

# iCARE(Individualized Coherent Absolute Risk Estimators) Package

October 7, 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  
11.964   0.083   12.049
```

Compute a summary of the risks and visualize the results

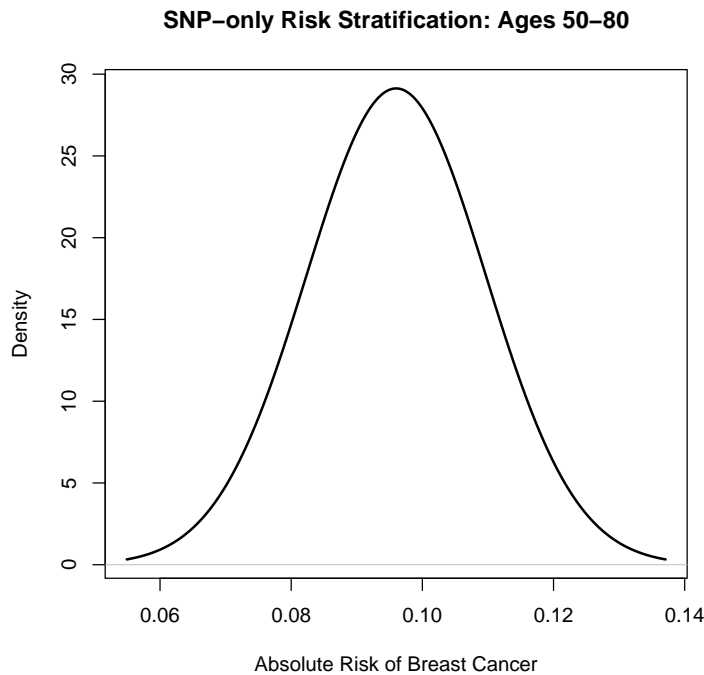
```
> summary(res_snps_miss$risk)
```

```
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.    |
|--|---------|---------|---------|---------|---------|---------|
|  | 0.05866 | 0.08633 | 0.09494 | 0.09601 | 0.10458 | 0.16191 |

```
> 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)
```

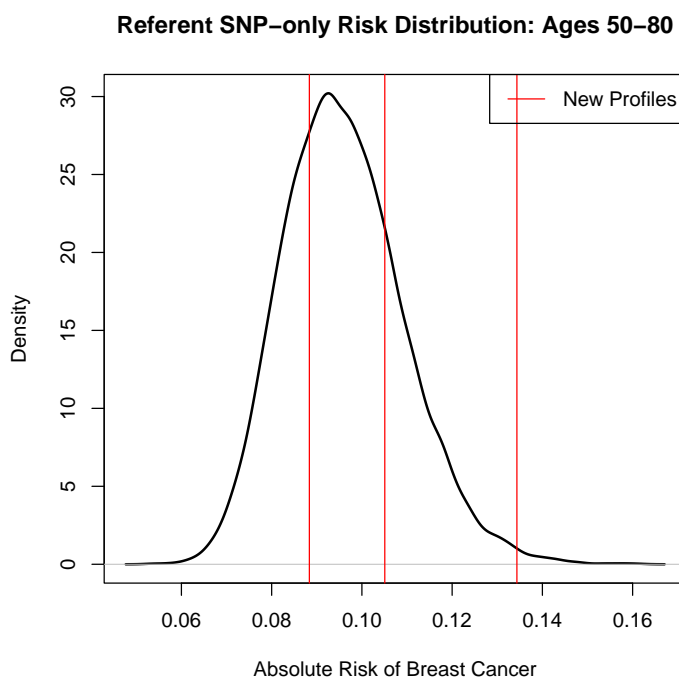
```
[1] "Note: As specified, the model does not adjust SNP imputations for family history."
      user system elapsed
0.434   0.007   0.442
```

```
> 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
1.129  0.288   1.417

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

Int_Start Int_End Risk_Estimate rs616488 rs11552449 rs11249433 rs12405132
1         50      80    0.10232545      NA      NA      NA      NA
2         50      80    0.09000722       2       0      NA      NA
3         50      80    0.16904477       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_1.37.0 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 |                 |              |