

# iCARE(Individualized Coherent Absolute Risk Estimators) Package

October 29, 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
```

```
16.694 0.008 16.816
```

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
```

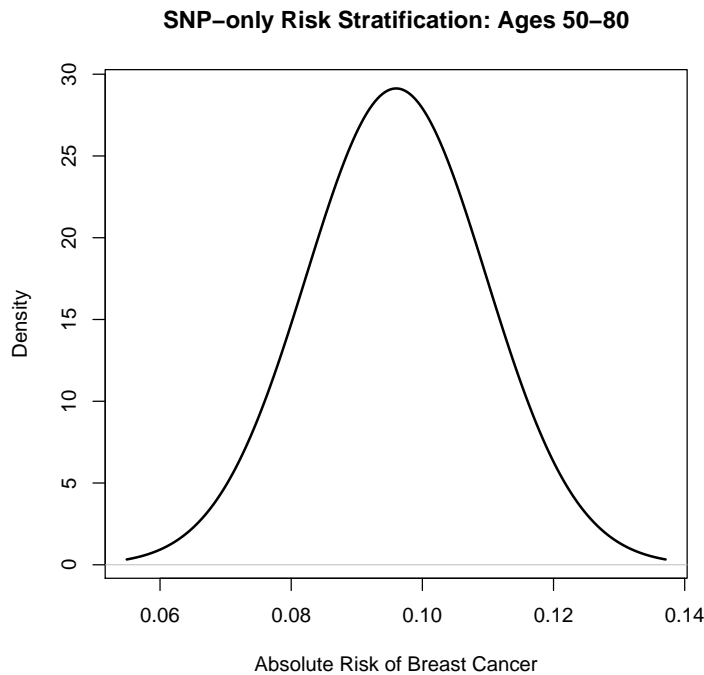
```
3rd Qu.:0.096
```

```
Max. :0.096
```

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

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
0.05685	0.08656	0.09504	0.09600	0.10443	0.16394

```
> 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)
```

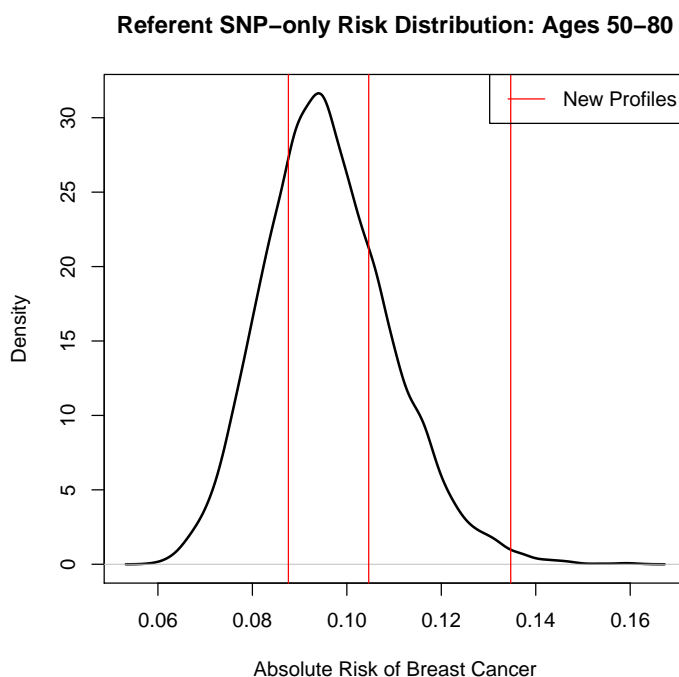
```
[1] "Note: As specified, the model does not adjust SNP imputations for family history."
      user system elapsed
0.740   0.020   1.003
```

```
> 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
1.554  0.188   1.947

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

Int_Start Int_End Risk_Estimate rs616488 rs11552449 rs11249433 rs12405132
1         50      80    0.10239554      NA      NA      NA      NA
2         50      80    0.09020315       2       0      NA      NA
3         50      80    0.16883665       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	alcoholweek_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) (2019-10-24 r77329)

Platform: x86\_64-pc-linux-gnu (64-bit)

Running under: Ubuntu 18.04.3 LTS

Matrix products: default

BLAS: /home/biocbuild/bbs-3.11-bioc/R/lib/libRblas.so

LAPACK: /home/biocbuild/bbs-3.11-bioc/R/lib/libRlapack.so

locale:

```
[1] LC_CTYPE=en_US.UTF-8      LC_NUMERIC=C
[3] LC_TIME=en_US.UTF-8      LC_COLLATE=C
[5] LC_MONETARY=en_US.UTF-8  LC_MESSAGES=en_US.UTF-8
[7] LC_PAPER=en_US.UTF-8     LC_NAME=C
[9] LC_ADDRESS=C             LC_TELEPHONE=C
[11] LC_MEASUREMENT=en_US.UTF-8 LC_IDENTIFICATION=C
```

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_2.44-1.1 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