AGEBASE     1.055     0.9482     1.048     1.062
## GENDER0     1.422     0.7030     1.277     1.585
##
## Concordance= 0.689  (se = 0.009 )
## Likelihood ratio test= 393.4  on 3 df,   p=<2e-16
## Wald test            = 362.4  on 3 df,   p=<2e-16
## Score (logrank) test = 375.1  on 3 df,   p=<2e-16
##
##
## $study8
## Call:
## survival::coxph(formula = formula, data = dataTable, weights = weights,
##     ties = ties, singular.ok = singular.ok, model = model, x = x,
##     y = y)
##
##   n= 5241, number of events= 2408
##
##              coef exp(coef)  se(coef)     z Pr(>|z|)
## REDMEAT 0.0007826 1.0007829 0.0007236 1.082    0.279
## AGEBASE 0.0190070 1.0191888 0.0021495 8.842  < 2e-16 ***
## GENDER0 0.2755924 1.3173108 0.0415884 6.627 3.43e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##         exp(coef) exp(-coef) lower .95 upper .95
## REDMEAT     1.001     0.9992    0.9994     1.002
## AGEBASE     1.019     0.9812    1.0149     1.023
## GENDER0     1.317     0.7591    1.2142     1.429
##
## Concordance= 0.585  (se = 0.008 )
## Likelihood ratio test= 134.1  on 3 df,   p=<2e-16
## Wald test            = 131.1  on 3 df,   p=<2e-16
```

```
## Score (logrank) test = 131.7  on 3 df,   p=<2e-16
##
##
## $study9
## Call:
## survival::coxph(formula = formula, data = dataTable, weights = weights,
##     ties = ties, singular.ok = singular.ok, model = model, x = x,
##     y = y)
##
##   n= 5241, number of events= 2408
##
##              coef exp(coef)  se(coef)     z Pr(>|z|)
## REDMEAT 0.0007826 1.0007829 0.0007236 1.082    0.279
## AGEBASE 0.0190070 1.0191888 0.0021495 8.842  < 2e-16 ***
## GENDER0 0.2755924 1.3173108 0.0415884 6.627 3.43e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##         exp(coef) exp(-coef) lower .95 upper .95
## REDMEAT     1.001     0.9992    0.9994     1.002
## AGEBASE     1.019     0.9812    1.0149     1.023
## GENDER0     1.317     0.7591    1.2142     1.429
##
## Concordance= 0.585  (se = 0.008 )
## Likelihood ratio test= 134.1  on 3 df,   p=<2e-16
## Wald test            = 131.1  on 3 df,   p=<2e-16
## Score (logrank) test = 131.7  on 3 df,   p=<2e-16
```

6 Forest plot of meta-analyzed hazard ratios

We now outline the hazard ratios from the survival models which are meta-analyzed. We use the *metafor* package for meta-analysis. We show a forest plot below.

7 References

- https://github.com/datashield
- http://www.metafor-project.org
- https://github.com/neelsoumya/datashield_testing_basic/tree/master/gui/survival_models_gui

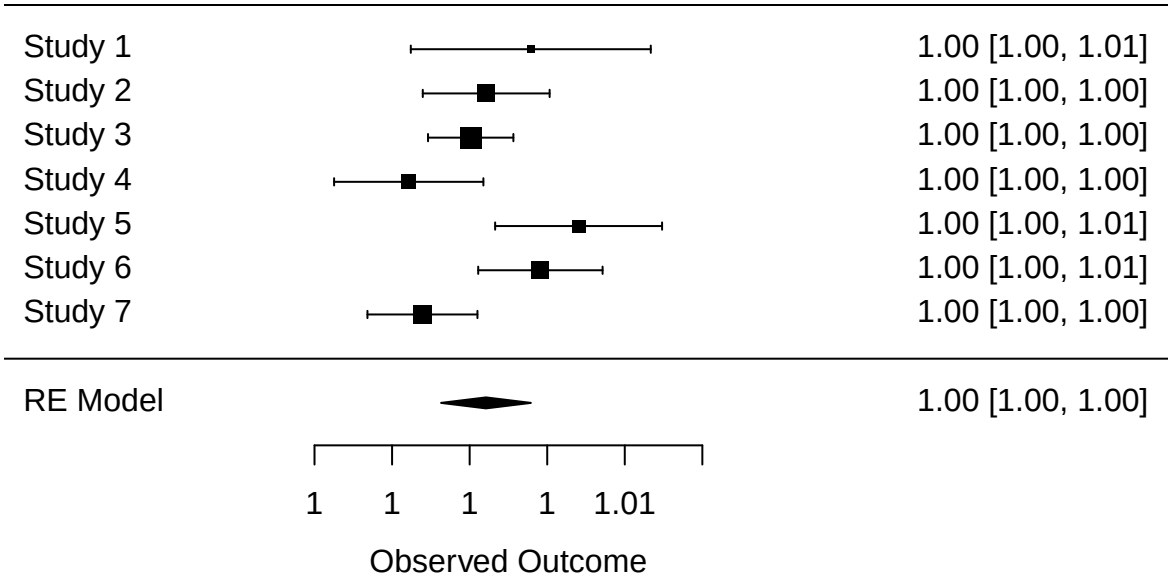

Figure 1: Forest plot of meta-analyzed hazard ratios.