

# ATbounds-vignette-RHC

```
library(ATbounds)
```

## Right Heart Catheterization Dataset

In this vignette, we revisit the well-known Right Heart Catheterization Dataset available at Vanderbilt Biostatistics Datasets Page. A cleaned version of the dataset is available in the package.

```
Y <- RHC[, "survival"]
D <- RHC[, "RHC"]
X <- RHC[, -c(1, 2)]
```

## Bounding the Average Treatment Effect

We take the reference propensity score to be  $\hat{p}_{\text{RPS}}(X_i) = n^{-1} \sum_{i=1}^n D_i$  for each observation  $i$ . That is, we assign the sample proportion of the treated to the reference propensity scores uniformly for all observations. Of course, this is likely to be misspecified; however, it has the advantage that  $1/\hat{p}_{\text{RPS}}(X_i)$  is never close to 0 or 1.

```
rps <- rep(mean(D), length(D))
```

We start with  $q = 1$ .

```
atebounds(Y, D, X, rps, q = 1)
#> $y1_lb
#> [1] 0.1217088
#>
#> $y1_ub
#> [1] 0.7408893
#>
#> $y0_lb
#> [1] 0.2292938
#>
#> $y0_ub
#> [1] 0.6101133
#>
#> $ate_lb
#> [1] -0.4884045
#>
#> $ate_ub
#> [1] 0.5115955
#>
#> $ate_rps
#> [1] -0.05072115
#>
#> attr(,"class")
#> [1] "ATbounds"
```

We now consider  $q = 2$

```

atebounds(Y, D, X, rps, q = 2)
#> $y1_lb
#> [1] 0.1919228
#>
#> $y1_ub
#> [1] 0.5253205
#>
#> $y0_lb
#> [1] 0.3108389
#>
#> $y0_ub
#> [1] 0.4505982
#>
#> $ate_lb
#> [1] -0.2586755
#>
#> $ate_ub
#> [1] 0.2144815
#>
#> $ate_rps
#> [1] -0.05072115
#>
#> attr("class")
#> [1] "ATbounds"

```

and  $q = 3$ .

```

atebounds(Y, D, X, rps, q = 3)
#> $y1_lb
#> [1] 0.2390884
#>
#> $y1_ub
#> [1] 0.4545434
#>
#> $y0_lb
#> [1] 0.3437921
#>
#> $y0_ub
#> [1] 0.4073485
#>
#> $ate_lb
#> [1] -0.1682601
#>
#> $ate_ub
#> [1] 0.1107513
#>
#> $ate_rps
#> [1] -0.05072115
#>
#> attr("class")
#> [1] "ATbounds"

```

Finally, we take a relatively large  $q = 10$ .

```

atebounds(Y, D, X, rps, q = 10)
#> $y1_lb
#> [1] 0.1032951
#>
#> $y1_ub
#> [1] 0.4865839
#>
#> $y0_lb
#> [1] 0.3520645
#>
#> $y0_ub
#> [1] 0.3741887
#>
#> $ate_lb
#> [1] -0.2708936
#>
#> $ate_ub
#> [1] 0.1345195
#>
#> $ate_rps
#> [1] -0.05072115
#>
#> attr("class")
#> [1] "ATbounds"

```

## Bounding the Average Treatment Effect on the Treated

We now look at ATT with a few values of  $q$ .

```

attbounds(Y, D, X, rps, q = 3)
#> $lb
#> [1] -0.1479596
#>
#> $ub
#> [1] 0.01893426
#>
#> $att_rps
#> [1] -0.05072115
#>
#> attr("class")
#> [1] "ATbounds"
attbounds(Y, D, X, rps, q = 5)
#> $lb
#> [1] -0.1059798
#>
#> $ub
#> [1] -0.01226633
#>
#> $att_rps
#> [1] -0.05072115
#>
#> attr("class")
#> [1] "ATbounds"
attbounds(Y, D, X, rps, q = 10)

```

```
#> $lb  
#> [1] -0.06088469  
#>  
#> $ub  
#> [1] -0.002788356  
#>  
#> $att_rps  
#> [1] -0.05072115  
#>  
#> attr("class")  
#> [1] "ATbounds"
```