

iCARE(Individualized Coherent Absolute Risk Estimators) Package

November 6, 2019

```
> library(iCARE)
```

Example 1.A

Load the breast cancer data.

```
> data("bc_data", package="iCARE")
```

In this example, we will estimate the risk of breast cancer in ages 50-80. A SNP-only model is fit, with no specific genotypes supplied for estimation. The population disease rates are from SEER.

```
> res_snps_miss = computeAbsoluteRisk(model.snp.info = bc_72_snps,
+                                     model.disease.incidence.rates = bc_inc,
+                                     model.competing.incidence.rates = mort_inc,
+                                     apply.age.start = 50,
+                                     apply.age.interval.length = 30,
+                                     return.refs.risk=TRUE)
```

Note: You did not provide apply.snp.profile. Will impute SNPs for 10000 people.
If require more, please provide apply.snp.profile input.

```
[1] "Note: As specified, the model does not adjust SNP imputations for family history."
      user system elapsed
10.70    0.34    11.06
```

Compute a summary of the risks and visualize the results

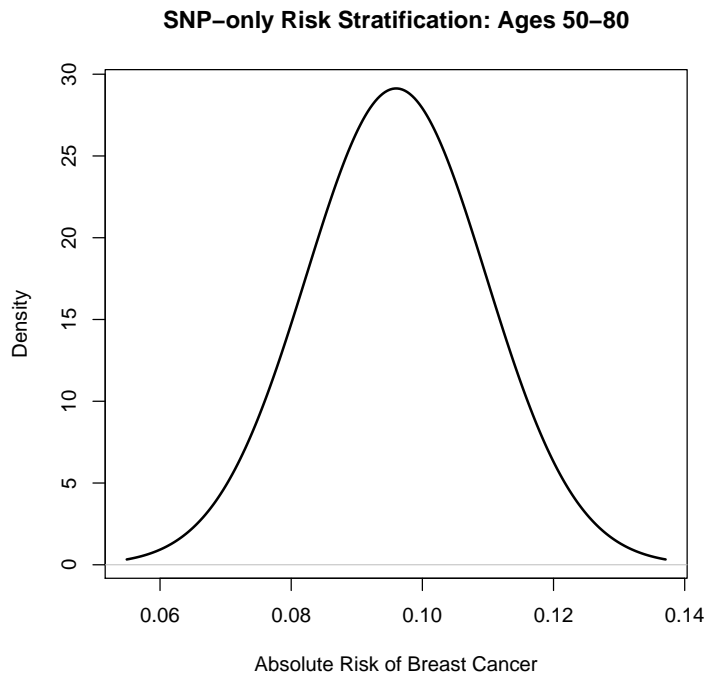
```
> summary(res_snps_miss$risk)
```

```
Risk_Estimate
Min.      :0.096
1st Qu.:0.096
Median :0.096
Mean     :0.096
3rd Qu.:0.096
Max.     :0.096
```

```
> summary(res_snps_miss$refs.risk)
```

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
0.05825	0.08639	0.09513	0.09600	0.10430	0.16124

```
> plot(density(res_snps_miss$risk), lwd=2,
+      main="SNP-only Risk Stratification: Ages 50-80",
+      xlab="Absolute Risk of Breast Cancer")
```



Example 1.B

In this example, we will again estimate the risk of breast cancer in ages 50-80. This time however, three specific genotypes are supplied for estimation (with some missing data). The argument `return.refs.risk = TRUE`, includes the referent dataset risks be included in results.

```
> res_snps_dat = computeAbsoluteRisk(model.snp.info = bc_72_snps,
+                                   model.disease.incidence.rates = bc_inc,
+                                   model.competing.incidence.rates = mort_inc,
+                                   apply.age.start = 50,
+                                   apply.age.interval.length = 30,
+                                   apply.snp.profile = new_snp_prof,
+                                   return.refs.risk = TRUE)
```

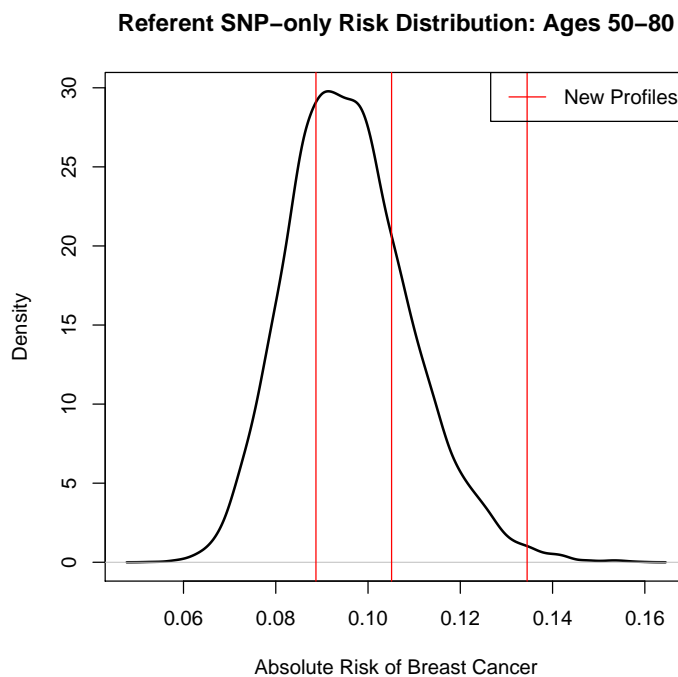
```
[1] "Note: As specified, the model does not adjust SNP imputations for family history."
      user system elapsed
0.38    0.19    0.57
```

```
> names(res_snps_dat)
```

```
[1] "risk"      "details"   "beta.used" "refs.risk"
```

Visualize the Results

```
> plot(density(res_snps_dat$refs.risk), lwd=2,
+      main="Referent SNP-only Risk Distribution: Ages 50-80",
+      xlab="Absolute Risk of Breast Cancer")
> abline(v=res_snps_dat$risk, col="red")
> legend("topright", legend="New Profiles", col="red", lwd=1)
```



Example 2

In this example, we will estimate the risk of breast cancer in ages 50-80 by fitting a model with 13 risk factors and 72 SNPs.

```
> res_covs_snps = computeAbsoluteRisk(model.formula=bc_model_formula,
+                                     model.cov.info=bc_model_cov_info,
+                                     model.snp.info=bc_72_snps,
+                                     model.log.RR=bc_model_log_or,
+                                     model.ref.dataset=ref_cov_dat,
+                                     model.disease.incidence.rates=bc_inc,
+                                     model.competing.incidence.rates=mort_inc,
+                                     model.bin.fh.name="famhist",
+                                     apply.age.start=50,
+                                     apply.age.interval.length=30,
+                                     apply.cov.profile=new_cov_prof,
```

```

+                                     apply.snp.profile=new_snp_prof,
+                                     return.refs.risk=TRUE)

user  system elapsed
1.06   0.25   1.31

Display details of the fit
> print(res_covs_snps$details)

Int_Start Int_End Risk_Estimate rs616488 rs11552449 rs11249433 rs12405132
1         50      80      0.1024582      NA      NA      NA      NA
2         50      80      0.0901514      2      0      NA      NA
3         50      80      0.1690787      2      0      1      1
rs12048493 rs6678914 rs4245739 rs72755295 rs12710696 rs4849887 rs2016394
1         NA      0      0      0      0      0      0
2         NA      NA      NA      NA      1      1      0
3         1      1      1      0      2      0      0
rs1550623 rs16857609 rs6762644 rs4973768 rs12493607 rs6796502 rs9790517
1         0      0      0      1      1      0      1
2         0      2      1      1      1      1      2
3         0      0      0      2      1      0      1
rs6828523 rs10069690 rs13162653 rs2012709 rs10941679 rs10472076 rs1353747
1         0      1      2      0      0      2      0
2         0      0      1      0      0      1      1
3         0      0      1      0      0      0      1
rs7707921 rs1432679 rs11242675 rs204247 rs9257408 rs4593472 rs720475
1         0      1      2      0      0      1      1
2         0      0      1      2      1      1      0
3         1      2      1      2      1      1      0
rs9693444 rs13365225 rs6472903 rs2943559 rs13267382 rs11780156 rs1011970
1         1      1      1      0      0      0      0
2         0      0      1      0      2      1      1
3         1      1      0      0      1      0      0
rs10759243 rs2380205 rs7072776 rs11814448 rs7904519 rs11199914 rs554219
1         0      2      2      0      0      1      1
2         1      0      0      0      0      0      0
3         1      1      1      0      2      0      1
rs75915166 rs11820646 rs12422552 rs17356907 rs1292011 rs11571833 rs2236007
1         0      1      1      0      1      0      1
2         0      0      0      0      0      0      0
3         0      1      1      0      2      0      0
rs2588809 rs999737 rs941764 rs11627032 rs17817449 rs11075995 rs13329835
1         0      0      1      0      1      1      1
2         1      0      0      1      1      1      0
3         0      0      1      0      0      1      1
rs146699004 rs745570 rs527616 rs1436904 rs6507583 rs4808801 rs3760982
1         0      0      0      0      0      1      0
2         1      2      0      0      0      1      1
3         1      2      1      1      0      1      1
rs2284378 rs2823093 rs17879961 rs132390 rs6001930 famhist menarche_dec parity

```

1	1	1	0	0	0	0	8	0
2	1	0	0	0	0	0	10	0
3	0	0	0	0	0	0	1	0
	birth_dec	agemeno_dec	height_dec	bmi_dec	rd_menohrt	rd2_everhrt_e		
1	2	2	6	10	1	0		
2	2	1	6	4	1	0		
3	1	7	1	10	1	0		
	rd2_everhrt_c	rd2_currhrt	alcoholdec	week_dec	ever_smoke			
1	0	0		1	1			
2	0	0		6	0			
3	0	0		1	1			

Session Information

```
> sessionInfo()
```

```
R Under development (unstable) (2019-11-04 r77367)
Platform: x86_64-w64-mingw32/x64 (64-bit)
Running under: Windows Server 2012 R2 x64 (build 9600)
```

```
Matrix products: default
```

```
locale:
```

```
[1] LC_COLLATE=C
[2] LC_CTYPE=English_United States.1252
[3] LC_MONETARY=English_United States.1252
[4] LC_NUMERIC=C
[5] LC_TIME=English_United States.1252
```

```
attached base packages:
```

```
[1] stats      graphics  grDevices  utils      datasets  methods    base
```

```
other attached packages:
```

```
[1] iCARE_1.15.0    Hmisc_4.2-0     ggplot2_3.2.1   Formula_1.2-3
[5] survival_3.1-6  lattice_0.20-38 gtools_3.8.1    plotrix_3.7-6
```

```
loaded via a namespace (and not attached):
```

```
[1] Rcpp_1.0.2      pillar_1.4.2    compiler_4.0.0
[4] RColorBrewer_1.1-2 base64enc_0.1-3  tools_4.0.0
[7] digest_0.6.22   rpart_4.1-15    checkmate_1.9.4
[10] htmlTable_1.13.2 tibble_2.1.3    gtable_0.3.0
[13] pkgconfig_2.0.3 rlang_0.4.1     Matrix_1.2-17
[16] rstudioapi_0.10 xfun_0.10       gridExtra_2.3
[19] stringr_1.4.0   knitr_1.25      withr_2.1.2
[22] dplyr_0.8.3     cluster_2.1.0   htmlwidgets_1.5.1
[25] grid_4.0.0      nnet_7.3-12     tidyselect_0.2.5
[28] data.table_1.12.6 glue_1.3.1      R6_2.4.0
[31] foreign_0.8-72  latticeExtra_0.6-28 purrr_0.3.3
[34] magrittr_1.5    htmltools_0.4.0 backports_1.1.5
```

[37]	scales_1.0.0	splines_4.0.0	assertthat_0.2.1
[40]	colorspace_1.4-1	stringi_1.4.3	acepack_1.4.1
[43]	lazyeval_0.2.2	munsell_0.5.0	crayon_1.3.4