

iCARE(Individualized Coherent Absolute Risk Estimators) Package

October 30, 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
12.156   0.101  12.260
```

Compute a summary of the risks and visualize the results

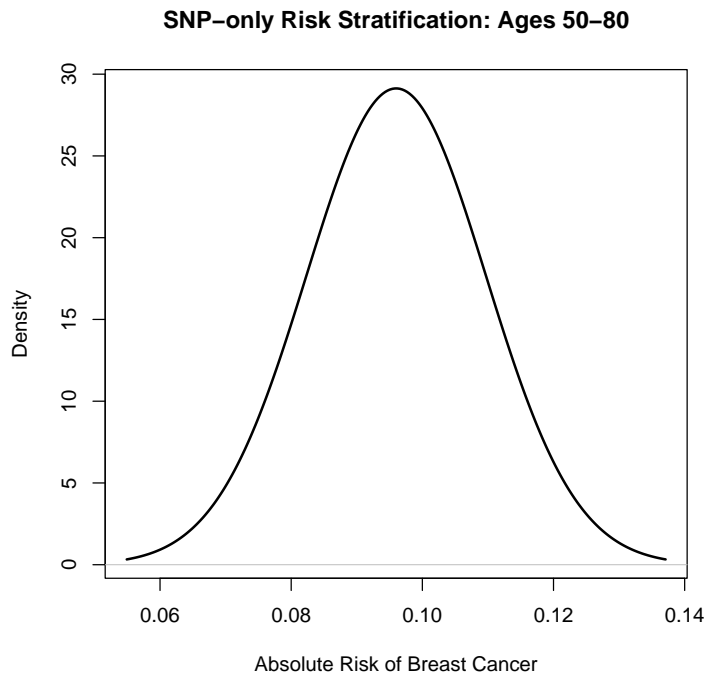
```
> summary(res_snps_miss$risk)
```

```
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.
0.05648	0.08654	0.09501	0.09601	0.10433	0.17917

```
> 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)
```

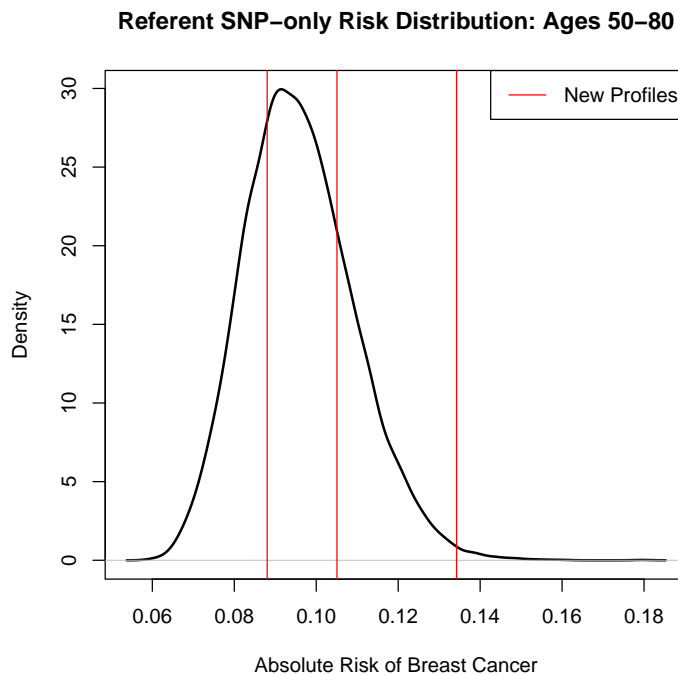
```
[1] "Note: As specified, the model does not adjust SNP imputations for family history."
      user system elapsed
0.453   0.007   0.462
```

```
> 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
1.158  0.311   1.469

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

Int_Start Int_End Risk_Estimate rs616488 rs11552449 rs11249433 rs12405132
1          50      80    0.10288235      NA      NA      NA      NA
2          50      80    0.09009057      2      0      NA      NA
3          50      80    0.16856731      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 version 4.5.1 Patched (2025-08-23 r88802)

Platform: x86_64-pc-linux-gnu

Running under: Ubuntu 24.04.3 LTS

Matrix products: default

BLAS: /home/biocbuild/bbs-3.22-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_1.38.0 Hmisc_5.2-4 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_4.5.1    rpart_4.1.24
[5] tidyselect_1.2.1  htmlTable_2.4.3  stringr_1.5.2     dichromat_2.0-0.1
[9] gridExtra_2.3     cluster_2.1.8.1  scales_1.4.0      fastmap_1.2.0
[13] ggplot2_4.0.0     R6_2.6.1         generics_0.1.4    Formula_1.2-5
[17] knitr_1.50        htmlwidgets_1.6.4 backports_1.5.0    checkmate_2.3.3
[21] tibble_3.3.0      nnet_7.3-20      pillar_1.11.1     RColorBrewer_1.1-3
[25] rlang_1.1.6       stringi_1.8.7    xfun_0.53         S7_0.2.0
```

[29]	cli_3.6.5	magrittr_2.0.4	digest_0.6.37	grid_4.5.1
[33]	rstudioapi_0.17.1	base64enc_0.1-3	lifecycle_1.0.4	vctrs_0.6.5
[37]	data.table_1.17.8	evaluate_1.0.5	glue_1.8.0	farver_2.1.2
[41]	colorspace_2.1-2	rmarkdown_2.30	foreign_0.8-90	tools_4.5.1
[45]	pkgconfig_2.0.3	htmltools_0.5.8.1		