

Practical Exercise 7, 2014

```
norw.death=read.table("http://folk.uio.no/borgan/abg-2008/data/
                      causes_death.txt", header=T)
norw.death=norw.death[norw.death$smkgr!=6, ]
library(survival)

# a)
fit0=coxph(Surv(agestart,agestop,dead)~factor(sex)+factor(smkgr),
           data=norw.death)

summary(fit0)

> summary(fit0)
n= 3929, number of events= 562

              coef exp(coef) se(coef)      z Pr(>|z|)
factor(sex)2  -0.54144   0.58191  0.09408 -5.755 8.65e-09 ***
factor(smkgr)2  0.31476   1.36992  0.13384  2.352  0.0187 *
factor(smkgr)3  0.89090   2.43733  0.14617  6.095 1.09e-09 ***
factor(smkgr)4  0.89495   2.44721  0.12716  7.038 1.95e-12 ***
factor(smkgr)5  1.08630   2.96329  0.15360  7.072 1.52e-12 ***
---
```

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	exp(coef)	exp(-coef)	lower .95	upper .95
factor(sex)2	0.5819	1.7185	0.4839	0.6997
factor(smkg)2	1.3699	0.7300	1.0538	1.7808
factor(smkg)3	2.4373	0.4103	1.8302	3.2459
factor(smkg)4	2.4472	0.4086	1.9074	3.1398
factor(smkg)5	2.9633	0.3375	2.1930	4.0042

Concordance= 0.641 (se = 0.013)

Rsquare= 0.038 (max possible= 0.896)

Likelihood ratio test= 153.2 on 5 df, p=0

Wald test = 144.6 on 5 df, p=0

Score (logrank) test = 156.1 on 5 df, p=0

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```
# b) Including systolic blood pressure (sbp) and body mass index (bmi)
names(norw.death)
fit1=coxph(Surv(agestart,agestop,dead)~factor(sex)+factor(smkggr)+sbp
           +bmi,data=norw.death)
```

```
> fit1
```

	coef	exp(coef)	se(coef)	z	p
factor(sex)2	-0.50341	0.60447	0.09570	-5.26	1.4e-07
factor(smkggr)2	0.34679	1.41452	0.13602	2.55	0.011
factor(smkggr)3	0.92299	2.51680	0.14835	6.22	4.9e-10
factor(smkggr)4	0.93969	2.55920	0.13006	7.23	5.0e-13
factor(smkggr)5	1.16135	3.19424	0.15687	7.40	1.3e-13
sbp	0.01742	1.01757	0.00217	8.03	1.0e-15
bmi	0.01589	1.01602	0.01244	1.28	0.202

```
Likelihood ratio test=219 on 7 df, p=0
```

```
n= 3863, number of events= 548
```

```
(66 observations deleted due to missingness)
```

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```
# c) Interactions
fit2=coxph(Surv(agestart,agestop,dead)~factor(sex)+factor(smkggr)+sbp*bmi)
#summary(fit2)
fit2
```

```
> fit2
```

	coef	exp(coef)	se(coef)	z	p
factor(sex)2	-0.528115	0.589715	0.096827	-5.45	4.9e-08
factor(smkggr)2	0.343225	1.409486	0.135962	2.52	0.012
factor(smkggr)3	0.913766	2.493697	0.148366	6.16	7.3e-10
factor(smkggr)4	0.935509	2.548511	0.130002	7.20	6.2e-13
factor(smkggr)5	1.149143	3.155489	0.156928	7.32	2.4e-13
sbp	-0.011476	0.988590	0.014647	-0.78	0.433
bmi	-0.147490	0.862871	0.082924	-1.78	0.075
sbp:bmi	0.001124	1.001125	0.000561	2.00	0.045

```
Likelihood ratio test=223 on 8 df, p=0
```

```
n= 3863, number of events= 548
```

```
(66 observations deleted due to missingness)
```

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```
# c) More interactions
```

```
> fit2b=coxph(Surv(agestart,agestop,dead)~factor(sex)*factor(smkggr)+sbp  
> #summary(fit2b)  
> fit2b
```

	coef	exp(coef)	se(coef)	z	p
factor(sex)2	-0.36362	0.69516	0.20151	-1.80	0.071
factor(smkggr)2	0.40799	1.50379	0.18577	2.20	0.028
factor(smkggr)3	1.06479	2.90023	0.21081	5.05	4.4e-07
factor(smkggr)4	1.08532	2.96038	0.18201	5.96	2.5e-09
factor(smkggr)5	1.17380	3.23427	0.20071	5.85	5.0e-09
sbp	0.01770	1.01786	0.00218	8.12	4.4e-16
bmi	0.01578	1.01590	0.01244	1.27	0.205
factor(sex)2:factor(smkggr)2	-0.05234	0.94901	0.28802	-0.18	0.856
factor(sex)2:factor(smkggr)3	-0.28578	0.75143	0.30169	-0.95	0.344
factor(sex)2:factor(smkggr)4	-0.36636	0.69325	0.27279	-1.34	0.179
factor(sex)2:factor(smkggr)5	0.32166	1.37941	0.35868	0.90	0.370

```
Likelihood ratio test=224 on 11 df, p=0
```

```
n= 3863, number of events= 548
```

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```
# c) Interactions with ANOVA-table
```

```
> anova(fit1,fit2b)
```

```
Analysis of Deviance Table
```

```
Cox model: response is Surv(agestart, agestop, dead)
```

```
Model 1: ~ factor(sex) + factor(smkg) + sbp + bmi
```

```
Model 2: ~ factor(sex) * factor(smkg) + sbp + bmi
```

```
loglik Chisq Df P(>|Chi|)
```

```
1 -4221.5
```

```
2 -4219.1 4.8586 4 0.3021
```

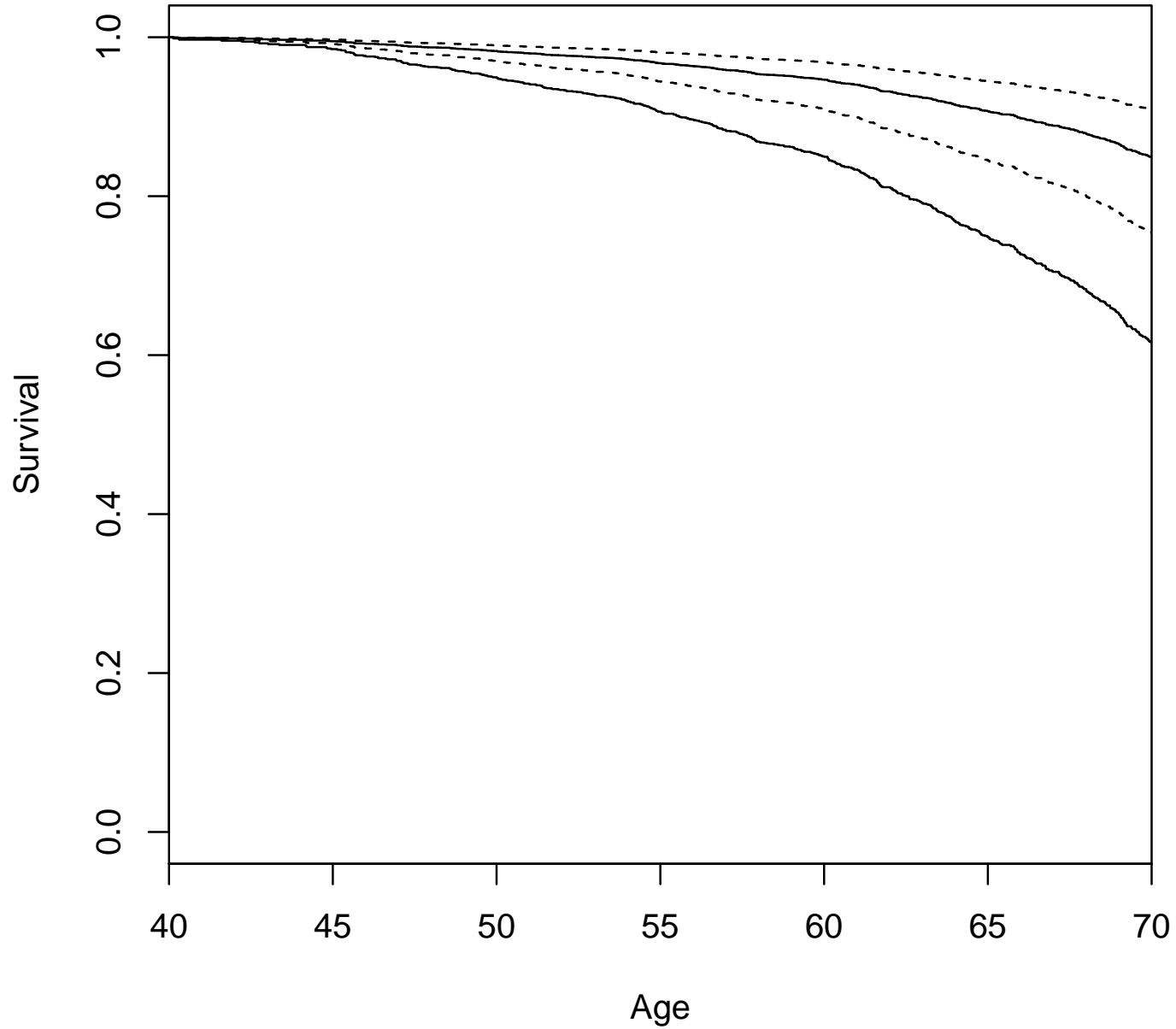
```
# d) Estimated survival Men / Women , Smokers / Non-smokers
```

```
new.cov=data.frame(sex=c(1,1,2,2),smkg=c(1,5,1,5))
```

```
surv0=survfit(fit0,newdata=new.cov)
```

```
plot(surv0,mark.time=F,xlim=c(40,70),xlab="Age",ylab="Survival",  
lty=c(1,1,2,2))
```

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```
# Estimated survival BMI and SBP
new.cov=data.frame(sex=rep(1,4),smkgr=rep(1,4),sbp=c(110,110,200,200),
                  bmi=c(20,30,20,30))

surv1=survfit(fit1,newdata=new.cov)
plot(surv1,mark.time=F,xlim=c(40,70),xlab="Age",ylab="Survival",
     lty=c(1,1,2,2))
```

