

# QBS 103 Project submission 2

2024-07-27

```
setwd("/Users/kevinyang/Documents/QBS103/data")
genes <- read.csv("QBS103_GSE157103_genes.csv")
meta <- read.csv("QBS103_GSE157103_series_matrix.csv")
```

```
library(ggplot2)
library(tidyr)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
## The following objects are masked from 'package:stats':
##
##   filter, lag
## The following objects are masked from 'package:base':
##
##   intersect, setdiff, setequal, union
```

```
library(ggpubr)
```

```
# merge the dataframe with selected gene
```

```
gene_name <- "A1BG"
gene_expression <- genes %>%
  filter(X == gene_name) %>% # select the column with the gene name
  select(-X) %>% # get rid of X
  t() %>% # transpose the data
  as.numeric() # turn into a numeric vector
```

```
new_data <- data.frame(meta$participant_id, meta$geo_accession, meta$sex, meta$icu_status, meta$ventilator_free_days)
```

```
# histogram of gene expression
```

```
# Create a data frame
```

```
gene_expression_df <- data.frame(Expression = gene_expression)
```

```
# Plot the histogram
```

```
my_hist <- ggplot(gene_expression_df, aes(x = Expression)) +
  geom_histogram(binwidth = 0.1, fill = "blue", color = "black", alpha = 0.7) +
  ggtitle(paste("Histogram of Gene Expression for", gene_name)) +
  xlab("Expression Value") +
  ylab("Frequency") +
  theme_classic()
ggsave("my_hist.pdf", plot=my_hist, width = 8, height = 6)
```

```
my_scatterplot <- ggplot(new_data, aes(x = gene_expression, y = meta.ventilator_free_days)) +
  geom_point(color = "blue", alpha = 0.7) +
  ggtitle(paste("Scatterplot of", gene_name, "Expression vs", "Ventilator Free Days")) +
```

```

xlab("Gene Expression") +
ylab("Number of Ventilator Free Days") +
theme_minimal() + theme(
  legend.position = "bottom",
  plot.title = element_text(hjust = 0.5, size = 14, face = "bold"),
  axis.title.x = element_text(size = 12, face = "bold"),
  axis.title.y = element_text(size = 12, face = "bold"),
  axis.text = element_text(size = 10)
)
ggsave("my_scatterplot.pdf", plot=my_scatterplot, width = 8, height = 6)

new_data <- new_data %>%
filter(meta.sex != " unknown")
colors = c("orangered", "palegreen")
# boxplot
my_boxplot <- ggplot(new_data, aes(x = meta.sex, y = gene_expression, fill = meta.icu_status)) +
geom_boxplot() +
scale_fill_manual(values = colors) +
ggtitle(paste("Boxplot of", gene_name, "Expression by Sex and ICU Status")) +
xlab("Sex") +
ylab("Gene Expression") +
theme_minimal() +
theme(
  legend.position = "bottom",
  plot.title = element_text(hjust = 0.5, size = 14, face = "bold"),
  axis.title.x = element_text(size = 12, face = "bold"),
  axis.title.y = element_text(size = 12, face = "bold"),
  axis.text = element_text(size = 10)
)
ggsave("my_boxplot.pdf", plot=my_boxplot, width = 8, height = 6)

plotting <- function(data_name, genes_list, cts_var, cate_var1, cate_var2, genes) {

  for (gene in genes_list) {
    # Create a data frame with the extracted gene expression data
    data <- data.frame(
      cate_var1 = data_name[,cate_var1],
      cate_var2 = data_name[,cate_var2],
      cts_var = data_name[,cts_var],
      gene_expression = genes %>%
        filter(X == gene) %>% # Assuming 'X' is the column with gene names
        select(-X) %>% # Remove the gene name column
        t() %>% # Transpose the data
        as.numeric() # Convert to numeric vector
    )

    # Plot 1: Histogram of Gene Expression
    plot1 <- ggplot(data, aes(x = gene_expression)) +
      geom_histogram(binwidth = 0.1, fill = "blue", color = "black", alpha = 0.7) +
      ggtitle(paste("Histogram of Gene Expression for", gene)) +
      xlab("Expression Value") +
      ylab("Frequency") +
      theme_minimal() + theme(
        legend.position = "bottom",

```

```

    plot.title = element_text(hjust = 0.5, size = 14, face = "bold"),
    axis.title.x = element_text(size = 12, face = "bold"),
    axis.title.y = element_text(size = 12, face = "bold"),
    axis.text = element_text(size = 10)
  )
print(plot1)

# Plot 2: Scatterplot of Gene Expression vs Continuous Variable
plot2 <- ggplot(data, aes(x = gene_expression, y = cts_var)) +
  geom_point(color = "blue", alpha = 0.7) +
  ggtitle(paste("Scatterplot of", gene, "Expression vs", cts_var)) +
  xlab("Gene Expression") +
  ylab(cts_var) +
  theme_minimal() + theme(
    legend.position = "bottom",
    plot.title = element_text(hjust = 0.5, size = 14, face = "bold"),
    axis.title.x = element_text(size = 12, face = "bold"),
    axis.title.y = element_text(size = 12, face = "bold"),
    axis.text = element_text(size = 10)
  )
print(plot2)

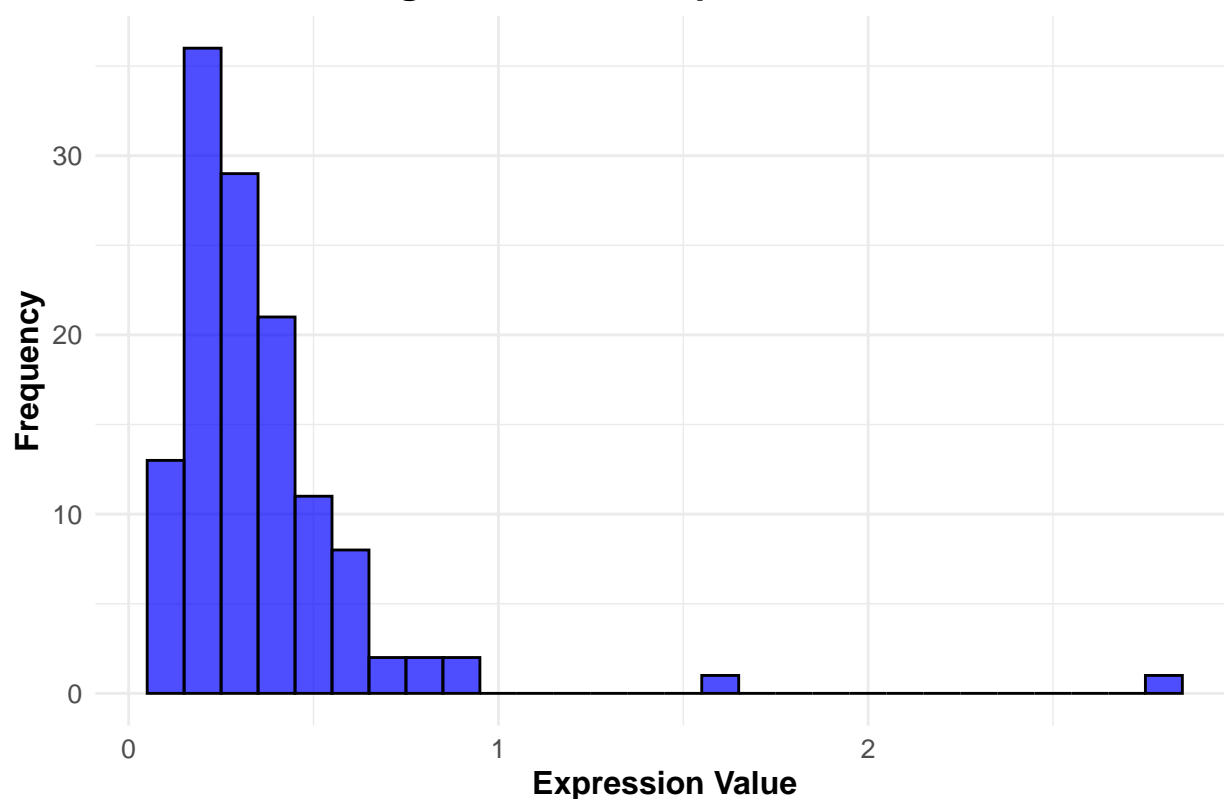
# Plot 3: Boxplot of Gene Expression by Categorical Variables
colors <- c("orangered", "palegreen")
plot3 <- ggplot(data, aes(x = cate_var1, y = gene_expression, fill = cate_var2)) +
  geom_boxplot() +
  scale_fill_manual(values = colors) +
  ggtitle(paste("Boxplot of", gene, "Expression by", cate_var1, "and", cate_var2)) +
  labs(fill = cate_var2) +
  xlab(cate_var1) +
  ylab("Gene Expression") +
  theme_minimal() +
  theme(
    legend.position = "bottom",
    plot.title = element_text(hjust = 0.5, size = 14, face = "bold"),
    axis.title.x = element_text(size = 12, face = "bold"),
    axis.title.y = element_text(size = 12, face = "bold"),
    axis.text = element_text(size = 10)
  )
print(plot3)

}
}

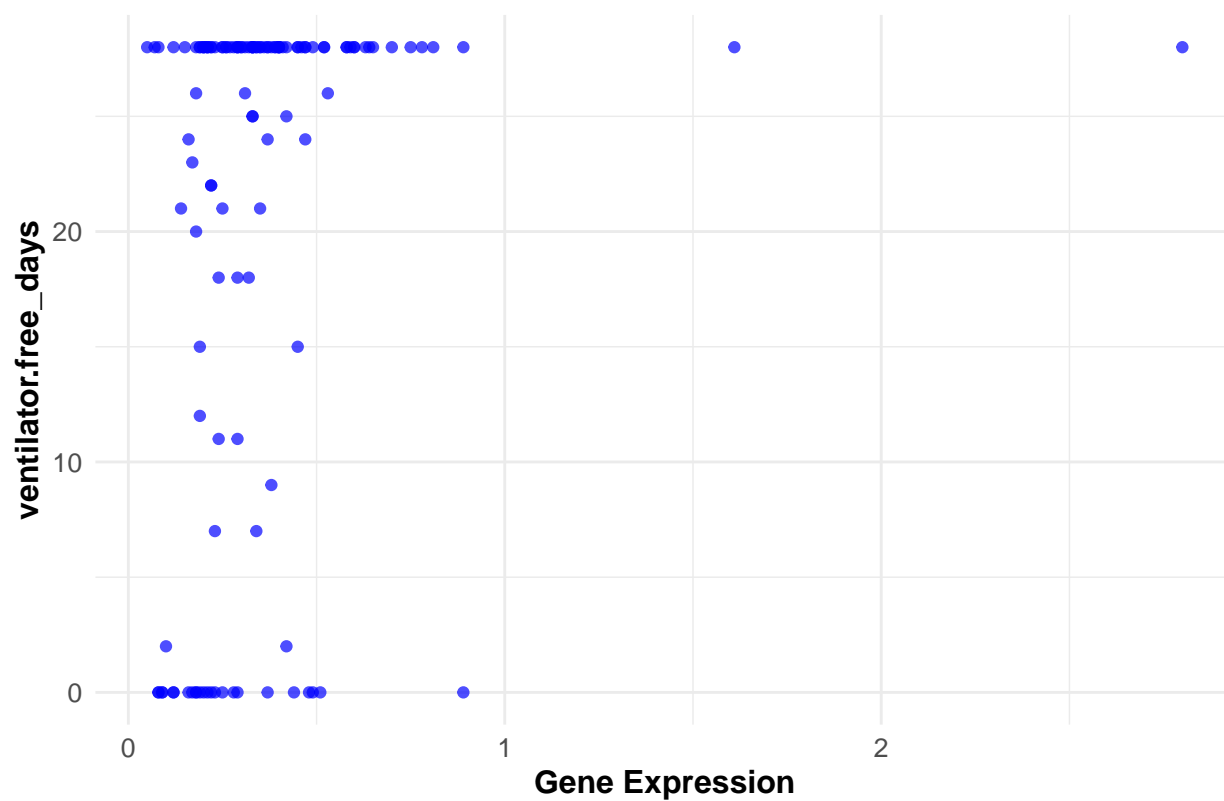
genes_list <- c("A1BG", "AACS", "A2ML1")
plotting(meta, genes_list, "ventilator.free_days", "sex", "icu_status", genes)

```

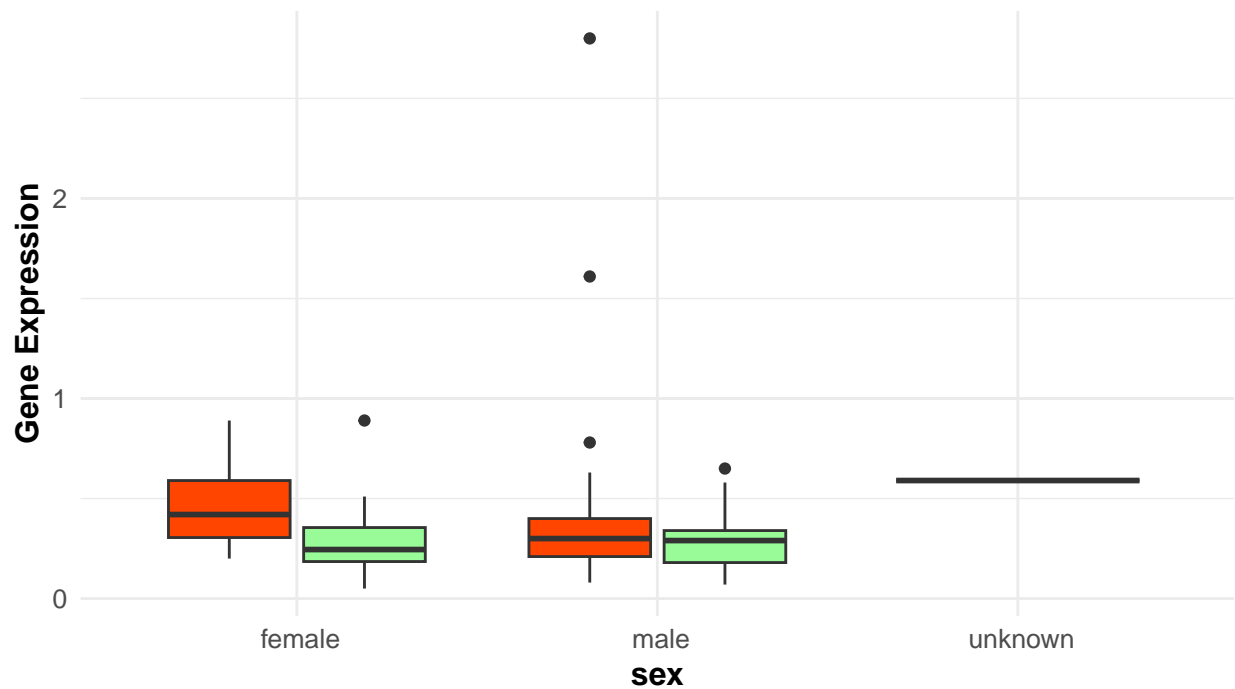
**Histogram of Gene Expression for A1BG**



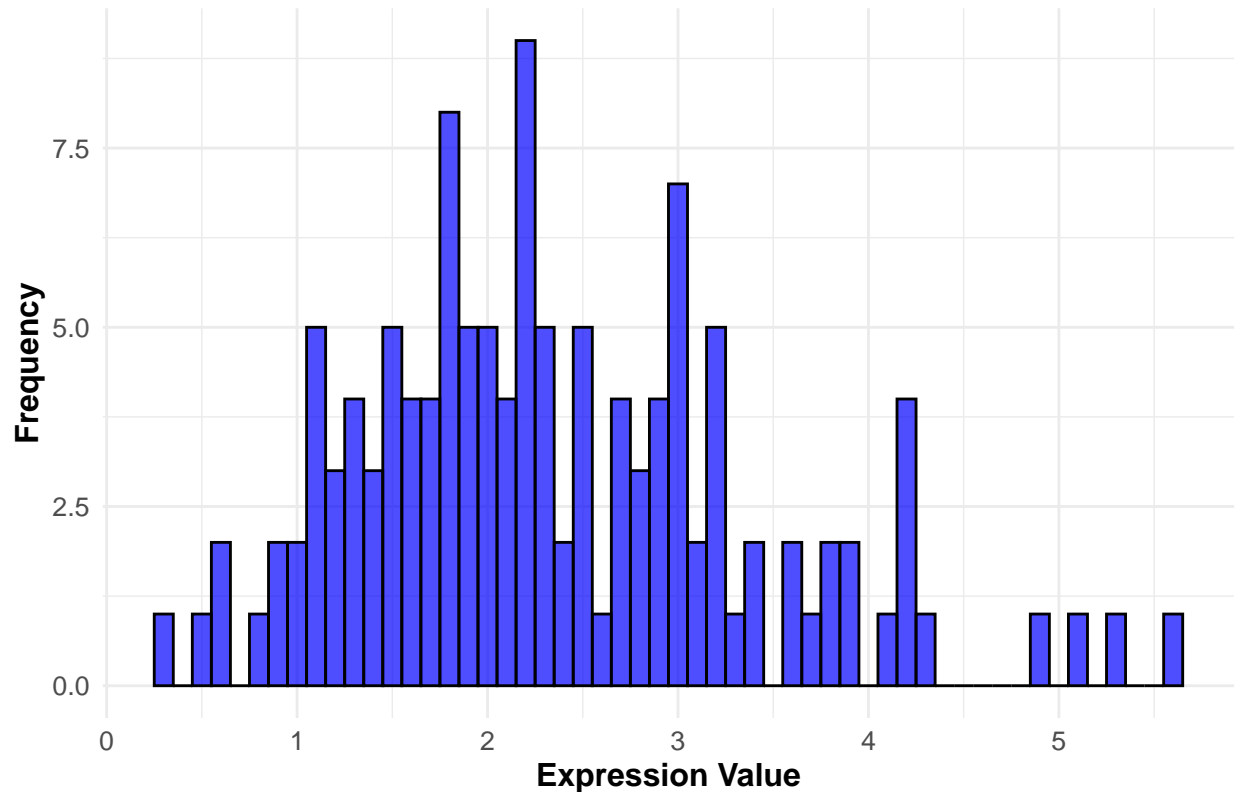
**Scatterplot of A1BG Expression vs ventilator.free\_days**



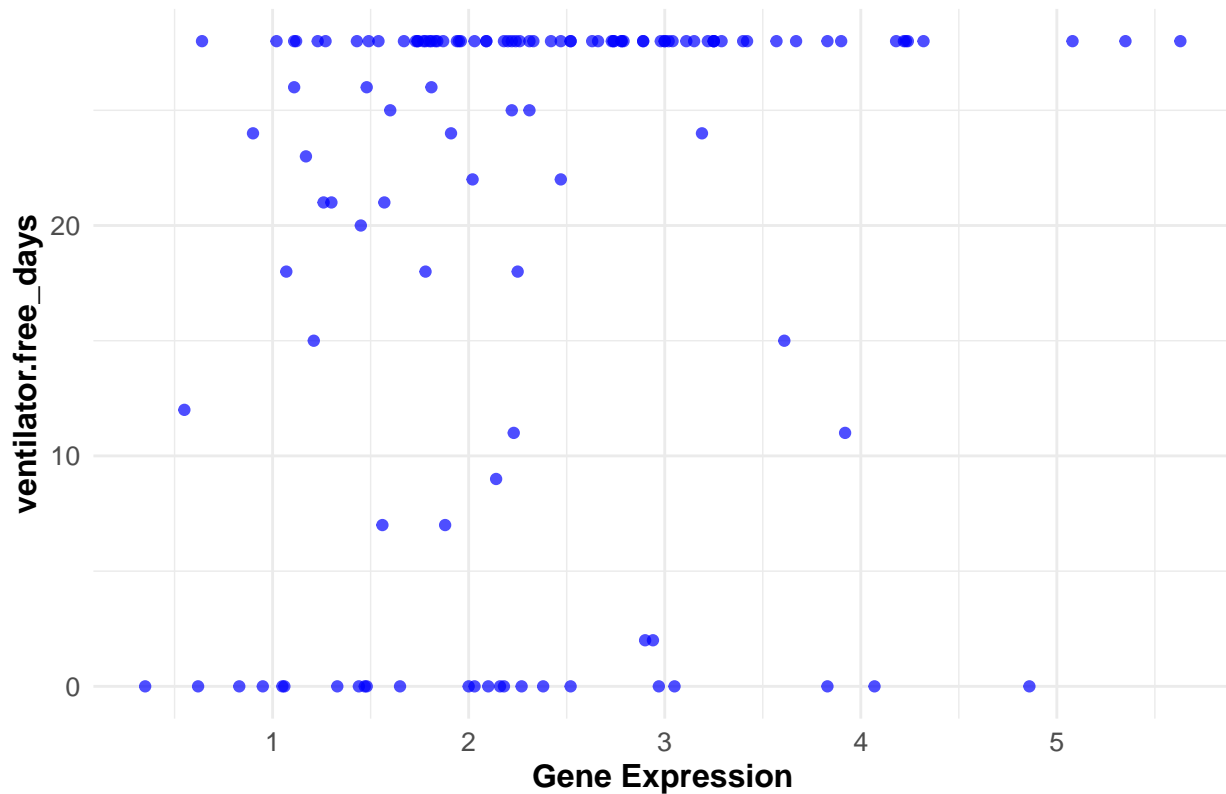
Boxplot of A1BG Expression by sex and icu\_status



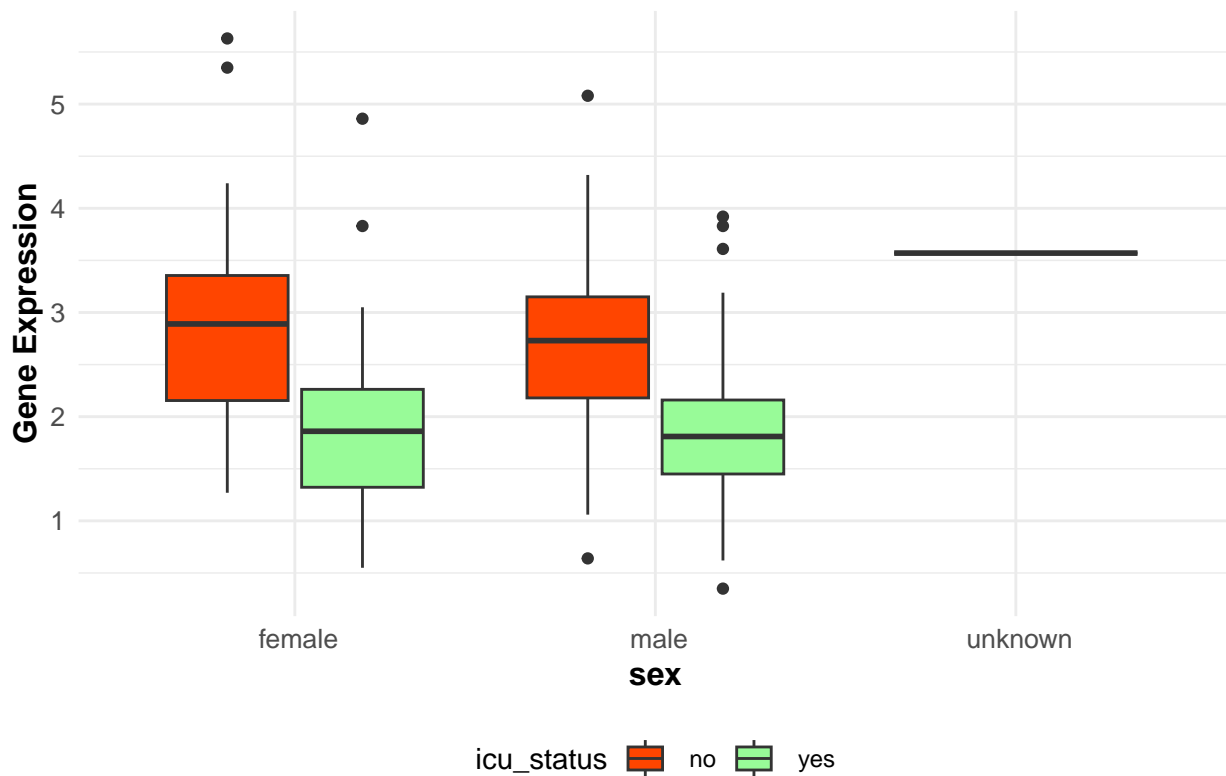
icu\_status no yes  
Histogram of Gene Expression for AACs

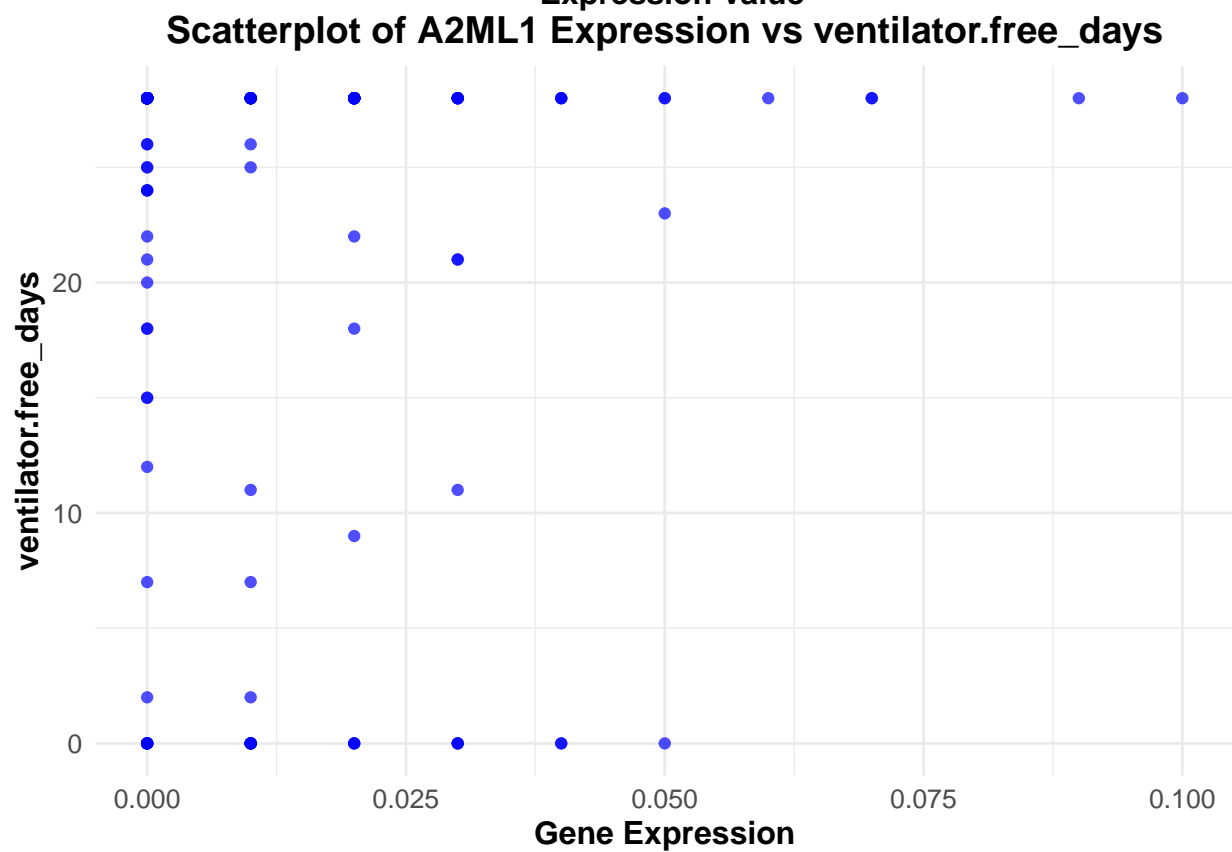


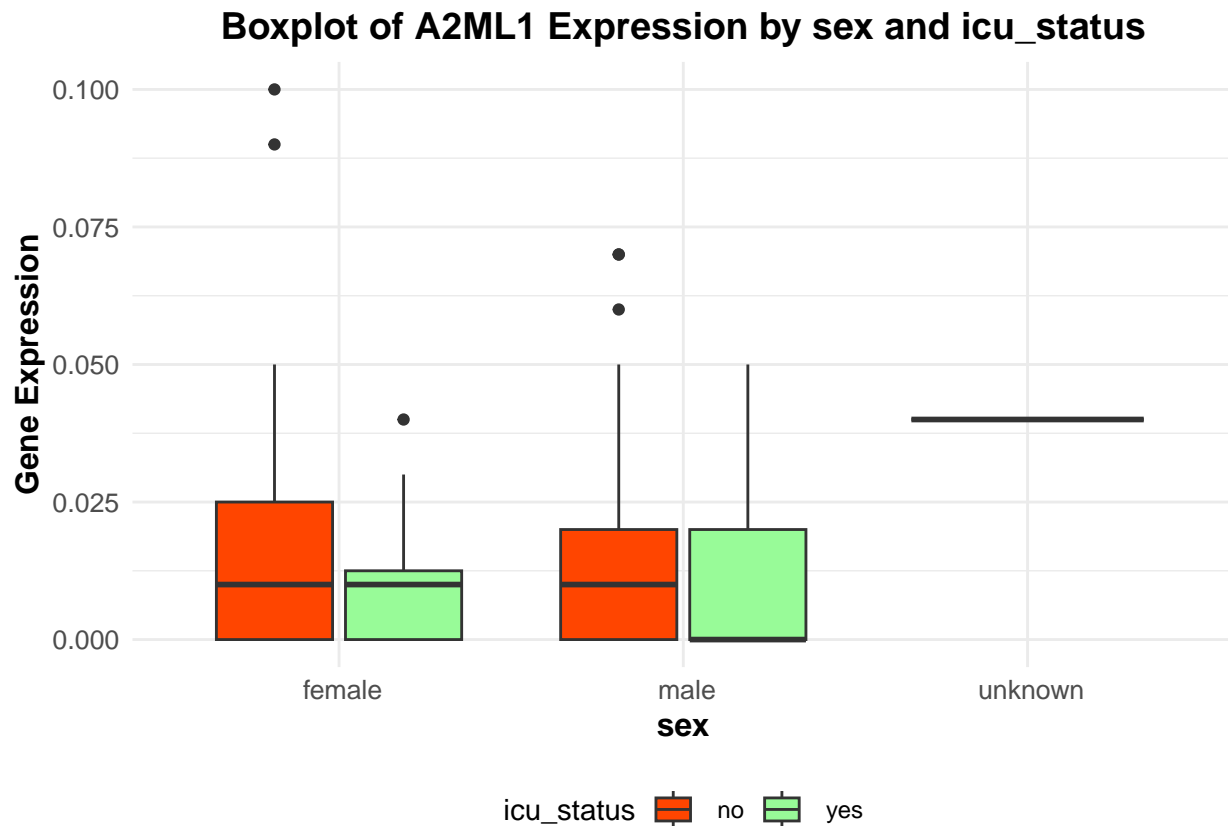
Scatterplot of AACCS Expression vs ventilator.free\_days



Boxplot of AACCS Expression by sex and icu\_status







```
library(table1)

##
## Attaching package: 'table1'
## The following objects are masked from 'package:base':
##
##     units, units<-

library(dplyr)
library(knitr)

# data preprocessing
# dropped a few cases where age is "89" and ":"
meta_filtered <- meta %>%
  mutate(age = as.numeric(age)) %>% # Convert 'age' to numeric
  filter(!is.na(age) & age == as.integer(age)) # Filter to keep only integer ages

## Warning: There was 1 warning in `mutate()`.
## i In argument: `age = as.numeric(age)`.
## Caused by warning:
## ! NAs introduced by coercion

meta_filtered <- meta_filtered %>%
  filter(sex != " unknown")

meta_filtered$sex <-
  factor(meta_filtered$sex, levels=c(' female', ' male'),
        labels = c('Female', 'Male'))
```



```

meta_filtered$mechanical_ventilation <-
  factor(meta_filtered$mechanical_ventilation, levels = c(' yes', ' no'),
         labels = c("Present", "Absent"))

label(meta_filtered$sex) <- "Sex"
label(meta_filtered$mechanical_ventilation) <- "Mechanincal Ventilation"
label(meta_filtered$age) <- "Age"
label(meta_filtered$hospital.free_days_post_45_day_followup) <- "45 Days Followup Post Hospital"
label(meta_filtered$ventilator.free_days) <- "Ventilator Free Days"

# Generate the table with customized text color
custom_format <- c(
  "Median [IQR]" = "MEDIAN [IQR]"
)
summary_table <-
  table1(~ mechanical_ventilation + sex
        + age + hospital.free_days_post_45_day_followup + ventilator.free_days
        | disease_status,
        data = meta_filtered,
        render.continuous = custom_format)

df_summary <- as.data.frame(summary_table)

latex_table <- kable(df_summary, format = "latex", booktabs = TRUE)

#kable

```

summary\_table

	disease state: COVID-19	disease state: non-COVID-19	Overall
	(N=98)	(N=24)	(N=122)
<b>Mechanincal Ventilation</b>			
Present	42 (42.9%)	9 (37.5%)	51 (41.8%)
Absent	56 (57.1%)	15 (62.5%)	71 (58.2%)
<b>Sex</b>			
Female	37 (37.8%)	13 (54.2%)	50 (41.0%)
Male	61 (62.2%)	11 (45.8%)	72 (59.0%)
<b>Age</b>			
Median [IQR]	62.0 [23.5]	64.0 [19.8]	62.0 [23.5]
<b>45 Days Followup Post Hospital</b>			
Median [IQR]	25.0 [38.0]	38.0 [13.0]	29.0 [39.0]
<b>Ventilator Free Days</b>			
Median [IQR]	28.0 [18.5]	28.0 [4.75]	28.0 [16.8]

```

# Remove non-numeric columns (e.g., 'X')
genes_numeric <- genes[, sapply(genes, is.numeric)]

# Proceed with variance calculation, ordering, and log2 transformation
variance <- apply(genes_numeric, MARGIN = 1, FUN = var)
genes_numeric <- genes_numeric[order(variance, decreasing = TRUE), ]
log2.genes <- log2(genes_numeric)

```

```

library(pheatmap)
# Subsetting meta_filtered to include only 'sex' and 'disease_status' columns
new_genes <- genes[20:30,]
rownames(new_genes) <- new_genes$X
new_genes <- new_genes[, -1]

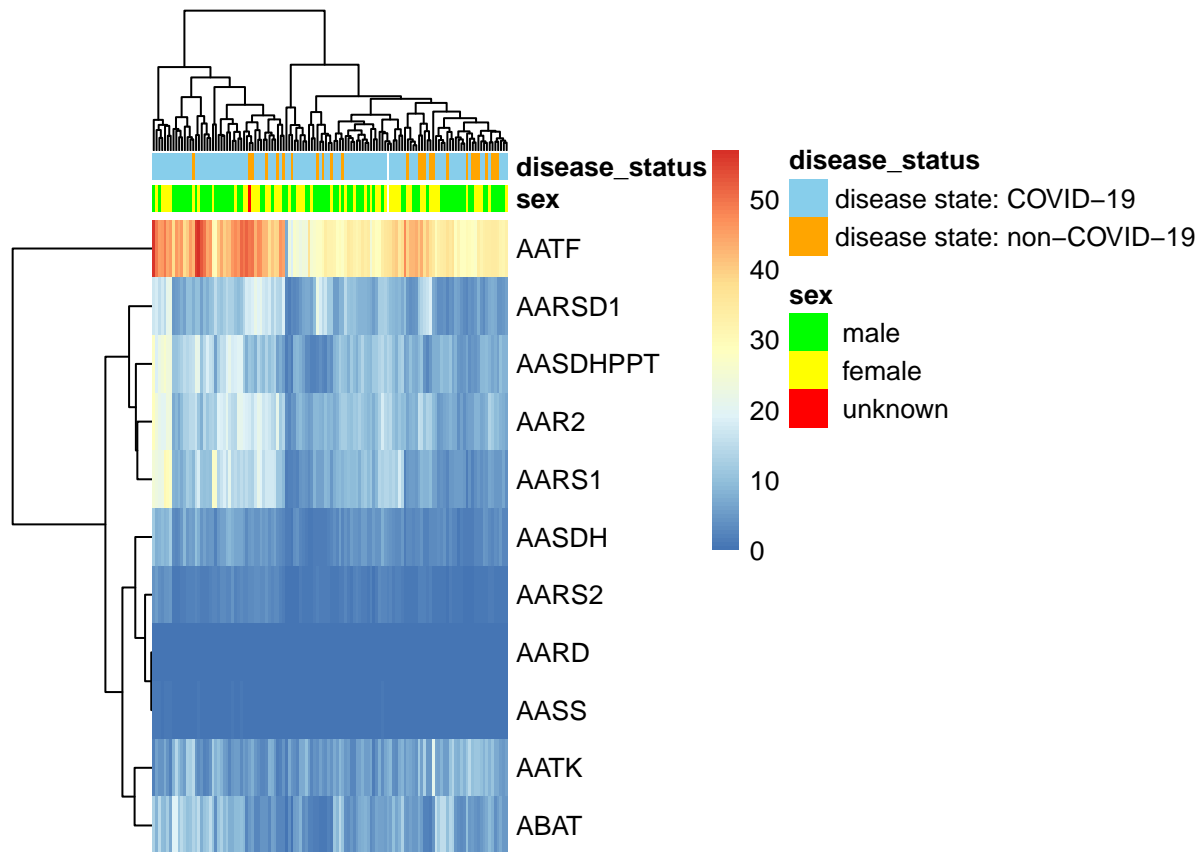
annotationData <- data.frame(participant_id = factor(meta$participant_id), sex = factor(meta$sex), disease_status = factor(meta$disease_status))
rownames(annotationData) <- annotationData[, 1]
annotationData <- annotationData[, -1]
head(annotationData)

##              sex      disease_status
## COVID_01_39y_male_NonICU  male disease state: COVID-19
## COVID_02_63y_male_NonICU  male disease state: COVID-19
## COVID_03_33y_male_NonICU  male disease state: COVID-19
## COVID_04_49y_male_NonICU  male disease state: COVID-19
## COVID_05_49y_male_NonICU  male disease state: COVID-19
## COVID_06_:y_male_NonICU   male disease state: COVID-19

# Define annotation colors (with matching keys to the cleaned subset_meta)
annotationColor <- list(sex = c(' male' = 'green', ' female' = 'yellow', ' unknown' = 'red'),
                        disease_status = c('disease state: COVID-19' = 'skyblue',
                                           'disease state: non-COVID-19' = 'orange'))

my_heat <- pheatmap(new_genes,
                    clusters_cols = T,
                    cluster_rows = T,
                    annotation_col = annotationData,
                    annotation_colors = annotationColor,
                    show_colnames = FALSE,
                    )

```



annotationData

##	sex	disease_status
## COVID_01_39y_male_NonICU	male	disease state: COVID-19
## COVID_02_63y_male_NonICU	male	disease state: COVID-19
## COVID_03_33y_male_NonICU	male	disease state: COVID-19
## COVID_04_49y_male_NonICU	male	disease state: COVID-19
## COVID_05_49y_male_NonICU	male	disease state: COVID-19
## COVID_06_:y_male_NonICU	male	disease state: COVID-19
## COVID_07_38y_female_NonICU	female	disease state: COVID-19
## COVID_08_78y_male_ICU	male	disease state: COVID-19
## COVID_09_64y_female_ICU	female	disease state: COVID-19
## COVID_10_62y_male_ICU	male	disease state: COVID-19
## COVID_11_52y_female_NonICU	female	disease state: COVID-19
## COVID_12_50y_male_ICU	male	disease state: COVID-19
## COVID_13_37y_male_NonICU	male	disease state: COVID-19
## COVID_14_55y_male_ICU	male	disease state: COVID-19
## COVID_15_68y_male_ICU	male	disease state: COVID-19
## COVID_16_48y_male_NonICU	male	disease state: COVID-19
## COVID_17_54y_male_NonICU	male	disease state: COVID-19
## COVID_18_70y_female_NonICU	female	disease state: COVID-19
## COVID_19_51y_male_NonICU	male	disease state: COVID-19
## COVID_20_62y_male_ICU	male	disease state: COVID-19
## COVID_21_66y_male_ICU	male	disease state: COVID-19
## COVID_22_43y_male_ICU	male	disease state: COVID-19
## COVID_23_76y_male_ICU	male	disease state: COVID-19
## COVID_24_55y_male_ICU	male	disease state: COVID-19

## COVID_25_55y_male_ICU	male	disease state: COVID-19
## COVID_26_41y_female_ICU	female	disease state: COVID-19
## COVID_27_71y_female_ICU	female	disease state: COVID-19
## COVID_28_63y_male_ICU	male	disease state: COVID-19
## COVID_29_63y_female_ICU	female	disease state: COVID-19
## COVID_30_54y_male_ICU	male	disease state: COVID-19
## COVID_31_50y_male_ICU	male	disease state: COVID-19
## COVID_32_72y_male_ICU	male	disease state: COVID-19
## COVID_33_81y_male_NonICU	male	disease state: COVID-19
## COVID_34_64y_female_NonICU	female	disease state: COVID-19
## COVID_35_58y_female_NonICU	female	disease state: COVID-19
## COVID_36_68y_male_NonICU	male	disease state: COVID-19
## COVID_37_87y_male_NonICU	male	disease state: COVID-19
## COVID_38_68y_male_ICU	male	disease state: COVID-19
## COVID_39_80y_female_ICU	female	disease state: COVID-19
## COVID_40_66y_male_ICU	male	disease state: COVID-19
## COVID_41_74y_male_ICU	male	disease state: COVID-19
## COVID_42_21y_female_ICU	female	disease state: COVID-19
## COVID_43_83y_female_ICU	female	disease state: COVID-19
## COVID_44_46y_male_ICU	male	disease state: COVID-19
## COVID_45_62y_female_ICU	female	disease state: COVID-19
## COVID_46_62y_male_ICU	male	disease state: COVID-19
## COVID_47_78y_male_ICU	male	disease state: COVID-19
## COVID_48_72y_female_ICU	female	disease state: COVID-19
## COVID_49_73y_male_ICU	male	disease state: COVID-19
## COVID_50_37y_male_ICU	male	disease state: COVID-19
## COVID_51_58y_female_NonICU	female	disease state: COVID-19
## COVID_52_71y_male_NonICU	male	disease state: COVID-19
## COVID_53_35y_female_NonICU	female	disease state: COVID-19
## COVID_55_62y_female_ICU	female	disease state: COVID-19
## COVID_56_33y_female_NonICU	female	disease state: COVID-19
## COVID_57_30y_female_NonICU	female	disease state: COVID-19
## COVID_58_62y_male_NonICU	male	disease state: COVID-19
## COVID_59_55y_male_NonICU	male	disease state: COVID-19
## COVID_60_49y_male_NonICU	male	disease state: COVID-19
## COVID_61_54y_female_NonICU	female	disease state: COVID-19
## COVID_62_78y_female_ICU	female	disease state: COVID-19
## COVID_63_39y_female_ICU	female	disease state: COVID-19
## COVID_64_65y_male_ICU	male	disease state: COVID-19
## COVID_65_84y_male_NonICU	male	disease state: COVID-19
## COVID_66_66y_female_NonICU	female	disease state: COVID-19
## COVID_67_57y_male_ICU	male	disease state: COVID-19
## COVID_68_79y_male_ICU	male	disease state: COVID-19
## COVID_69_77y_female_NonICU	female	disease state: COVID-19
## COVID_70_81y_male_NonICU	male	disease state: COVID-19
## COVID_71_37y_male_ICU	male	disease state: COVID-19
## COVID_72_50y_female_NonICU	female	disease state: COVID-19
## COVID_73_82y_male_NonICU	male	disease state: COVID-19
## COVID_74_55y_female_ICU	female	disease state: COVID-19
## COVID_75_55y_male_NonICU	male	disease state: COVID-19
## COVID_76_73y_female_ICU	female	disease state: COVID-19
## COVID_77_55y_female_ICU	female	disease state: COVID-19
## COVID_78_80y_male_NonICU	male	disease state: COVID-19
## COVID_79_27y_male_NonICU	male	disease state: COVID-19

## COVID_80_71y_male_ICU	male	disease state: COVID-19
## COVID_82_67y_male_NonICU	male	disease state: COVID-19
## COVID_83_85y_female_NonICU	female	disease state: COVID-19
## COVID_84_75y_female_NonICU	female	disease state: COVID-19
## COVID_85_62y_male_ICU	male	disease state: COVID-19
## COVID_86_52y_female_NonICU	female	disease state: COVID-19
## COVID_87_61y_male_ICU	male	disease state: COVID-19
## COVID_89_90y_female_NonICU	female	disease state: COVID-19
## COVID_90_86y_female_NonICU	female	disease state: COVID-19
## COVID_91_29y_female_NonICU	female	disease state: COVID-19
## COVID_92_82y_female_ICU	female	disease state: COVID-19
## COVID_93_81y_female_ICU	female	disease state: COVID-19
## COVID_94_24y_female_NonICU	female	disease state: COVID-19
## COVID_95_49y_male_NonICU	male	disease state: COVID-19
## COVID_96_51y_male_NonICU	male	disease state: COVID-19
## COVID_97_76y_male_ICU	male	disease state: COVID-19
## COVID_98_81y_male_NonICU	male	disease state: COVID-19
## COVID_99_71y_male_ICU	male	disease state: COVID-19
## COVID_100_74y_female_NonICU	female	disease state: COVID-19
## COVID_101_58y_male_ICU	male	disease state: COVID-19
## COVID_102_84y_male_NonICU	male	disease state: COVID-19
## COVID_103_83y_male_NonICU	male	disease state: COVID-19
## NONCOVID_01_54y_female_NonICU	female	disease state: non-COVID-19
## NONCOVID_02_65y_male_ICU	male	disease state: non-COVID-19
## NONCOVID_03_65y_male_ICU	male	disease state: non-COVID-19
## NONCOVID_04_90y_male_NonICU	male	disease state: non-COVID-19
## NONCOVID_05_83y_female_NonICU	female	disease state: non-COVID-19
## NONCOVID_06_75y_female_ICU	female	disease state: non-COVID-19
## NONCOVID_07_50y_male_ICU	male	disease state: non-COVID-19
## NONCOVID_08_53y_female_ICU	female	disease state: non-COVID-19
## NONCOVID_09_49y_female_NonICU	female	disease state: non-COVID-19
## NONCOVID_10_67y_male_ICU	male	disease state: non-COVID-19
## NONCOVID_11_58y_female_NonICU	female	disease state: non-COVID-19
## NONCOVID_12_82y_male_ICU	male	disease state: non-COVID-19
## NONCOVID_13_65y_male_ICU	male	disease state: non-COVID-19
## NONCOVID_14_75y_female_ICU	female	disease state: non-COVID-19
## NONCOVID_15_83y_unknown_ICU	unknown	disease state: non-COVID-19
## NONCOVID_16_40y_female_ICU	female	disease state: non-COVID-19
## NONCOVID_17_84y_female_ICU	female	disease state: non-COVID-19
## NONCOVID_18_88y_male_ICU	male	disease state: non-COVID-19
## NONCOVID_19_66y_female_ICU	female	disease state: non-COVID-19
## NONCOVID_20_62y_female_ICU	female	disease state: non-COVID-19
## NONCOVID_21_71y_male_NonICU	male	disease state: non-COVID-19
## NONCOVID_22_63y_male_NonICU	male	disease state: non-COVID-19
## NONCOVID_23_42y_female_NonICU	female	disease state: non-COVID-19
## NONCOVID_24_32y_female_NonICU	female	disease state: non-COVID-19
## NONCOVID_25_62y_male_NonICU	male	disease state: non-COVID-19
## NONCOVID_26_36y_male_ICU	male	disease state: non-COVID-19

#### new\_genes

##	COVID_01_39y_male_NonICU	COVID_02_63y_male_NonICU
## AAR2	21.59	19.22
## AARD	0.18	0.08
## AARS1	13.52	13.91

##	AARS2	2.43	2.15
##	AARSD1	9.63	11.80
##	AASDH	6.38	4.83
##	AASDHPPT	19.45	12.14
##	AASS	0.21	0.42
##	AATF	45.83	39.37
##	AATK	5.60	9.79
##	ABAT	9.63	10.36
##	COVID_03_33y_male_NonICU	COVID_04_49y_male_NonICU	
##	AAR2	8.72	20.83
##	AARD	0.05	0.03
##	AARS1	5.60	15.34
##	AARS2	1.08	2.69
##	AARSD1	4.04	14.61
##	AASDH	2.76	8.23
##	AASDHPPT	7.64	18.94
##	AASS	0.04	0.41
##	AATF	42.35	41.92
##	AATK	5.34	4.73
##	ABAT	4.59	11.02
##	COVID_05_49y_male_NonICU	COVID_06_.y_male_NonICU	
##	AAR2	7.46	13.60
##	AARD	0.10	0.09
##	AARS1	6.29	13.70
##	AARS2	0.55	2.21
##	AARSD1	5.32	11.30
##	AASDH	5.23	4.91
##	AASDHPPT	11.54	14.16
##	AASS	0.21	0.26
##	AATF	30.56	36.30
##	AATK	1.50	7.52
##	ABAT	4.42	7.04
##	COVID_07_38y_female_NonICU	COVID_08_78y_male_ICU	
##	AAR2	23.90	8.18
##	AARD	0.12	0.06
##	AARS1	29.47	4.97
##	AARS2	4.35	1.06
##	AARSD1	21.09	4.32
##	AASDH	8.90	4.57
##	AASDHPPT	23.49	10.08
##	AASS	0.63	0.09
##	AATF	44.16	31.81
##	AATK	4.16	5.62
##	ABAT	12.02	7.26
##	COVID_09_64y_female_ICU	COVID_10_62y_male_ICU	
##	AAR2	13.44	11.33
##	AARD	0.09	0.01
##	AARS1	27.92	10.07
##	AARS2	2.72	2.33
##	AARSD1	10.81	8.66
##	AASDH	4.60	4.20
##	AASDHPPT	14.37	7.58
##	AASS	0.17	0.20
##	AATF	30.44	30.99

##	AATK	12.09	6.09	
##	ABAT	10.30	5.56	
##	COVID_11_52y_female_NonICU	COVID_12_50y_male_ICU		
##	AAR2	22.86	11.32	
##	AARD	0.06	0.16	
##	AARS1	26.95	10.68	
##	AARS2	4.80	1.68	
##	AARSD1	21.97	8.05	
##	AASDH	11.87	5.32	
##	AASDHPPT	23.71	13.14	
##	AASS	1.11	0.39	
##	AATF	45.66	35.24	
##	AATK	1.81	7.43	
##	ABAT	6.89	7.95	
##	COVID_13_37y_male_NonICU	COVID_14_55y_male_ICU	COVID_15_68y_male_ICU	
##	AAR2	16.34	6.47	7.38
##	AARD	0.13	0.04	0.09
##	AARS1	20.95	8.80	7.54
##	AARS2	2.59	0.80	0.95
##	AARSD1	13.10	5.92	5.34
##	AASDH	8.99	3.04	3.66
##	AASDHPPT	21.48	11.79	8.37
##	AASS	0.42	0.35	0.20
##	AATF	41.33	43.86	31.54
##	AATK	2.50	9.26	6.88
##	ABAT	7.57	11.39	10.91
##	COVID_16_48y_male_NonICU	COVID_17_54y_male_NonICU		
##	AAR2	21.22	18.46	
##	AARD	0.13	0.05	
##	AARS1	22.11	16.25	
##	AARS2	3.61	3.21	
##	AARSD1	14.93	10.71	
##	AASDH	8.37	5.75	
##	AASDHPPT	22.61	15.91	
##	AASS	0.98	0.39	
##	AATF	45.35	44.33	
##	AATK	4.13	8.34	
##	ABAT	14.68	12.55	
##	COVID_18_70y_female_NonICU	COVID_19_51y_male_NonICU		
##	AAR2	14.61	16.03	
##	AARD	0.09	0.03	
##	AARS1	12.60	14.93	
##	AARS2	2.32	2.36	
##	AARSD1	9.39	10.02	
##	AASDH	4.47	9.90	
##	AASDHPPT	12.58	21.86	
##	AASS	0.34	0.47	
##	AATF	36.50	54.87	
##	AATK	8.79	5.08	
##	ABAT	6.04	11.59	
##	COVID_20_62y_male_ICU	COVID_21_66y_male_ICU	COVID_22_43y_male_ICU	
##	AAR2	9.06	5.35	3.99
##	AARD	0.03	0.15	0.17
##	AARS1	7.87	4.26	2.39

##	AARS2	1.04	0.72	0.30
##	AARSD1	5.16	3.44	2.51
##	AASDH	2.76	2.88	3.76
##	AASDHPPT	10.31	10.24	7.98
##	AASS	0.35	0.11	0.14
##	AATF	46.16	33.95	26.37
##	AATK	13.88	8.08	3.69
##	ABAT	18.91	15.04	5.19
##	COVID_23_76y_male_ICU	COVID_24_55y_male_ICU	COVID_25_55y_male_ICU	
##	AAR2	6.77	8.06	17.34
##	AARD	0.03	0.12	0.11
##	AARS1	3.83	4.98	18.62
##	AARS2	0.73	1.18	3.02
##	AARSD1	4.30	4.41	12.29
##	AASDH	4.50	3.85	6.12
##	AASDHPPT	8.95	10.43	15.00
##	AASS	0.21	0.19	0.54
##	AATF	34.65	35.23	39.65
##	AATK	5.60	10.40	5.41
##	ABAT	14.89	14.04	9.02
##	COVID_26_41y_female_ICU	COVID_27_71y_female_ICU	COVID_28_63y_male_ICU	
##	AAR2	11.01	9.79	6.93
##	AARD	0.08	0.09	0.19
##	AARS1	9.54	11.90	8.42
##	AARS2	1.50	1.37	0.90
##	AARSD1	7.98	8.09	4.57
##	AASDH	5.38	5.40	3.04
##	AASDHPPT	12.42	10.07	10.30
##	AASS	0.26	0.31	0.19
##	AATF	29.52	33.25	38.01
##	AATK	8.67	5.46	8.16
##	ABAT	14.30	8.34	18.85
##	COVID_29_63y_female_ICU	COVID_30_54y_male_ICU	COVID_31_50y_male_ICU	
##	AAR2	6.55	9.81	8.44
##	AARD	0.03	0.05	0.03
##	AARS1	3.45	9.35	9.11
##	AARS2	0.58	1.01	0.93
##	AARSD1	4.28	9.76	5.53
##	AASDH	2.35	5.45	2.62
##	AASDHPPT	8.56	11.82	9.48
##	AASS	0.19	0.20	0.21
##	AATF	31.84	34.05	28.40
##	AATK	10.07	2.44	5.33
##	ABAT	4.62	5.02	9.07
##	COVID_32_72y_male_ICU	COVID_33_81y_male_NonICU		
##	AAR2	10.20	14.61	
##	AARD	0.08	0.11	
##	AARS1	2.07	17.17	
##	AARS2	0.64	2.72	
##	AARSD1	9.98	13.54	
##	AASDH	1.36	5.11	
##	AASDHPPT	6.19	11.44	
##	AASS	0.28	0.45	
##	AATF	47.32	40.75	



##	AATK	4.76	7.63	
##	ABAT	5.63	6.02	
##	COVID_34_64y_female_NonICU	COVID_35_58y_female_NonICU		
##	AAR2	9.93	11.38	
##	AARD	0.10	0.12	
##	AARS1	8.63	17.81	
##	AARS2	1.58	1.77	
##	AARSD1	7.15	8.96	
##	AASDH	4.40	3.27	
##	AASDHPPT	11.43	11.49	
##	AASS	0.50	0.18	
##	AATF	28.40	35.31	
##	AATK	3.69	7.28	
##	ABAT	6.27	8.38	
##	COVID_36_68y_male_NonICU	COVID_37_87y_male_NonICU		
##	AAR2	8.96	9.36	
##	AARD	0.05	0.55	
##	AARS1	9.44	6.99	
##	AARS2	1.10	1.54	
##	AARSD1	7.63	7.45	
##	AASDH	3.76	4.77	
##	AASDHPPT	9.50	12.81	
##	AASS	0.24	0.41	
##	AATF	34.60	46.15	
##	AATK	5.55	6.85	
##	ABAT	6.91	14.79	
##	COVID_38_68y_male_ICU	COVID_39_80y_female_ICU	COVID_40_66y_male_ICU	
##	AAR2	6.90	7.67	9.45
##	AARD	0.00	0.03	0.06
##	AARS1	5.36	4.62	14.19
##	AARS2	0.95	0.60	1.33
##	AARSD1	6.61	6.36	7.00
##	AASDH	2.70	2.07	4.68
##	AASDHPPT	8.36	6.23	12.58
##	AASS	0.13	0.04	0.22
##	AATF	28.34	24.16	37.86
##	AATK	8.37	7.29	8.32
##	ABAT	4.91	3.01	13.04
##	COVID_41_74y_male_ICU	COVID_42_21y_female_ICU	COVID_43_83y_female_ICU	
##	AAR2	5.92	10.61	2.74
##	AARD	0.04	0.03	0.19
##	AARS1	4.33	14.16	2.04
##	AARS2	0.34	1.52	0.50
##	AARSD1	3.99	8.93	1.48
##	AASDH	1.40	3.53	1.31
##	AASDHPPT	3.68	9.74	3.33
##	AASS	0.11	0.22	0.03
##	AATF	29.56	39.06	23.57
##	AATK	14.77	3.72	7.25
##	ABAT	4.84	9.91	3.68
##	COVID_44_46y_male_ICU	COVID_45_62y_female_ICU	COVID_46_62y_male_ICU	
##	AAR2	12.56	4.73	10.72
##	AARD	0.00	0.00	0.04
##	AARS1	8.68	3.83	10.03

##	AARS2	1.17	0.72	1.54
##	AARSD1	6.18	3.88	10.32
##	AASDH	8.60	3.90	3.15
##	AASDHPPT	15.37	7.76	7.81
##	AASS	0.26	0.22	0.11
##	AATF	37.64	32.54	35.15
##	AATK	5.52	5.95	5.29
##	ABAT	12.51	11.70	3.03
##	COVID_47_78y_male_ICU	COVID_48_72y_female_ICU	COVID_49_73y_male_ICU	
##	AAR2	7.48	6.06	13.53
##	AARD	0.00	0.09	0.04
##	AARS1	10.68	4.44	8.09
##	AARS2	1.44	0.94	1.37
##	AARSD1	6.02	5.95	16.23
##	AASDH	4.43	1.05	1.96
##	AASDHPPT	10.68	2.20	2.54
##	AASS	0.20	0.01	0.05
##	AATF	52.61	25.55	40.75
##	AATK	4.15	2.55	4.98
##	ABAT	7.77	2.21	1.94
##	COVID_50_37y_male_ICU	COVID_51_58y_female_NonICU		
##	AAR2	3.64	18.84	
##	AARD	0.00	0.13	
##	AARS1	1.59	13.17	
##	AARS2	0.33	2.38	
##	AARSD1	2.39	13.89	
##	AASDH	1.14	5.37	
##	AASDHPPT	1.63	12.19	
##	AASS	0.06	0.10	
##	AATF	7.20	49.57	
##	AATK	1.23	5.48	
##	ABAT	0.41	8.98	
##	COVID_52_71y_male_NonICU	COVID_53_35y_female_NonICU		
##	AAR2	7.60	11.07	
##	AARD	0.00	0.07	
##	AARS1	4.79	17.83	
##	AARS2	0.63	2.16	
##	AARSD1	4.85	10.01	
##	AASDH	3.11	7.90	
##	AASDHPPT	7.28	21.28	
##	AASS	0.15	0.73	
##	AATF	43.60	56.99	
##	AATK	4.00	2.99	
##	ABAT	4.92	14.83	
##	COVID_55_62y_female_ICU	COVID_56_33y_female_NonICU		
##	AAR2	8.20	8.85	
##	AARD	0.10	0.18	
##	AARS1	5.39	12.43	
##	AARS2	0.77	1.80	
##	AARSD1	3.87	7.98	
##	AASDH	2.98	3.19	
##	AASDHPPT	10.25	7.66	
##	AASS	0.10	0.36	
##	AATF	42.51	40.38	

##	AATK	6.46	2.92	
##	ABAT	5.91	6.63	
##	COVID_57_30y_female_NonICU	COVID_58_62y_male_NonICU		
##	AAR2	24.02	10.22	
##	AARD	0.00	0.02	
##	AARS1	23.29	8.96	
##	AARS2	5.23	1.49	
##	AARSD1	18.17	16.96	
##	AASDH	7.93	1.44	
##	AASDHPPT	18.44	2.08	
##	AASS	1.09	0.10	
##	AATF	49.31	33.96	
##	AATK	5.90	3.74	
##	ABAT	8.28	0.88	
##	COVID_59_55y_male_NonICU	COVID_60_49y_male_NonICU		
##	AAR2	14.64	16.99	
##	AARD	0.11	0.09	
##	AARS1	14.05	14.94	
##	AARS2	4.06	2.98	
##	AARSD1	12.58	17.47	
##	AASDH	7.82	5.03	
##	AASDHPPT	17.74	9.17	
##	AASS	1.05	0.27	
##	AATF	45.74	42.22	
##	AATK	4.89	2.45	
##	ABAT	7.49	4.35	
##	COVID_61_54y_female_NonICU	COVID_62_78y_female_ICU		
##	AAR2	20.46	11.79	
##	AARD	0.32	0.06	
##	AARS1	22.33	9.47	
##	AARS2	3.27	1.88	
##	AARSD1	17.47	10.26	
##	AASDH	9.13	4.40	
##	AASDHPPT	23.96	9.59	
##	AASS	0.43	0.28	
##	AATF	45.81	32.03	
##	AATK	4.13	2.42	
##	ABAT	9.43	3.39	
##	COVID_63_39y_female_ICU	COVID_64_65y_male_ICU	COVID_65_84y_male_NonICU	
##	AAR2	13.73	6.94	14.50
##	AARD	0.03	0.19	0.11
##	AARS1	14.90	5.09	11.02
##	AARS2	1.85	0.86	1.99
##	AARSD1	10.51	3.56	9.89
##	AASDH	6.36	2.45	6.18
##	AASDHPPT	18.64	6.81	15.21
##	AASS	0.51	0.15	0.36
##	AATF	47.55	36.76	45.17
##	AATK	5.26	13.55	12.29
##	ABAT	9.66	12.73	10.48
##	COVID_66_66y_female_NonICU	COVID_67_57y_male_ICU	COVID_68_79y_male_ICU	
##	AAR2	18.43	11.62	8.66
##	AARD	0.14	0.05	0.07
##	AARS1	15.13	26.78	8.02

##	AARS2	2.45	2.28	1.27
##	AARSD1	17.85	15.34	9.25
##	AASDH	3.35	2.16	1.25
##	AASDHPPT	7.75	5.93	1.79
##	AASS	0.22	0.12	0.08
##	AATF	51.42	29.55	26.27
##	AATK	4.48	8.20	4.30
##	ABAT	2.83	3.62	1.29
##	COVID_69_77y_female_NonICU	COVID_70_81y_male_NonICU		
##	AAR2	20.17	20.68	
##	AARD	0.00	0.25	
##	AARS1	30.66	14.85	
##	AARS2	4.33	2.91	
##	AARSD1	14.35	10.70	
##	AASDH	8.09	6.33	
##	AASDHPPT	26.41	19.58	
##	AASS	1.02	0.58	
##	AATF	49.50	50.75	
##	AATK	6.95	3.22	
##	ABAT	8.62	10.15	
##	COVID_71_37y_male_ICU	COVID_72_50y_female_NonICU		
##	AAR2	7.56	21.54	
##	AARD	0.00	0.00	
##	AARS1	6.64	21.34	
##	AARS2	1.02	3.42	
##	AARSD1	4.77	19.25	
##	AASDH	2.69	4.29	
##	AASDHPPT	8.06	13.83	
##	AASS	0.20	0.38	
##	AATF	30.91	47.65	
##	AATK	5.09	3.67	
##	ABAT	4.65	2.76	
##	COVID_73_82y_male_NonICU	COVID_74_55y_female_ICU		
##	AAR2	28.52	10.09	
##	AARD	0.19	0.04	
##	AARS1	25.07	11.26	
##	AARS2	4.11	2.08	
##	AARSD1	16.98	6.98	
##	AASDH	11.56	3.48	
##	AASDHPPT	27.65	9.11	
##	AASS	0.58	0.29	
##	AATF	55.87	24.46	
##	AATK	2.09	6.56	
##	ABAT	13.05	3.01	
##	COVID_75_55y_male_NonICU	COVID_76_73y_female_ICU		
##	AAR2	11.33	8.18	
##	AARD	0.10	0.04	
##	AARS1	10.41	2.25	
##	AARS2	1.38	0.47	
##	AARSD1	7.68	3.03	
##	AASDH	4.28	4.48	
##	AASDHPPT	18.31	8.55	
##	AASS	0.25	0.03	
##	AATF	44.00	24.91	

##	AATK	2.59	2.30
##	ABAT	11.52	5.83
##	COVID_77_55y_female_ICU	COVID_78_80y_male_NonICU	
##	AAR2	6.71	14.67
##	AARD	0.00	0.09
##	AARS1	3.91	9.70
##	AARS2	0.61	1.26
##	AARSD1	6.03	9.12
##	AASDH	2.41	5.80
##	AASDHPPT	8.04	14.73
##	AASS	0.28	0.20
##	AATF	32.72	49.67
##	AATK	6.21	2.14
##	ABAT	4.69	10.58
##	COVID_79_27y_male_NonICU	COVID_80_71y_male_ICU	
##	AAR2	13.01	5.73
##	AARD	0.05	0.08
##	AARS1	9.93	5.30
##	AARS2	2.24	0.95
##	AARSD1	10.09	4.44
##	AASDH	4.78	2.09
##	AASDHPPT	15.77	4.22
##	AASS	0.40	0.24
##	AATF	45.85	27.99
##	AATK	4.52	10.37
##	ABAT	15.17	2.91
##	COVID_82_67y_male_NonICU	COVID_83_85y_female_NonICU	
##	AAR2	12.85	14.36
##	AARD	0.00	0.37
##	AARS1	7.53	13.68
##	AARS2	1.86	2.63
##	AARSD1	8.09	12.61
##	AASDH	3.79	5.50
##	AASDHPPT	10.62	11.86
##	AASS	0.28	0.55
##	AATF	32.34	35.35
##	AATK	6.07	6.55
##	ABAT	7.33	5.43
##	COVID_84_75y_female_NonICU	COVID_85_62y_male_ICU	
##	AAR2	13.13	6.74
##	AARD	0.09	0.12
##	AARS1	6.77	4.31
##	AARS2	1.16	0.90
##	AARSD1	7.12	6.89
##	AASDH	2.96	1.66
##	AASDHPPT	8.34	3.36
##	AASS	0.07	0.06
##	AATF	33.65	23.24
##	AATK	7.98	10.11
##	ABAT	9.24	4.21
##	COVID_86_52y_female_NonICU	COVID_87_61y_male_ICU	
##	AAR2	13.11	18.11
##	AARD	0.17	0.03
##	AARS1	16.90	13.10

##	AARS2	2.85	2.59
##	AARSD1	16.64	12.53
##	AASDH	5.74	7.51
##	AASDHPPT	13.15	14.37
##	AASS	0.52	0.94
##	AATF	38.60	33.69
##	AATK	4.65	3.52
##	ABAT	5.36	6.22
##	COVID_89_90y_female_NonICU	COVID_90_86y_female_NonICU	
##	AAR2	8.02	12.91
##	AARD	0.05	0.08
##	AARS1	6.04	14.13
##	AARS2	1.04	2.89
##	AARSD1	6.26	12.21
##	AASDH	3.40	4.18
##	AASDHPPT	7.53	13.14
##	AASS	0.26	0.30
##	AATF	29.41	28.65
##	AATK	6.52	7.49
##	ABAT	15.51	5.76
##	COVID_91_29y_female_NonICU	COVID_92_82y_female_ICU	
##	AAR2	12.21	9.47
##	AARD	0.03	0.00
##	AARS1	9.24	4.51
##	AARS2	2.28	1.57
##	AARSD1	14.25	4.57
##	AASDH	4.18	2.78
##	AASDHPPT	9.92	7.45
##	AASS	0.35	0.09
##	AATF	31.21	22.38
##	AATK	4.92	7.36
##	ABAT	3.42	8.22
##	COVID_93_81y_female_ICU	COVID_94_24y_female_NonICU	
##	AAR2	17.06	18.35
##	AARD	0.00	0.06
##	AARS1	17.35	16.92
##	AARS2	3.02	3.87
##	AARSD1	18.22	22.09
##	AASDH	3.46	4.42
##	AASDHPPT	10.18	7.61
##	AASS	0.19	0.23
##	AATF	37.37	43.17
##	AATK	8.02	5.03
##	ABAT	2.77	2.41
##	COVID_95_49y_male_NonICU	COVID_96_51y_male_NonICU	
##	AAR2	12.96	8.10
##	AARD	0.23	0.09
##	AARS1	12.13	6.16
##	AARS2	1.85	1.24
##	AARSD1	9.93	17.82
##	AASDH	4.56	1.41
##	AASDHPPT	14.15	3.57
##	AASS	0.24	0.07
##	AATF	40.37	27.71

##	AATK	12.56	5.95
##	ABAT	9.74	0.79
##	COVID_97_76y_male_ICU	COVID_98_81y_male_NonICU	COVID_99_71y_male_ICU
##	AAR2	3.94	5.69
##	AARD	0.09	0.06
##	AARS1	5.63	2.87
##	AARS2	0.75	0.58
##	AARSD1	6.10	7.12
##	AASDH	1.00	0.97
##	AASDHPPT	4.89	3.17
##	AASS	0.09	0.06
##	AATF	31.65	36.85
##	AATK	7.70	5.78
##	ABAT	3.82	2.10
##	COVID_100_74y_female_NonICU	COVID_101_58y_male_ICU	
##	AAR2	11.55	19.98
##	AARD	0.09	0.06
##	AARS1	10.85	19.20
##	AARS2	1.71	3.27
##	AARSD1	13.11	21.56
##	AASDH	3.02	5.89
##	AASDHPPT	7.66	10.87
##	AASS	0.17	0.29
##	AATF	46.54	47.01
##	AATK	1.72	2.78
##	ABAT	2.36	4.30
##	COVID_102_84y_male_NonICU	COVID_103_83y_male_NonICU	
##	AAR2	7.39	3.97
##	AARD	0.04	0.03
##	AARS1	4.74	4.82
##	AARS2	1.02	0.45
##	AARSD1	3.17	2.93
##	AASDH	4.73	1.14
##	AASDHPPT	8.56	4.74
##	AASS	0.19	0.03
##	AATF	33.19	27.96
##	AATK	8.24	8.27
##	ABAT	5.96	3.46
##	NONCOVID_01_54y_female_NonICU	NONCOVID_02_65y_male_ICU	
##	AAR2	12.82	9.18
##	AARD	0.06	0.11
##	AARS1	9.45	4.62
##	AARS2	1.77	1.03
##	AARSD1	18.26	7.09
##	AASDH	3.25	3.98
##	AASDHPPT	4.68	7.87
##	AASS	0.27	0.15
##	AATF	37.33	34.32
##	AATK	4.60	7.36
##	ABAT	1.60	3.84
##	NONCOVID_03_65y_male_ICU	NONCOVID_04_90y_male_NonICU	
##	AAR2	5.92	8.34
##	AARD	0.02	0.34
##	AARS1	2.16	4.52

##	AARS2	0.38	0.96
##	AARSD1	3.90	5.33
##	AASDH	1.35	4.01
##	AASDHPPT	4.98	9.13
##	AASS	0.03	0.20
##	AATF	28.33	33.81
##	AATK	9.81	10.56
##	ABAT	5.55	7.21
##	NONCOVID_05_83y_female_NonICU	NONCOVID_06_75y_female_ICU	
##	AAR2	8.72	21.36
##	AARD	0.09	0.02
##	AARS1	5.12	11.33
##	AARS2	1.09	2.87
##	AARSD1	11.58	14.21
##	AASDH	2.46	3.83
##	AASDHPPT	3.83	6.23
##	AASS	0.13	0.18
##	AATF	32.30	38.95
##	AATK	4.26	1.43
##	ABAT	1.67	2.45
##	NONCOVID_07_50y_male_ICU	NONCOVID_08_53y_female_ICU	
##	AAR2	15.39	8.07
##	AARD	0.05	0.06
##	AARS1	6.68	5.11
##	AARS2	1.77	1.05
##	AARSD1	11.12	7.78
##	AASDH	3.20	2.40
##	AASDHPPT	9.06	5.61
##	AASS	0.20	0.20
##	AATF	40.42	33.98
##	AATK	11.63	11.34
##	ABAT	6.95	3.52
##	NONCOVID_09_49y_female_NonICU	NONCOVID_10_67y_male_ICU	
##	AAR2	17.74	12.47
##	AARD	0.10	0.06
##	AARS1	17.19	8.10
##	AARS2	4.04	1.23
##	AARSD1	16.09	8.44
##	AASDH	5.22	2.73
##	AASDHPPT	13.53	10.65
##	AASS	0.11	0.06
##	AATF	42.64	27.90
##	AATK	2.93	6.90
##	ABAT	4.25	10.81
##	NONCOVID_11_58y_female_NonICU	NONCOVID_12_82y_male_ICU	
##	AAR2	15.12	7.03
##	AARD	0.06	0.13
##	AARS1	8.97	2.63
##	AARS2	1.82	0.37
##	AARSD1	13.20	2.50
##	AASDH	4.03	2.01
##	AASDHPPT	10.69	8.60
##	AASS	0.14	0.06
##	AATF	43.38	36.86



##	AATK	6.20	5.64
##	ABAT	5.30	9.81
##	NONCOVID_13_65y_male_ICU	NONCOVID_14_75y_female_ICU	
##	AAR2	11.94	5.14
##	AARD	0.00	0.07
##	AARS1	5.94	1.55
##	AARS2	1.39	0.47
##	AARSD1	7.47	2.53
##	AASDH	2.66	1.47
##	AASDHPPT	6.35	6.54
##	AASS	0.11	0.04
##	AATF	34.24	30.16
##	AATK	10.74	11.02
##	ABAT	7.93	10.14
##	NONCOVID_15_83y_unknown_ICU	NONCOVID_16_40y_female_ICU	
##	AAR2	17.72	9.44
##	AARD	0.09	0.02
##	AARS1	13.24	6.05
##	AARS2	3.16	0.92
##	AARSD1	17.13	7.40
##	AASDH	5.06	2.99
##	AASDHPPT	11.14	7.69
##	AASS	0.37	0.16
##	AATF	49.21	35.08
##	AATK	5.97	20.71
##	ABAT	4.90	4.47
##	NONCOVID_17_84y_female_ICU	NONCOVID_18_88y_male_ICU	
##	AAR2	14.28	9.83
##	AARD	0.18	0.06
##	AARS1	8.67	4.92
##	AARS2	1.82	0.81
##	AARSD1	7.93	4.13
##	AASDH	5.39	2.93
##	AASDHPPT	15.44	5.71
##	AASS	0.19	0.03
##	AATF	42.71	33.86
##	AATK	14.59	6.96
##	ABAT	13.29	5.63
##	NONCOVID_19_66y_female_ICU	NONCOVID_20_62y_female_ICU	
##	AAR2	8.37	6.64
##	AARD	0.02	0.07
##	AARS1	3.75	5.10
##	AARS2	0.82	1.03
##	AARSD1	4.69	4.92
##	AASDH	2.46	3.38
##	AASDHPPT	4.33	6.97
##	AASS	0.05	0.13
##	AATF	27.21	39.19
##	AATK	10.91	6.89
##	ABAT	4.26	4.76
##	NONCOVID_21_71y_male_NonICU	NONCOVID_22_63y_male_NonICU	
##	AAR2	14.16	7.81
##	AARD	0.14	0.00
##	AARS1	9.01	5.95

## AARS2	1.68	1.21
## AARSD1	18.30	14.49
## AASDH	2.75	1.69
## AASDHPPT	5.68	2.59
## AASS	0.13	0.05
## AATF	44.55	29.72
## AATK	4.42	4.50
## ABAT	2.76	0.57
##	NONCOVID_23_42y_female_NonICU	NONCOVID_24_32y_female_NonICU
## AAR2	10.34	15.42
## AARD	0.02	0.17
## AARS1	8.00	12.70
## AARS2	1.84	2.87
## AARSD1	15.23	18.29
## AASDH	2.05	5.50
## AASDHPPT	4.34	10.23
## AASS	0.11	0.19
## AATF	37.58	50.13
## AATK	12.95	7.76
## ABAT	1.72	6.03
##	NONCOVID_25_62y_male_NonICU	NONCOVID_26_36y_male_ICU
## AAR2	9.07	4.86
## AARD	0.11	0.10
## AARS1	5.92	2.24
## AARS2	1.80	0.44
## AARSD1	22.52	3.03
## AASDH	1.31	0.64
## AASDHPPT	2.50	1.61
## AASS	0.17	0.01
## AATF	27.51	18.31
## AATK	3.43	4.15
## ABAT	1.18	0.53

```
levels(annotationData$sex)
```

```
## [1] "female" "male" "unknown"
```

```
ggsave("my_heat.pdf", plot=my_heat, width = 8, height = 6)
```

```
new_data <- new_data %>%
filter(meta.sex != "unknown")
colors = c("orangered", "palegreen")
# boxplot
my_violin <- ggplot(new_data, aes(x = meta.sex, y = gene_expression, fill = meta.icu_status)) +
geom_violin() +
scale_fill_manual(values = colors) +
ggtitle(paste("Boxplot of A1BG Expression by Sex and ICU Status")) +
xlab("Sex") +
ylab("Gene Expression") +
labs(fill = "ICU_Status")
theme_minimal() +
theme(
legend.position = "bottom",
plot.title = element_text(hjust = 0.5, size = 14, face = "bold"),
axis.title.x = element_text(size = 12, face = "bold"),
```

```
axis.title.y = element_text(size = 12, face = "bold"),
axis.text = element_text(size = 10)
)
```

```
## List of 136
## $ line :List of 6
## ..$ colour : chr "black"
## ..$ linewidth : num 0.5
## ..$ linetype : num 1
## ..$ lineend : chr "butt"
## ..$ arrow : logi FALSE
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_line" "element"
## $ rect :List of 5
## ..$ fill : chr "white"
## ..$ colour : chr "black"
## ..$ linewidth : num 0.5
## ..$ linetype : num 1
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_rect" "element"
## $ text :List of 11
## ..$ family : chr ""
## ..$ face : chr "plain"
## ..$ colour : chr "black"
## ..$ size : num 11
## ..$ hjust : num 0.5
## ..$ vjust : num 0.5
## ..$ angle : num 0
## ..$ lineheight : num 0.9
## ..$ margin : 'margin' num [1:4] 0points 0points 0points 0points
## ..- attr(*, "unit")= int 8
## ..$ debug : logi FALSE
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ title : NULL
## $ aspect.ratio : NULL
## $ axis.title : NULL
## $ axis.title.x :List of 11
## ..$ family : NULL
## ..$ face : chr "bold"
## ..$ colour : NULL
## ..$ size : num 12
## ..$ hjust : NULL
## ..$ vjust : num 1
## ..$ angle : NULL
## ..$ lineheight : NULL
## ..$ margin : 'margin' num [1:4] 2.75points 0points 0points 0points
## ..- attr(*, "unit")= int 8
## ..$ debug : NULL
## ..$ inherit.blank: logi FALSE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.title.x.top :List of 11
## ..$ family : NULL
## ..$ face : NULL
```

```

## ..$ colour      : NULL
## ..$ size        : NULL
## ..$ hjust       : NULL
## ..$ vjust       : num 0
## ..$ angle       : NULL
## ..$ lineheight  : NULL
## ..$ margin      : 'margin' num [1:4] 0points 0points 2.75points 0points
## ..- attr(*, "unit")= int 8
## ..$ debug       : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.title.x.bottom      : NULL
## $ axis.title.y             :List of 11
## ..$ family               : NULL
## ..$ face                 : chr "bold"
## ..$ colour              : NULL
## ..$ size                : num 12
## ..$ hjust               : NULL
## ..$ vjust               : num 1
## ..$ angle               : num 90
## ..$ lineheight          : NULL
## ..$ margin              : 'margin' num [1:4] 0points 2.75points 0points 0points
## ..- attr(*, "unit")= int 8
## ..$ debug               : NULL
## ..$ inherit.blank: logi FALSE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.title.y.left       : NULL
## $ axis.title.y.right      :List of 11
## ..$ family               : NULL
## ..$ face                 : NULL
## ..$ colour              : NULL
## ..$ size                : NULL
## ..$ hjust               : NULL
## ..$ vjust               : num 1
## ..$ angle               : num -90
## ..$ lineheight          : NULL
## ..$ margin              : 'margin' num [1:4] 0points 0points 0points 2.75points
## ..- attr(*, "unit")= int 8
## ..$ debug               : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.text               :List of 11
## ..$ family               : NULL
## ..$ face                 : NULL
## ..$ colour              : chr "grey30"
## ..$ size                : num 10
## ..$ hjust               : NULL
## ..$ vjust               : NULL
## ..$ angle               : NULL
## ..$ lineheight          : NULL
## ..$ margin              : NULL
## ..$ debug               : NULL
## ..$ inherit.blank: logi FALSE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"

```

```

## $ axis.text.x                               :List of 11
## ..$ family      : NULL
## ..$ face         : NULL
## ..$ colour       : NULL
## ..$ size         : NULL
## ..$ hjust        : NULL
## ..$ vjust        : num 1
## ..$ angle        : NULL
## ..$ lineheight    : NULL
## ..$ margin       : 'margin' num [1:4] 2.2points 0points 0points 0points
## ..- attr(*, "unit")= int 8
## ..$ debug        : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.text.x.top                               :List of 11
## ..$ family      : NULL
## ..$ face         : NULL
## ..$ colour       : NULL
## ..$ size         : NULL
## ..$ hjust        : NULL
## ..$ vjust        : num 0
## ..$ angle        : NULL
## ..$ lineheight    : NULL
## ..$ margin       : 'margin' num [1:4] 0points 0points 2.2points 0points
## ..- attr(*, "unit")= int 8
## ..$ debug        : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.text.x.bottom                           : NULL
## $ axis.text.y                               :List of 11
## ..$ family      : NULL
## ..$ face         : NULL
## ..$ colour       : NULL
## ..$ size         : NULL
## ..$ hjust        : num 1
## ..$ vjust        : NULL
## ..$ angle        : NULL
## ..$ lineheight    : NULL
## ..$ margin       : 'margin' num [1:4] 0points 2.2points 0points 0points
## ..- attr(*, "unit")= int 8
## ..$ debug        : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.text.y.left                             : NULL
## $ axis.text.y.right                           :List of 11
## ..$ family      : NULL
## ..$ face         : NULL
## ..$ colour       : NULL
## ..$ size         : NULL
## ..$ hjust        : num 0
## ..$ vjust        : NULL
## ..$ angle        : NULL
## ..$ lineheight    : NULL
## ..$ margin       : 'margin' num [1:4] 0points 0points 0points 2.2points

```

```

## ..- attr(*, "unit")= int 8
## ..$ debug : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.text.theta : NULL
## $ axis.text.r :List of 11
## ..$ family : NULL
## ..$ face : NULL
## ..$ colour : NULL
## ..$ size : NULL
## ..$ hjust : num 0.5
## ..$ vjust : NULL
## ..$ angle : NULL
## ..$ lineheight : NULL
## ..$ margin : 'margin' num [1:4] 0points 2.2points 0points 2.2points
## ..- attr(*, "unit")= int 8
## ..$ debug : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.ticks : list()
## ..- attr(*, "class")= chr [1:2] "element_blank" "element"
## $ axis.ticks.x : NULL
## $ axis.ticks.x.top : NULL
## $ axis.ticks.x.bottom : NULL
## $ axis.ticks.y : NULL
## $ axis.ticks.y.left : NULL
## $ axis.ticks.y.right : NULL
## $ axis.ticks.theta : NULL
## $ axis.ticks.r : NULL
## $ axis.minor.ticks.x.top : NULL
## $ axis.minor.ticks.x.bottom : NULL
## $ axis.minor.ticks.y.left : NULL
## $ axis.minor.ticks.y.right : NULL
## $ axis.minor.ticks.theta : NULL
## $ axis.minor.ticks.r : NULL
## $ axis.ticks.length : 'simpleUnit' num 2.75points
## ..- attr(*, "unit")= int 8
## $ axis.ticks.length.x : NULL
## $ axis.ticks.length.x.top : NULL
## $ axis.ticks.length.x.bottom : NULL
## $ axis.ticks.length.y : NULL
## $ axis.ticks.length.y.left : NULL
## $ axis.ticks.length.y.right : NULL
## $ axis.ticks.length.theta : NULL
## $ axis.ticks.length.r : NULL
## $ axis.minor.ticks.length : 'rel' num 0.75
## $ axis.minor.ticks.length.x : NULL
## $ axis.minor.ticks.length.x.top : NULL
## $ axis.minor.ticks.length.x.bottom: NULL
## $ axis.minor.ticks.length.y : NULL
## $ axis.minor.ticks.length.y.left : NULL
## $ axis.minor.ticks.length.y.right : NULL
## $ axis.minor.ticks.length.theta : NULL
## $ axis.minor.ticks.length.r : NULL

```

```

## $ axis.line : list()
##   .. attr(*, "class")= chr [1:2] "element_blank" "element"
## $ axis.line.x : NULL
## $ axis.line.x.top : NULL
## $ axis.line.x.bottom : NULL
## $ axis.line.y : NULL
## $ axis.line.y.left : NULL
## $ axis.line.y.right : NULL
## $ axis.line.theta : NULL
## $ axis.line.r : NULL
## $ legend.background : list()
##   .. attr(*, "class")= chr [1:2] "element_blank" "element"
## $ legend.margin : 'margin' num [1:4] 5.5points 5.5points 5.5points 5.5points
##   .. attr(*, "unit")= int 8
## $ legend.spacing : 'simpleUnit' num 11points
##   .. attr(*, "unit")= int 8
## $ legend.spacing.x : NULL
## $ legend.spacing.y : NULL
## $ legend.key : list()
##   .. attr(*, "class")= chr [1:2] "element_blank" "element"
## $ legend.key.size : 'simpleUnit' num 1.2lines
##   .. attr(*, "unit")= int 3
## $ legend.key.height : NULL
## $ legend.key.width : NULL
## $ legend.key.spacing : 'simpleUnit' num 5.5points
##   .. attr(*, "unit")= int 8
## $ legend.key.spacing.x : NULL
## $ legend.key.spacing.y : NULL
## $ legend.frame : NULL
## $ legend.ticks : NULL
## $ legend.ticks.length : 'rel' num 0.2
## $ legend.axis.line : NULL
## $ legend.text :List of 11
##   ..$ family : NULL
##   ..$ face : NULL
##   ..$ colour : NULL
##   ..$ size : 'rel' num 0.8
##   ..$ hjust : NULL
##   ..$ vjust : NULL
##   ..$ angle : NULL
##   ..$ lineheight : NULL
##   ..$ margin : NULL
##   ..$ debug : NULL
##   ..$ inherit.blank: logi TRUE
##   .. attr(*, "class")= chr [1:2] "element_text" "element"
## $ legend.text.position : NULL
## $ legend.title :List of 11
##   ..$ family : NULL
##   ..$ face : NULL
##   ..$ colour : NULL
##   ..$ size : NULL
##   ..$ hjust : num 0
##   ..$ vjust : NULL
##   ..$ angle : NULL

```

```

## ..$ lineheight      : NULL
## ..$ margin          : NULL
## ..$ debug           : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ legend.title.position      : NULL
## $ legend.position            : chr "bottom"
## $ legend.position.inside     : NULL
## $ legend.direction           : NULL
## $ legend.byrow               : NULL
## $ legend.justification       : chr "center"
## $ legend.justification.top    : NULL
## $ legend.justification.bottom : NULL
## $ legend.justification.left   : NULL
## $ legend.justification.right  : NULL
## $ legend.justification.inside : NULL
## $ legend.location            : NULL
## $ legend.box                 : NULL
## $ legend.box.just            : NULL
## $ legend.box.margin          : 'margin' num [1:4] 0cm 0cm 0cm 0cm
## ..- attr(*, "unit")= int 1
## $ legend.box.background      : list()
## ..- attr(*, "class")= chr [1:2] "element_blank" "element"
## $ legend.box.spacing         : 'simpleUnit' num 11points
## ..- attr(*, "unit")= int 8
## [list output truncated]
## - attr(*, "class")= chr [1:2] "theme" "gg"
## - attr(*, "complete")= logi TRUE
## - attr(*, "validate")= logi TRUE
ggsave("my_violin.pdf", plot=my_violin, width = 8, height = 6)

```