

iCARE(Individualized Coherent Absolute Risk Estimators) Package

April 15, 2025

```
> 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  
12.119 0.117 12.236
```

Compute a summary of the risks and visualize the results

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

```
Risk_Estimate  
Min. :0.09601  
1st Qu.:0.09601  
Median :0.09601  
Mean :0.09601  
3rd Qu.:0.09601  
Max. :0.09601
```

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

```

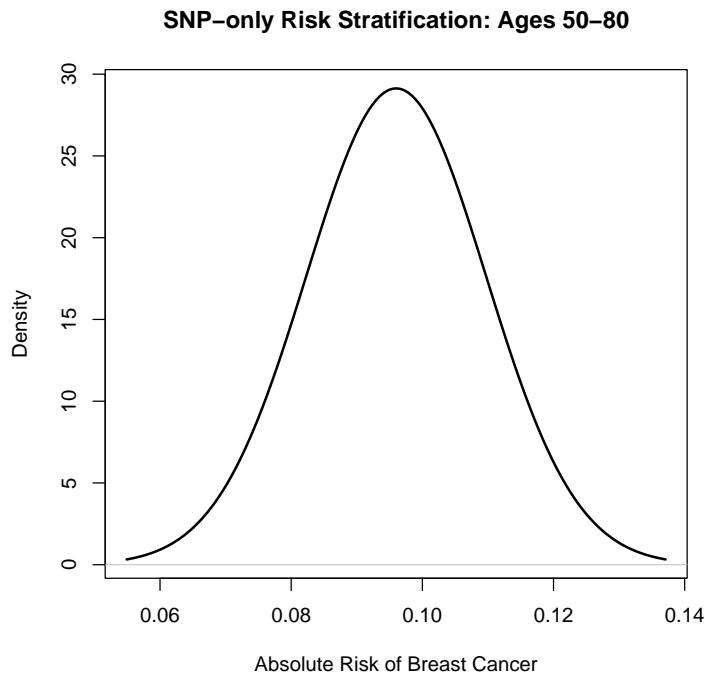
      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
0.05418 0.08651 0.09492 0.09601 0.10434 0.15953

```

```

> 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
0.363  0.010  0.373

```

```

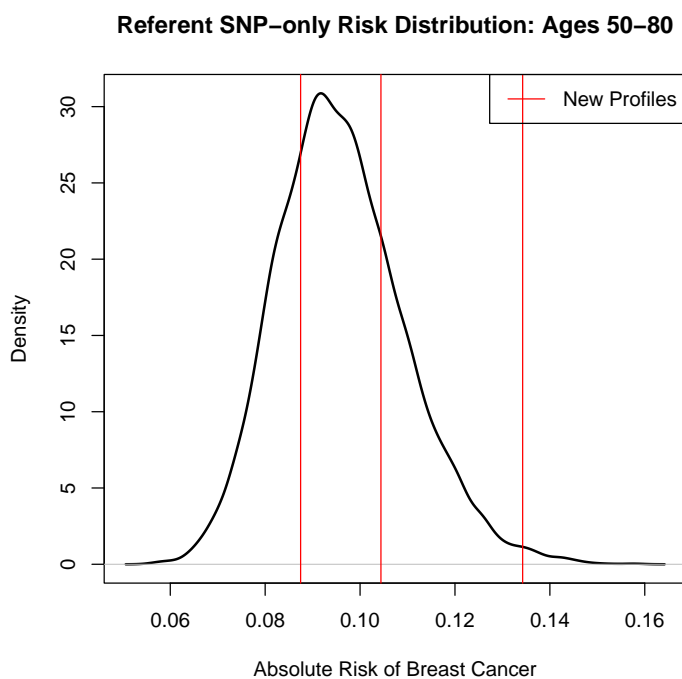
> names(res_snps_dat)

```

```
[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
1.070  0.326  1.396

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

Int_Start Int_End Risk_Estimate rs616488 rs11552449 rs11249433 rs12405132
1         50      80    0.10216707         NA         NA         NA         NA
2         50      80    0.09006272          2          0         NA         NA
3         50      80    0.16858517          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          0          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 version 4.5.0 RC (2025-04-04 r88126)

Platform: x86_64-pc-linux-gnu

Running under: Ubuntu 24.04.2 LTS

Matrix products: default

BLAS: /home/biocbuild/bbs-3.21-bioc/R/lib/libRblas.so

LAPACK: /usr/lib/x86_64-linux-gnu/lapack/liblapack.so.3.12.0 LAPACK version 3.12.0

locale:

```
[1] LC_CTYPE=en_US.UTF-8      LC_NUMERIC=C
[3] LC_TIME=en_GB            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
```

time zone: America/New_York

tzcode source: system (glibc)

attached base packages:

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

other attached packages:

```
[1] iCARE_1.36.0 Hmisc_5.2-3 gtools_3.9.5 plotrix_3.8-4
```

loaded via a namespace (and not attached):

```
[1] gtable_0.3.6      dplyr_1.1.4      compiler_4.5.0   rpart_4.1.24
[5] tidyselect_1.2.1  htmlTable_2.4.3  stringr_1.5.1    gridExtra_2.3
[9] cluster_2.1.8.1  scales_1.3.0     fastmap_1.2.0    ggplot2_3.5.2
[13] R6_2.6.1          generics_0.1.3   Formula_1.2-5    knitr_1.50
[17] htmlwidgets_1.6.4 backports_1.5.0  checkmate_2.3.2  tibble_3.2.1
[21] munsell_0.5.1     nnet_7.3-20     pillar_1.10.2    rlang_1.1.6
[25] stringi_1.8.7     xfun_0.52        cli_3.6.4        magrittr_2.0.3
```

```
[29] digest_0.6.37      grid_4.5.0          rstudioapi_0.17.1  base64enc_0.1-3
[33] lifecycle_1.0.4    vctrs_0.6.5        data.table_1.17.0  evaluate_1.0.3
[37] glue_1.8.0         colorspace_2.1-1   rmarkdown_2.29     foreign_0.8-90
[41] tools_4.5.0        pkgconfig_2.0.3    htmltools_0.5.8.1
```