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CLASS: 1ST MSC DATA ANAYTICS

DATASET: STROKE

Data description:

The dataset consists of 11 clinical features for predicting stroke events , and with this dataset we can find the reasons and factors behind a person getting stroke.

Attribute explanation:

Id- a unique id is given to the patients

Gender- the gender of the patient

Age- the age of the patient in numeric

Hypertension- the blood pressure that is higher than that of an average blood pressure measure is present or not is given

Heart disease- tells if the patient has any heart disease or not

Work type- describes the working mode of the patient if self employed or govt job or private

Residence type- describes where the patient is from

Average glucose level- gives the average glucose level of the patient

Bmi- tells the body mass index of each patient

Smoking status- tells if ever the patient has smoked or not in their entire lifetime

Assumption:

The patients who smoke on a daily basis can have high rate of getting strokes as the nicotine will increase the average glucose level. The age of a person can also be a reason as the person gets older higher the risk of strokes. Bmi of a

person is also connected to strokes as each unit increases in body the risk of getting a stroke is raised by 5 percent.

Hypothesis:

According to the given data my assumption is wrong as the smoking status of the people who never smoked have had strokes more than the ones that smoke or formerly smoked.

Insight:

- The people between the age group 60-80 have the higher risk to get a stroke.
- Age is also a factor where hypertension plays a role.
- The never smoked category of people have the higher risk to get a stroke more than formerly smoked and smokes.
- The bmi of the patients ranges mostly from 20 to 40.

Inference:

From the above visualizations and observations, it is known that most patients do not have any heart diseases and also are not prone to stroke. The smoking status from the data gave us a very unexpected fact that the non-smokers have a greater risk to get a stroke.

```
library(readr)
library(plyr)
df <- read_csv("stroke.csv", col_types = cols(...6 = col_skip(),
                                                bmi = col_number()))

## New names:
## • `` -> `...6`

## Warning: One or more parsing issues, call `problems()` on your data frame
for details,
```

```
## e.g.:
##   dat <- vroom(...)
##   problems(dat)
```

```
summary(df)
```

```
##        id           gender               age         hypertension
##  Min.   :   67   Length:5110        Min.   : 0.08   Min.   :0.00000
##  1st Qu.:17741   Class :character   1st Qu.:25.00   1st Qu.:0.00000
##  Median :36932   Mode  :character   Median :45.00   Median :0.00000
##  Mean   :36518                      Mean   :43.23   Mean   :0.09746
##  3rd Qu.:54682                      3rd Qu.:61.00   3rd Qu.:0.00000
##  Max.   :72940                      Max.   :82.00   Max.   :1.00000
##
##  heart_disease      work_type         Residence_type     avg_glucose_level
##  Min.   :0.00000   Length:5110        Length:5110        Min.   : 55.12
##  1st Qu.:0.00000   Class :character   Class :character   1st Qu.: 77.25
##  Median :0.00000   Mode  :character   Mode  :character   Median : 91.89
##  Mean   :0.05401                                         Mean   :106.15
##  3rd Qu.:0.00000                                         3rd Qu.:114.09
##  Max.   :1.00000                                         Max.   :271.74
##
##       bmi        smoking_status         stroke
##  Min.   :10.30   Length:5110        Min.   :0.00000
##  1st Qu.:23.50   Class :character   1st Qu.:0.00000
##  Median :28.10   Mode  :character   Median :0.00000
##  Mean   :28.89                      Mean   :0.04873
##  3rd Qu.:33.10                      3rd Qu.:0.00000
##  Max.   :97.60                      Max.   :1.00000
##  NA's   :201
```

```
install.packages("dplyr")
```

```
## Installing package into '/cloud/lib/x86_64-pc-linux-gnu-library/4.2'
## (as 'lib' is unspecified)
```

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
##
## The following objects are masked from 'package:plyr':
##
##     arrange, count, desc, failwith, id, mutate, rename, summarise,
##     summarize
##
## The following objects are masked from 'package:stats':
##
##     filter, lag
##
## The following objects are masked from 'package:base':
```

```
##
##     intersect, setdiff, setequal, union
```

```
str(df)
```

```
## spc_tbl_ [5,110 × 11] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ id                : num [1:5110] 9046 51676 31112 60182 1665 ...
##  $ gender            : chr [1:5110] "Male" "Female" "Male" "Female" ...
##  $ age               : num [1:5110] 67 61 80 49 79 81 74 69 59 78 ...
##  $ hypertension      : num [1:5110] 0 0 0 0 1 0 1 0 0 0 ...
##  $ heart_disease     : num [1:5110] 1 0 1 0 0 0 1 0 0 0 ...
##  $ work_type         : chr [1:5110] "Private" "Self-employed" "Private"
"Private" ...
##  $ Residence_type    : chr [1:5110] "Urban" "Rural" "Rural" "Urban" ...
##  $ avg_glucose_level: num [1:5110] 229 202 106 171 174 ...
##  $ bmi               : num [1:5110] 36.6 NA 32.5 34.4 24 29 27.4 22.8 NA
24.2 ...
##  $ smoking_status    : chr [1:5110] "formerly smoked" "never smoked" "never
smoked" "smokes" ...
##  $ stroke            : num [1:5110] 1 1 1 1 1 1 1 1 1 1 ...
##  - attr(*, "spec")=
##   .. cols(
##   ..   id = col_double(),
##   ..   gender = col_character(),
##   ..   age = col_double(),
##   ..   hypertension = col_double(),
##   ..   heart_disease = col_double(),
##   ..   ...6 = col_skip(),
##   ..   work_type = col_character(),
##   ..   Residence_type = col_character(),
##   ..   avg_glucose_level = col_double(),
##   ..   bmi = col_number(),
##   ..   smoking_status = col_character(),
##   ..   stroke = col_double()
##   .. )
##  - attr(*, "problems")=<externalptr>
```

```
summarise(df,mean(avg_glucose_level))
```

```
## # A tibble: 1 × 1
##   `mean(avg_glucose_level)`
##                       <dbl>
## 1                      106.
```

```
unique(df["age"])
```

```
## # A tibble: 104 × 1
##      age
##    <dbl>
##  1    67
##  2    61
```

```
##  3    80
##  4    49
##  5    79
##  6    81
##  7    74
##  8    69
##  9    59
## 10    78
## # … with 94 more rows

colSums(is.na(df))

##                id            gender               age      hypertension
##                 0                 0                 0                 0
##     heart_disease         work_type    Residence_type avg_glucose_level
##                 0                 0                 0                 0
##               bmi    smoking_status            stroke
##               201                 0                 0

df["bmi"][is.na(df["bmi"])] <- 28
df$bmi[is.na(df$bmi)] <- sapply(df$bmi, median, na.rm = TRUE)
df$bmi

##    [1] 36.6 28.0 32.5 34.4 24.0 29.0 27.4 22.8 28.0 24.2 29.7 36.8 27.3
28.0
##   [15] 28.2 30.9 37.5 25.8 37.8 28.0 22.4 48.9 26.6 32.5 27.2 23.5 28.2
28.0
##   [29] 28.3 28.0 44.2 25.4 22.2 30.5 29.7 26.5 33.7 23.1 32.0 29.9 23.9
28.5
##   [43] 26.4 28.0 20.2 33.6 28.0 38.6 33.7 39.2 28.0 28.0 27.7 31.4 28.0
36.5
##   [57] 33.2 28.0 32.8 27.7 40.4 22.2 25.3 30.2 28.0 24.0 47.5 20.3 30.0
28.9
##   [71] 28.0 28.1 31.1 27.4 26.4 21.7 27.0 24.1 28.0 45.9 44.1 28.0 22.9
29.7
##   [85] 28.0 29.1 27.3 32.3 41.1 25.6 29.8 26.3 37.5 26.2 29.4 32.3 24.4
31.4
##   [99] 27.7 28.0 28.8 31.4 34.6 19.4 28.5 28.0 30.3 40.4 24.2 41.5 22.6
24.2
##  [113] 28.0 56.6 27.1 30.9 27.3 31.3 24.0 31.0 28.0 30.3 31.7 35.8 28.0
28.4
##  [127] 28.0 24.0 29.0 28.0 36.5 20.1 36.5 28.0 26.7 38.7 29.9 34.9 27.0
26.6
##  [141] 25.0 23.8 21.8 36.8 30.0 27.5 28.0 24.6 32.9 26.1 28.0 31.9 34.1
27.5
##  [155] 25.6 36.9 31.4 37.3 34.1 25.0 28.0 28.0 28.0 45.7 34.2 23.6 27.3
28.0
##  [169] 22.3 31.4 28.0 28.0 26.4 32.9 28.0 37.1 45.0 25.5 28.0 26.1 30.8
32.0
##  [183] 29.9 28.0 37.4 31.7 34.5 27.9 29.5 28.0 46.0 42.5 35.5 31.1 26.9
35.8
```

```
##  [197] 45.5 28.5 28.0 26.6 28.0 31.5 32.0 30.8 31.1 33.0 23.4 26.9 33.6
23.9
##  [211] 26.3 27.3 30.7 20.5 21.5 31.0 27.1 40.0 28.0 28.6 28.1 28.4 42.2
25.8
##  [225] 31.9 31.0 27.5 28.0 29.6 35.4 16.9 21.5 34.4 28.0 26.8 39.3 31.7
32.6
##  [239] 28.4 35.9 21.2 34.5 42.4 40.5 36.7 30.9 29.3 28.0 19.6 18.0 39.2
17.6
##  [253] 35.9 19.1 50.1 17.7 27.0 32.3 54.6 35.0 22.0 39.4 26.1 42.4 33.0
19.7
##  [267] 22.5 24.6 25.2 41.8 60.9 31.5 27.3 23.7 24.5 28.4 26.9 26.7 31.2
25.0
##  [281] 25.4 27.5 16.0 27.0 31.6 25.1 30.9 24.8 23.4 29.4 18.3 20.0 19.5
36.0
##  [295] 27.7 27.5 28.5 26.8 33.6 29.1 28.5 34.9 25.1 35.3 26.4 31.5 40.1
43.1
##  [309] 36.7 29.3 21.2 31.2 21.4 27.9 34.3 31.0 27.7 36.0 38.7 27.6 25.1
16.5
##  [323] 22.8 35.4 24.3 34.3 40.1 25.7 21.9 38.4 26.1 30.5 25.9 54.7 29.9
18.6
##  [337] 27.1 24.9 25.2 19.4 29.0 48.2 28.0 34.6 24.6 25.8 26.1 29.0 27.2
20.7
##  [351] 30.0 37.3 34.1 23.6 25.2 39.5 23.5 23.3 64.8 28.1 28.0 24.4 29.8
24.9
##  [365] 35.1 32.3 43.6 21.0 47.3 16.6 37.5 24.2 31.6 21.6 31.0 31.1 15.5
27.3
##  [379] 20.5 35.6 16.7 41.8 41.9 16.4 17.1 29.2 27.1 37.9 44.6 22.8 33.2
22.3
##  [393] 26.4 39.6 28.1 39.2 36.0 37.8 40.3 41.5 17.7 21.2 41.6 23.8 23.7
24.8
##  [407] 39.0 37.9 31.1 23.2 18.9 36.1 36.3 40.5 25.4 46.5 16.8 46.6 26.4
26.2
##  [421] 35.2 20.9 36.8 34.4 22.2 13.8 40.3 28.4 31.7 34.2 54.7 24.6 28.0
36.9
##  [435] 31.1 31.9 31.8 18.0 28.5 29.5 22.0 29.4 28.8 26.2 26.9 23.2 27.9
36.8
##  [449] 28.9 31.0 29.4 15.3 37.1 30.5 38.2 23.2 30.2 45.2 21.8 24.4 17.0
19.5
##  [463] 49.8 27.8 25.1 26.8 60.2 27.5 28.1 27.3 27.4 22.2 22.9 26.6 23.0
32.6
##  [477] 22.1 28.0 22.5 28.0 25.5 31.4 26.0 20.0 31.6 31.2 21.7 24.2 25.0
36.7
##  [491] 28.9 29.7 44.3 51.0 39.7 34.7 35.0 21.3 29.1 23.9 36.0 41.2 27.1
33.2
##  [505] 25.4 30.7 34.8 19.2 31.7 35.7 37.8 29.7 35.8 23.6 39.7 40.5 21.4
40.8
##  [519] 24.7 21.0 45.0 26.2 28.0 28.3 41.6 19.0 32.4 34.0 39.4 28.7 31.8
31.2
##  [533] 20.9 32.1 31.0 23.1 26.7 27.9 27.3 51.5 20.4 29.6 30.6 33.6 71.9
24.2
```

```
##  [547] 17.7 22.6 28.1 26.5 28.7 39.5 35.1 27.9 19.3 28.4 26.7 40.9 17.2
28.3
##  [561] 16.1 27.6 16.5 35.8 16.2 24.6 32.0 35.3 19.2 40.4 30.7 24.3 26.4
34.7
##  [575] 31.7 35.6 22.8 28.0 35.6 40.6 29.3 21.0 20.0 26.7 18.4 34.5 27.7
21.1
##  [589] 24.4 19.4 42.3 32.2 26.8 25.4 23.5 50.2 26.1 17.5 24.2 30.8 23.4
30.9
##  [603] 23.6 18.7 27.7 16.7 31.2 17.0 29.8 19.7 29.1 27.2 22.3 27.0 42.1
34.2
##  [617] 40.9 29.4 32.8 21.9 39.6 28.3 47.8 39.3 28.0 27.1 31.2 23.1 20.8
34.1
##  [631] 30.1 35.8 34.6 29.8 26.7 30.2 29.7 54.6 23.3 35.6 27.0 21.6 29.4
22.8
##  [645] 17.3 29.8 36.4 34.7 28.7 26.7 22.1 27.7 40.5 23.0 25.3 22.1 28.0
12.0
##  [659] 28.4 29.6 36.2 22.8 55.7 24.3 26.9 25.3 35.3 18.3 28.0 26.0 21.0
28.0
##  [673] 55.7 27.6 20.5 30.2 21.9 28.8 36.2 25.9 28.0 21.4 20.4 31.6 14.4
23.7
##  [687] 30.2 19.5 32.6 34.2 43.0 42.2 19.7 41.7 21.6 24.2 19.2 25.8 23.2
20.8
##  [701] 28.4 30.2 23.1 16.7 39.5 33.8 34.6 25.0 43.9 27.1 25.9 22.7 27.1
25.6
##  [715] 28.4 57.5 35.8 19.5 31.2 43.6 31.2 23.5 18.7 24.4 29.4 37.0 29.4
38.5
##  [729] 23.5 28.0 16.3 35.9 35.9 20.3 32.3 27.9 22.3 31.8 29.7 27.1 24.5
28.9
##  [743] 28.0 24.6 31.6 32.3 41.1 30.0 26.4 30.0 20.8 44.0 30.6 17.2 29.1
27.4
##  [757] 23.5 31.8 23.5 28.5 32.7 54.2 25.6 41.2 27.0 21.3 34.3 29.5 31.6
26.1
##  [771] 27.5 26.5 33.2 40.2 32.5 23.4 32.5 23.9 29.5 24.0 17.7 26.2 33.3
17.4
##  [785] 29.0 21.7 37.8 41.8 24.2 31.1 23.1 25.1 41.3 22.7 24.0 20.5 20.4
27.6
##  [799] 27.0 26.4 34.9 35.0 28.5 32.3 23.9 52.3 26.4 20.9 23.3 32.7 26.5
27.9
##  [813] 30.3 27.6 14.6 40.9 28.4 23.7 27.9 25.2 34.4 36.7 22.2 27.2 27.3
27.3
##  [827] 42.2 26.4 39.4 34.8 20.0 34.1 31.4 17.8 46.1 28.1 24.7 22.7 34.6
21.4
##  [841] 27.4 36.6 32.9 24.7 21.4 33.1 26.7 24.4 25.8 34.3 18.1 43.8 26.9
36.6
##  [855] 24.9 27.6 20.9 30.3 37.4 35.9 50.3 31.5 24.4 38.9 28.6 28.0 27.5
28.0
##  [869] 43.7 27.0 29.3 34.7 28.0 39.9 26.7 24.8 29.7 15.9 31.4 28.0 27.8
35.5
##  [883] 31.7 33.2 27.7 31.9 25.8 27.7 23.4 24.3 30.3 29.1 20.1 21.2 31.6
41.6
```

```
##  [897] 36.4 30.5 32.8 32.3 30.1 34.7 29.7 28.0 31.3 35.6 35.2 27.6 35.2
28.1
##  [911] 31.8 23.3 28.8 19.5 30.0 25.5 28.8 40.2 32.9 22.4 36.9 19.8 12.3
32.4
##  [925] 24.8 16.4 35.9 23.0 78.0 30.5 26.8 35.3 27.9 22.1 38.3 41.0 28.0
22.8
##  [939] 30.1 20.8 31.7 30.1 30.8 42.6 37.1 34.2 43.4 18.7 34.0 23.2 41.7
15.1
##  [953] 20.6 18.9 26.6 30.1 32.1 15.1 33.5 23.4 43.2 19.1 26.1 17.3 32.1
28.0
##  [967] 30.4 29.9 32.8 22.7 28.7 35.2 22.4 32.3 18.6 42.1 38.0 22.3 33.4
23.2
##  [981] 18.0 20.1 19.2 28.7 28.1 22.6 18.0 21.4 27.8 27.6 32.2 24.9 27.1
24.6
##  [995] 24.6 18.9 16.3 31.8 21.0 20.1 29.1 32.3 29.4 50.2 44.9 28.5 19.5
45.0
## [1009] 22.8 25.5 31.5 31.6 31.0 29.5 23.1 30.7 44.7 33.5 25.9 28.3 26.8
27.8
## [1023] 36.0 22.1 38.4 30.1 26.2 26.6 32.6 27.0 25.3 31.9 18.4 30.4 28.2
35.7
## [1037] 35.0 27.2 23.0 25.0 24.5 30.9 26.0 27.2 30.4 21.7 29.1 17.6 29.2
28.1
## [1051] 26.6 26.9 36.2 25.9 40.9 31.5 23.3 37.6 39.8 35.1 21.9 53.4 34.4
24.0
## [1065] 29.3 26.0 31.3 31.0 26.5 16.0 21.1 42.2 27.7 23.6 18.3 44.3 27.3
55.2
## [1079] 44.7 33.1 30.0 40.1 23.1 30.3 30.5 22.8 42.0 29.9 24.0 36.7 22.2
25.5
## [1093] 34.3 16.0 25.6 23.3 41.6 35.6 22.0 26.8 31.9 19.7 28.0 31.1 34.4
33.2
## [1107] 28.0 21.6 25.4 41.6 33.1 21.8 30.0 35.2 35.6 28.0 27.8 29.3 37.2
26.1
## [1121] 21.6 22.7 30.2 18.0 27.8 23.5 41.2 22.7 29.2 42.2 24.0 45.5 19.4
28.2
## [1135] 20.1 27.2 26.5 17.6 42.8 29.3 21.3 29.8 24.1 35.2 18.8 17.4 31.5
29.9
## [1149] 27.3 28.1 28.9 25.2 24.3 37.9 28.2 18.4 23.1 39.4 29.5 18.3 28.7
32.9
## [1163] 26.7 20.1 17.6 43.7 41.1 26.8 31.2 27.4 25.1 33.0 30.7 42.9 14.3
33.2
## [1177] 43.0 22.3 32.8 30.5 36.0 26.5 20.1 28.0 28.1 16.2 30.0 31.3 26.7
37.7
## [1191] 35.8 27.0 20.7 22.2 28.0 41.5 33.5 21.8 22.1 30.2 38.7 32.1 41.3
20.1
## [1205] 22.1 24.9 23.0 29.3 22.8 31.6 19.4 22.5 31.6 29.1 28.0 43.4 26.5
29.7
## [1219] 21.8 23.4 23.0 21.5 14.6 28.5 29.0 26.9 29.6 28.5 25.5 30.5 23.0
22.8
## [1233] 31.4 35.2 23.3 28.0 31.2 24.8 25.8 48.4 43.1 28.0 27.8 21.4 22.1
31.8
```

```
## [1247] 20.1 29.1 22.6 25.1 33.3 15.9 20.8 19.5 39.0 23.1 18.8 50.6 36.3
32.8
## [1261] 35.8 26.7 26.3 26.5 43.7 24.7 46.2 49.5 43.3 30.9 38.7 28.6 30.2
30.5
## [1275] 33.9 28.6 24.5 28.0 17.2 27.2 19.3 18.5 32.0 44.5 37.0 30.8 24.7
18.3
## [1289] 44.0 27.6 45.4 28.5 17.6 28.0 27.5 32.8 29.5 36.4 26.1 35.3 28.0
18.1
## [1303] 27.1 23.0 55.0 26.6 28.0 24.1 30.3 32.2 26.5 30.6 25.8 41.9 29.2
44.3
## [1317] 29.1 17.5 31.9 32.2 26.0 25.4 54.8 27.9 28.0 32.8 34.0 25.5 35.6
28.3
## [1331] 36.9 22.1 31.5 26.7 24.9 32.4 32.2 30.3 28.7 24.1 25.3 24.8 28.0
34.8
## [1345] 39.2 24.7 28.6 27.7 33.1 27.3 20.3 33.9 28.0 28.3 32.4 19.7 33.7
35.5
## [1359] 20.0 16.3 36.4 28.1 26.9 29.4 17.2 26.5 19.5 30.6 31.9 26.6 19.9
18.0
## [1373] 26.7 25.3 31.4 21.1 17.9 27.5 37.6 24.1 18.1 31.0 26.6 38.7 27.2
27.8
## [1387] 28.3 27.5 43.3 20.1 25.9 25.8 16.4 29.4 28.9 26.7 27.8 38.7 26.8
36.1
## [1401] 26.7 27.0 21.2 21.0 37.4 26.5 28.9 29.5 17.7 34.9 28.1 36.8 33.3
29.2
## [1415] 34.0 33.9 28.7 21.1 38.2 27.7 35.8 27.1 20.5 35.6 15.6 43.0 17.8
28.0
## [1429] 25.8 20.5 19.9 24.4 18.3 35.1 35.1 37.1 29.4 31.7 31.4 33.1 28.5
24.0
## [1443] 18.0 27.6 16.9 16.4 35.1 28.8 17.6 21.3 19.7 37.3 35.5 25.5 30.0
21.9
## [1457] 45.5 28.0 34.9 19.3 32.1 26.9 32.5 19.5 31.7 21.0 28.0 20.3 28.0
21.5
## [1471] 40.4 28.0 30.1 40.2 34.7 25.9 23.7 34.3 34.3 26.3 22.1 33.3 37.3
20.5
## [1485] 19.1 34.7 16.3 28.0 17.2 41.1 25.0 27.5 21.5 15.1 29.6 30.2 34.9
30.7
## [1499] 36.5 21.5 33.2 50.2 22.3 28.0 27.3 28.3 31.9 24.9 32.7 26.4 24.8
30.7
## [1513] 25.4 32.0 24.4 20.4 29.5 24.4 22.8 20.0 36.3 32.8 34.4 30.5 29.7
36.9
## [1527] 34.2 37.0 28.0 47.5 24.2 30.6 52.8 38.6 32.8 42.9 25.9 24.7 35.8
28.0
## [1541] 31.2 26.1 30.8 40.5 25.2 28.7 28.0 30.4 15.2 36.6 34.5 23.7 35.7
38.9
## [1555] 40.0 18.4 29.0 20.6 28.2 66.8 26.2 34.8 34.5 30.6 55.1 18.8 29.1
22.1
## [1569] 28.9 34.7 20.3 25.1 18.2 25.5 34.4 48.5 25.2 32.5 42.1 19.5 27.7
25.1
## [1583] 29.6 32.9 55.9 25.1 24.7 17.5 20.8 23.3 22.8 26.6 25.5 25.8 25.4
57.3
```

```
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10.3
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## [3837] 15.5 31.1 37.5 37.7 24.2 33.4 33.0 25.7 19.4 33.4 18.0 40.1 26.9
22.5
## [3851] 27.6 23.3 35.7 28.4 29.4 31.9 25.1 35.6 21.1 17.8 31.5 26.6 44.8
31.3
## [3865] 17.2 25.3 28.8 49.9 18.0 23.5 18.1 41.7 28.0 20.7 30.3 27.8 18.9
20.4
## [3879] 31.8 44.8 37.1 39.9 24.1 18.1 36.3 19.1 21.1 28.9 18.9 43.3 37.2
32.2
## [3893] 26.3 25.4 18.3 21.4 22.9 16.2 29.6 21.5 24.2 37.3 33.3 33.1 22.2
24.4
## [3907] 30.3 28.2 17.0 53.8 30.4 22.3 25.3 28.0 29.8 43.8 34.5 25.5 31.5
39.2
## [3921] 47.3 17.0 38.2 31.1 22.4 32.0 24.7 36.3 20.2 27.4 29.6 54.3 28.6
43.9
## [3935] 22.2 28.4 23.7 18.3 18.3 28.9 28.0 27.1 13.8 21.9 24.0 28.0 20.8
39.8
## [3949] 26.2 43.9 27.3 28.0 22.0 40.0 20.1 42.2 25.8 27.2 30.9 47.9 33.1
37.8
## [3963] 25.4 28.4 16.6 35.1 32.7 29.8 13.0 27.5 23.6 36.9 16.7 26.5 37.0
27.7
## [3977] 23.5 40.4 27.7 28.3 55.0 28.7 25.0 24.8 35.5 25.0 17.3 37.8 32.8
28.7
## [3991] 28.8 28.4 24.9 29.6 26.1 29.5 23.9 25.8 36.2 31.3 26.1 19.1 17.6
21.4
## [4005] 24.0 25.5 19.9 19.9 35.5 26.9 24.2 30.0 30.9 26.5 30.6 19.1 23.2
30.5
## [4019] 15.8 16.9 18.0 13.9 36.7 30.8 34.6 16.3 38.2 27.3 30.4 34.5 17.4
32.0
## [4033] 33.4 40.2 30.1 46.2 35.6 29.4 27.3 17.4 26.9 17.7 23.6 27.7 38.0
35.2
```
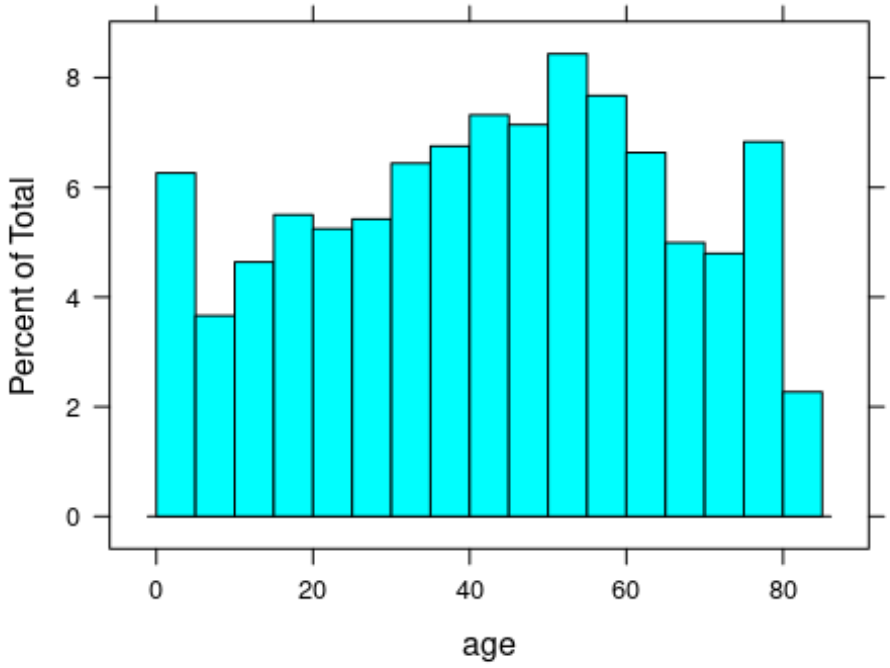

```
## [4047] 28.0 32.4 36.1 30.6 29.0 22.3 27.3 17.4 39.0 26.7 24.2 22.8 25.6
21.9
## [4061] 25.9 30.6 25.7 33.3 23.8 17.2 31.0 24.7 27.1 28.0 38.3 50.9 29.2
23.6
## [4075] 33.5 16.3 30.8 31.1 26.4 18.6 37.3 26.6 17.6 22.3 20.2 30.9 31.5
29.7
## [4089] 32.5 32.8 25.4 27.2 31.6 39.6 19.8 29.6 25.5 25.8 32.1 25.6 26.3
39.4
## [4103] 25.6 34.0 35.8 24.9 29.3 23.4 24.5 29.8 28.9 27.3 23.2 34.2 23.3
26.9
## [4117] 21.8 26.9 29.9 22.4 27.5 35.0 27.9 25.5 28.6 34.8 50.6 30.9 14.8
31.4
## [4131] 22.3 19.1 27.4 17.5 36.2 25.4 25.7 28.6 33.7 37.9 28.4 20.0 29.1
27.6
## [4145] 27.6 24.2 31.0 34.5 27.0 20.7 26.1 19.2 28.0 23.6 57.2 33.0 22.2
24.8
## [4159] 24.7 27.9 21.6 34.8 32.9 28.0 28.0 25.0 24.7 27.3 34.2 39.1 22.7
33.9
## [4173] 18.6 16.7 20.6 20.1 45.2 25.3 32.4 34.9 43.7 23.0 21.5 24.9 22.9
25.0
## [4187] 21.3 46.1 64.4 37.0 21.3 28.3 31.1 25.1 27.6 29.4 14.1 35.2 23.9
34.0
## [4201] 27.1 29.5 28.0 20.7 39.5 33.7 23.2 30.1 28.8 92.0 38.0 27.7 43.2
24.1
## [4215] 28.7 34.8 23.5 28.5 20.3 43.0 18.3 27.2 22.0 50.8 35.4 55.9 27.9
19.8
## [4229] 26.0 26.8 28.0 32.5 15.0 14.2 17.0 26.2 24.9 26.6 22.7 32.7 36.7
31.5
## [4243] 36.9 27.6 20.7 20.2 23.4 25.3 28.2 27.0 24.8 34.8 17.3 27.8 16.2
28.0
## [4257] 21.7 21.4 29.3 36.2 28.3 23.5 25.9 27.1 21.5 30.5 23.4 37.6 24.0
25.1
## [4271] 28.7 41.8 25.6 27.2 24.4 20.7 19.6 24.8 32.6 20.5 36.2 45.4 27.6
28.0
## [4285] 34.7 32.4 28.0 28.7 45.3 40.3 38.9 46.0 32.4 19.4 27.5 26.2 31.1
34.6
## [4299] 24.3 34.6 28.5 32.1 28.0 20.9 33.8 25.8 31.8 26.8 25.9 29.2 25.3
41.7
## [4313] 38.8 29.1 30.9 39.3 41.8 26.2 33.8 26.1 24.1 30.7 22.4 23.0 30.2
30.3
## [4327] 28.7 36.3 16.3 34.5 20.8 31.0 17.6 22.7 38.4 40.8 32.9 31.3 28.5
27.6
## [4341] 40.2 24.7 17.7 25.4 28.5 26.2 26.0 45.3 31.5 20.6 29.4 57.9 39.1
23.8
## [4355] 38.1 19.5 35.5 26.4 22.2 29.1 41.9 22.6 33.3 21.3 20.4 28.7 28.8
38.7
## [4369] 32.3 37.9 25.3 27.7 25.1 16.8 27.7 28.6 37.6 32.7 22.7 16.0 23.5
45.8
## [4383] 20.8 16.7 22.2 33.1 32.7 41.4 24.1 28.0 24.2 23.5 23.0 20.3 24.8
26.1
```

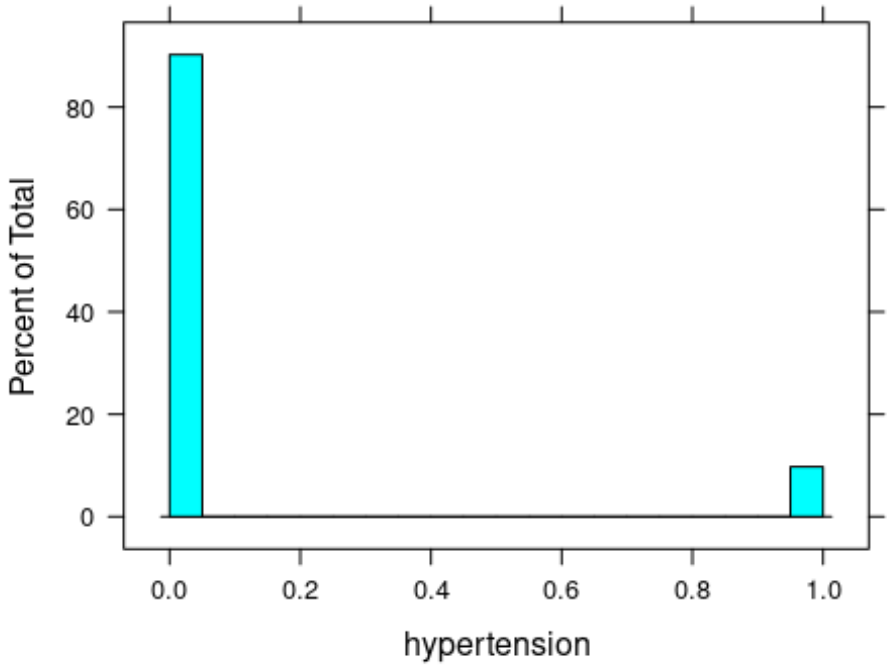
```
## [4397] 24.2 19.3 18.2 24.2 41.5 28.0 37.0 32.2 35.9 47.6 32.1 55.7 22.2
20.1
## [4411] 14.6 28.4 20.6 19.8 23.4 25.1 30.1 33.3 24.0 27.8 21.4 25.5 28.0
21.8
## [4425] 18.9 21.9 30.6 29.8 28.7 35.5 29.1 32.8 22.8 31.3 29.0 19.0 24.1
21.4
## [4439] 28.0 27.6 28.7 24.5 25.0 29.6 29.9 35.6 27.9 42.6 21.2 28.5 25.6
28.0
## [4453] 31.1 30.4 22.9 31.9 48.8 43.0 21.8 35.5 24.3 23.1 18.5 42.4 32.3
22.6
## [4467] 17.8 18.4 26.9 32.0 23.4 31.4 22.4 28.9 27.4 57.2 28.4 23.5 28.3
38.2
## [4481] 33.3 33.3 28.8 32.1 28.9 25.5 25.9 19.5 23.8 24.9 18.5 30.6 16.1
32.5
## [4495] 27.4 30.2 23.5 36.0 24.8 27.5 40.0 18.1 18.8 23.6 29.7 43.7 27.3
20.2
## [4509] 23.8 21.4 25.1 17.9 34.5 27.1 26.1 43.4 33.2 37.2 41.3 35.4 26.1
24.5
## [4523] 28.0 32.7 29.2 20.4 33.5 14.0 33.5 27.5 35.3 30.1 32.6 47.5 31.6
23.5
## [4537] 40.3 34.1 16.1 26.4 19.0 34.7 23.3 32.6 26.0 35.1 18.6 30.4 32.8
21.6
## [4551] 23.3 31.4 26.3 20.1 28.3 40.4 18.6 44.7 25.3 28.3 39.9 28.0 34.7
31.9
## [4565] 35.0 32.7 30.6 27.9 20.4 29.6 23.5 46.4 27.4 25.2 25.8 33.3 27.7
28.9
## [4579] 33.1 38.1 27.9 17.4 27.1 22.7 28.3 21.5 30.0 18.6 45.2 39.7 31.5
23.2
## [4593] 27.3 26.5 19.3 26.1 19.8 25.1 37.3 30.3 16.1 25.1 26.7 29.3 38.7
35.8
## [4607] 21.7 31.4 26.9 33.0 24.5 44.9 25.5 22.1 24.3 32.4 28.0 33.1 26.7
37.9
## [4621] 39.6 19.8 30.0 23.1 34.3 38.4 32.8 34.4 44.6 32.8 26.4 27.3 32.4
43.2
## [4635] 33.6 26.4 46.9 36.3 34.9 29.6 16.5 35.4 23.6 33.1 40.2 14.8 34.8
33.5
## [4649] 31.9 16.1 50.2 35.9 39.6 27.5 32.3 15.4 28.4 19.5 25.0 26.3 39.6
38.6
## [4663] 33.9 32.2 25.1 37.4 30.1 27.0 32.4 26.8 27.2 36.7 36.0 37.2 19.1
21.8
## [4677] 26.5 35.0 32.6 23.9 33.7 29.4 29.0 20.2 28.0 27.4 25.0 30.7 23.0
26.6
## [4691] 18.1 47.1 29.7 19.9 13.3 32.7 31.8 31.4 20.4 33.2 30.5 30.3 34.2
34.4
## [4705] 48.1 22.8 30.5 35.9 33.7 24.1 25.4 25.5 29.2 28.0 17.4 29.9 21.5
24.7
## [4719] 25.1 34.4 27.9 31.5 31.8 30.1 26.4 27.2 22.5 29.8 26.1 24.9 23.5
30.1
## [4733] 37.3 25.5 35.3 27.6 28.7 29.9 34.2 24.9 36.8 24.5 34.6 30.0 28.8
28.6
```

```
## [4747] 23.6 20.1 21.1 34.1 28.0 29.5 37.8 31.2 31.1 34.2 17.7 39.2 22.2
29.5
## [4761] 27.0 16.8 23.3 33.5 15.6 28.2 22.6 20.2 22.2 22.6 26.7 22.9 21.5
30.3
## [4775] 14.8 24.3 17.4 29.0 26.3 51.7 29.2 18.3 21.9 16.3 27.4 20.4 23.2
30.3
## [4789] 16.7 31.0 28.0 33.5 17.0 19.4 14.6 32.2 37.7 27.4 25.0 20.1 21.7
38.2
## [4803] 17.0 28.4 30.0 34.1 19.3 21.6 32.9 27.2 27.8 29.9 28.4 24.1 24.0
23.4
## [4817] 32.6 33.1 33.8 30.3 36.9 29.7 38.8 30.9 36.9 18.8 25.5 32.3 25.8
31.1
## [4831] 27.9 18.6 20.1 26.7 30.3 30.4 30.0 24.9 60.9 24.3 38.7 18.6 17.1
29.4
## [4845] 16.9 34.2 27.6 47.8 18.9 24.4 25.2 30.7 26.1 25.3 32.8 45.7 24.6
32.3
## [4859] 47.6 34.4 18.2 44.5 36.6 19.4 22.9 20.0 36.1 27.3 42.2 26.4 23.6
18.6
## [4873] 18.0 31.1 30.0 43.8 23.8 36.2 32.6 18.0 25.5 29.9 32.1 25.4 23.4
23.4
## [4887] 21.8 30.8 37.9 42.5 23.4 35.4 32.3 27.0 46.3 30.1 34.7 18.3 16.2
33.2
## [4901] 18.6 25.1 24.1 33.1 24.8 23.4 54.1 28.9 38.1 37.2 19.6 29.0 26.7
20.5
## [4915] 34.1 42.4 37.7 39.1 28.9 30.7 33.8 28.0 32.1 40.5 24.8 31.8 27.0
13.7
## [4929] 23.4 16.4 14.9 38.8 38.6 32.2 28.0 30.6 28.1 35.2 21.8 28.1 28.2
28.4
## [4943] 37.4 21.8 19.8 16.2 33.6 21.2 28.4 28.0 41.1 24.9 56.6 28.8 33.7
38.6
## [4957] 33.8 22.4 37.3 23.4 39.1 21.2 31.2 28.0 21.1 15.7 29.1 26.1 16.2
27.1
## [4971] 28.8 37.9 21.6 30.1 29.7 26.4 46.0 26.1 23.2 28.4 20.5 24.6 32.2
30.5
## [4985] 28.0 24.9 26.5 34.5 21.5 15.9 17.7 26.5 24.4 26.6 23.9 30.1 23.6
18.4
## [4999] 32.1 24.4 27.3 34.8 28.4 40.2 31.1 24.0 38.1 29.9 24.5 49.5 35.5
29.5
## [5013] 28.8 22.1 29.4 45.0 27.1 28.3 20.1 31.3 17.6 24.5 24.1 31.3 31.5
29.9
## [5027] 30.2 27.8 15.6 26.3 24.8 17.1 20.3 18.7 28.8 28.7 24.6 25.3 29.7
28.0
## [5041] 21.1 26.9 26.2 26.3 24.8 25.0 34.6 42.7 28.0 24.5 19.3 29.3 22.1
27.8
## [5055] 24.7 25.3 41.2 47.6 23.4 22.7 29.7 32.3 36.9 27.7 24.3 37.4 25.1
24.3
## [5069] 24.3 28.7 16.8 35.8 40.0 24.3 25.6 37.8 23.0 21.0 15.5 17.1 28.0
40.8
## [5083] 37.5 24.2 26.9 33.1 21.8 34.7 30.2 16.8 21.0 30.9 38.9 28.0 24.3
17.4
```

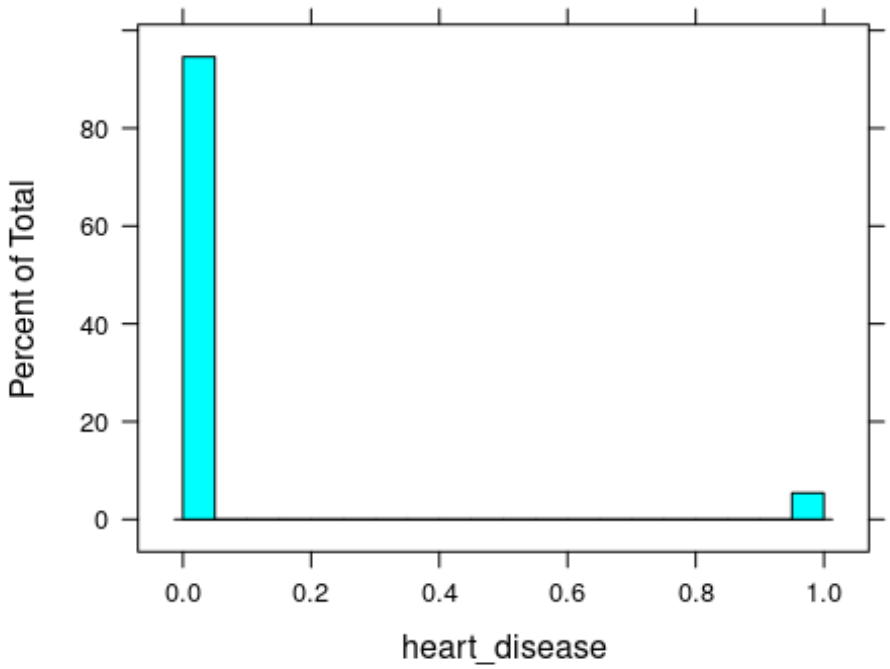
```
## [5097] 28.2 40.8 17.5 28.0 28.3 24.5 21.7 46.9 18.6 28.0 40.0 30.6 25.6
26.2

install.packages("lattice")

## Installing package into '/cloud/lib/x86_64-pc-linux-gnu-library/4.2'
## (as 'lib' is unspecified)

library(lattice)
histogram(~age,data=df,breaks=20)
```



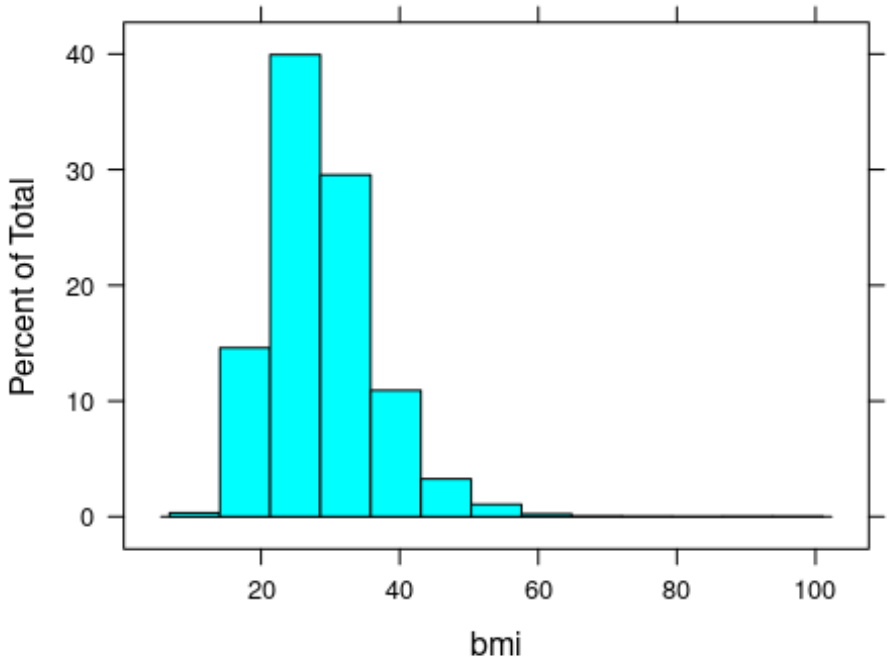

```
histogram(~hypertension,data=df,breaks=20)
```



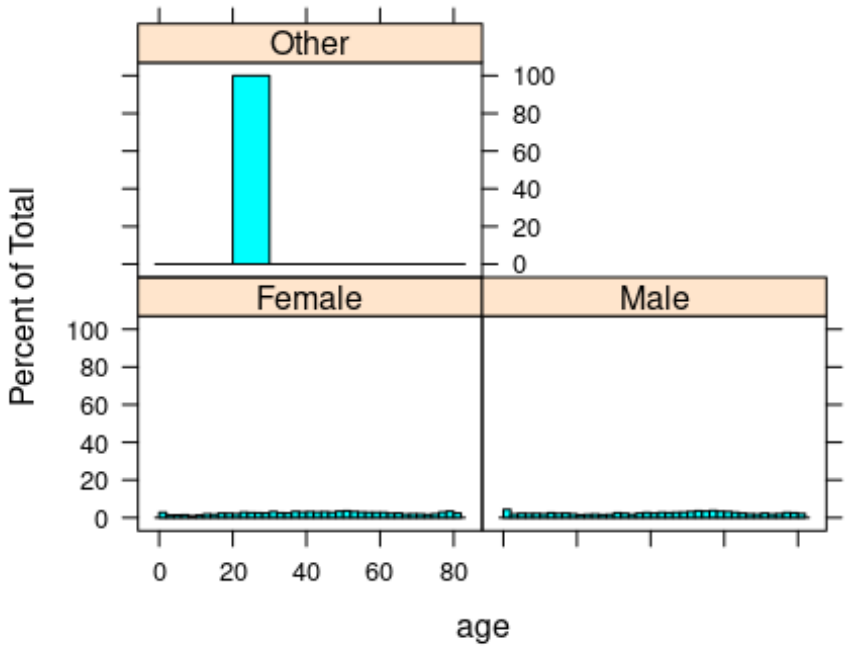

```
histogram(~heart_disease,data=df,breaks=20)
```



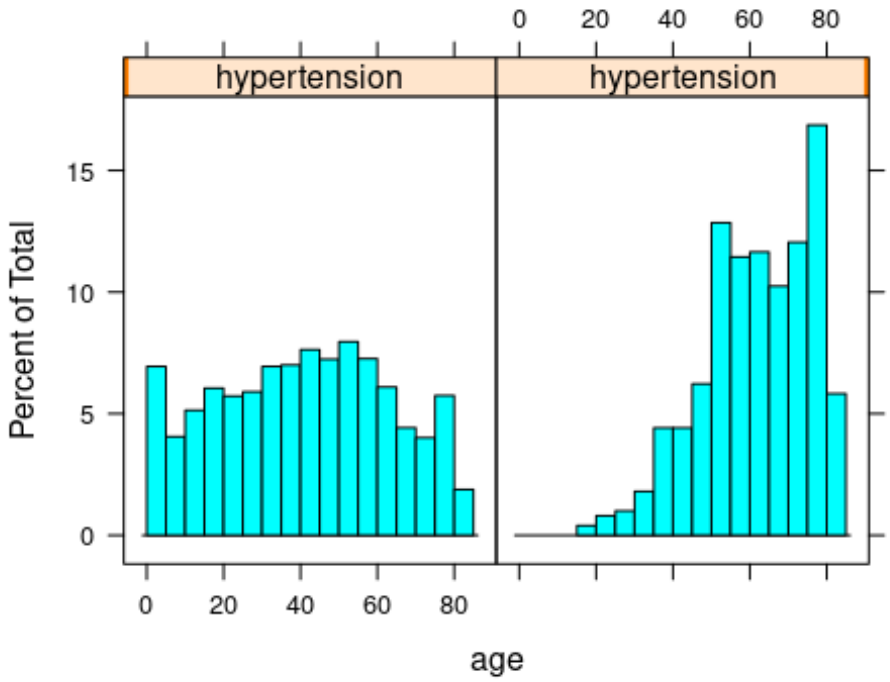

```
histogram(~bmi,data=df)
```



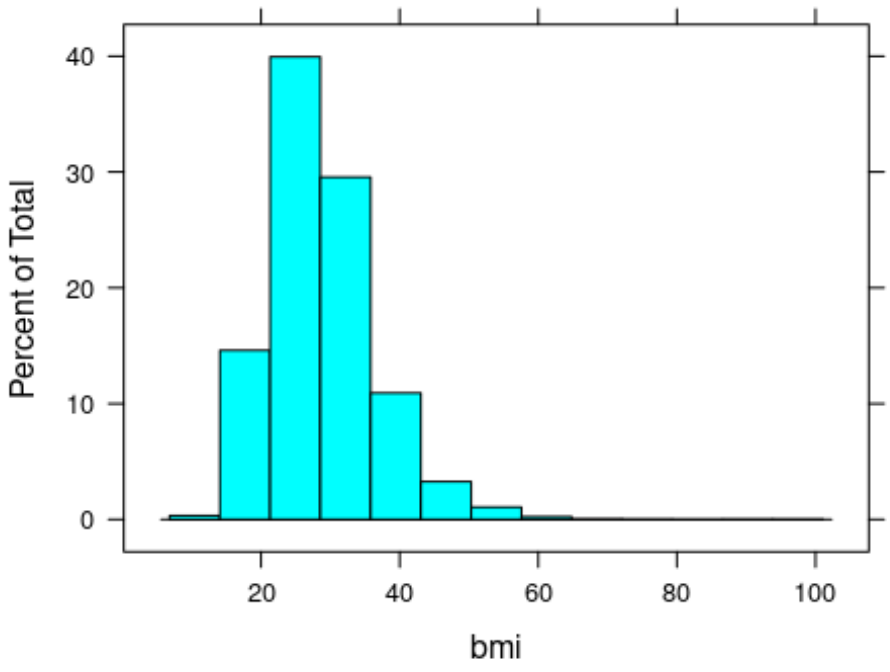

```
histogram(~age|gender,data=df,breaks=50)
```



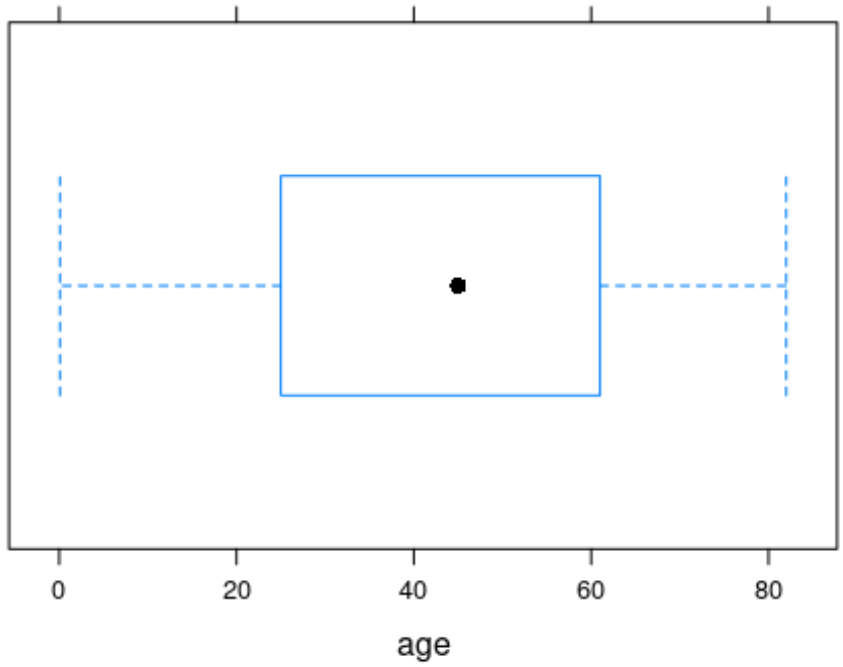

```
histogram(~age|hypertension,data=df,breaks=20)
```



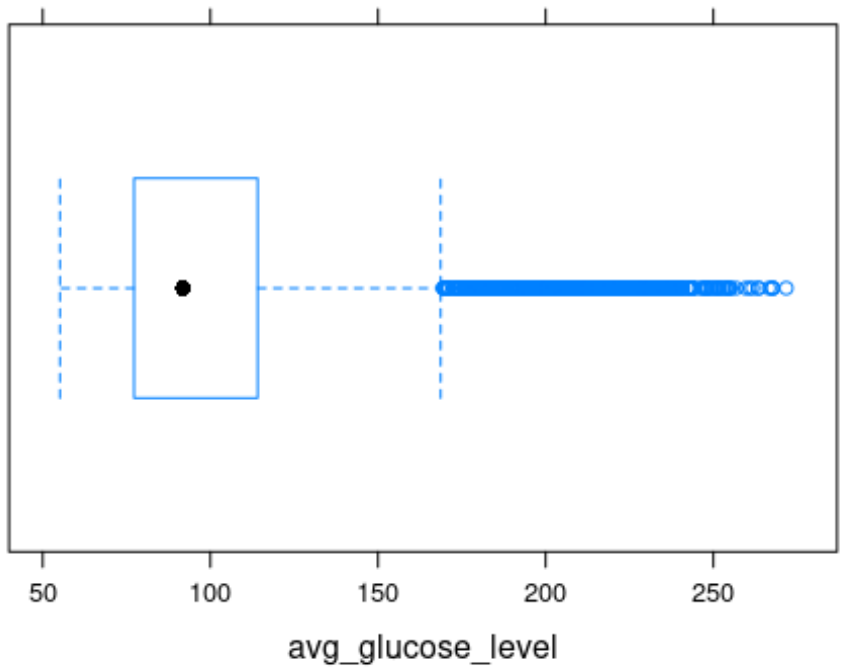

```
histogram(~bmi,data=df)
```



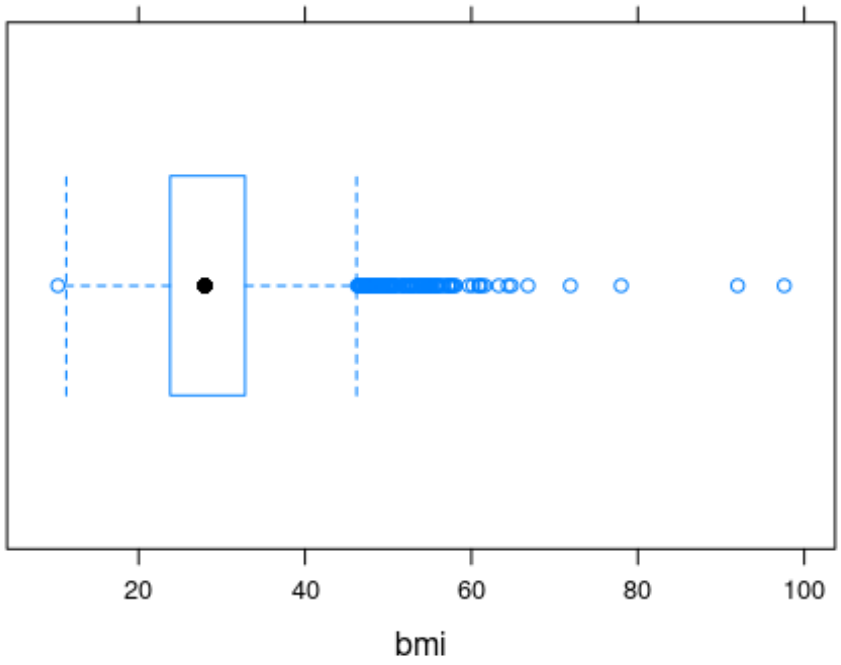

```
bwplot(~age,data = df)
```



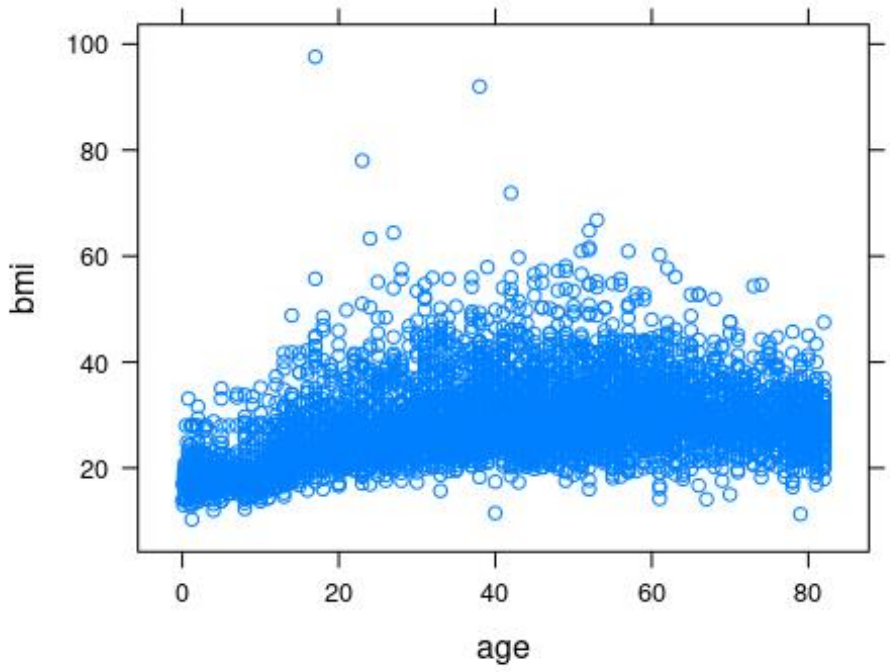

```
bwplot(~avg_glucose_level,data = df)
```



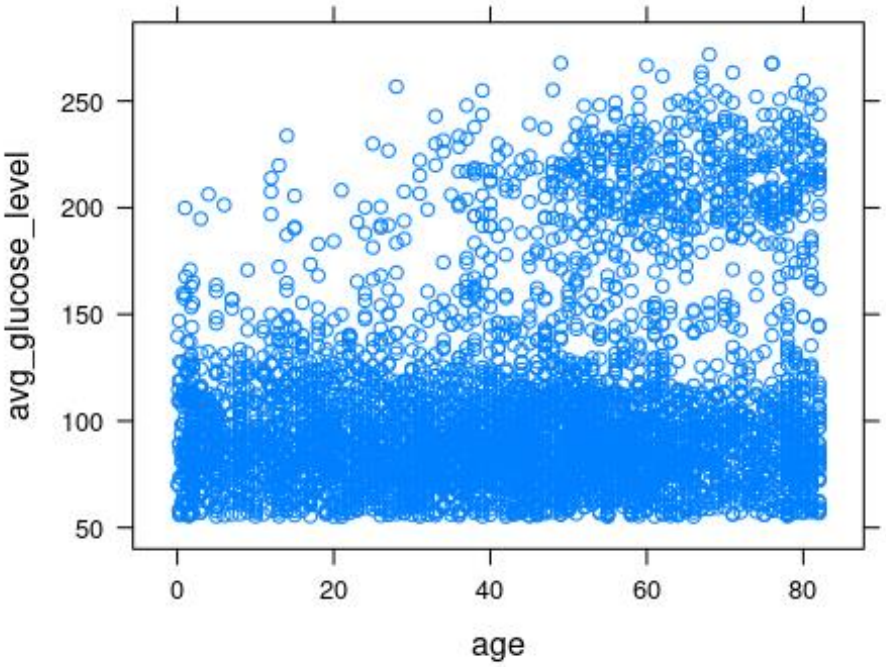

```
bwplot(~bmi,data=df)
```




```
xyplot(bmi~age,data=df)
```



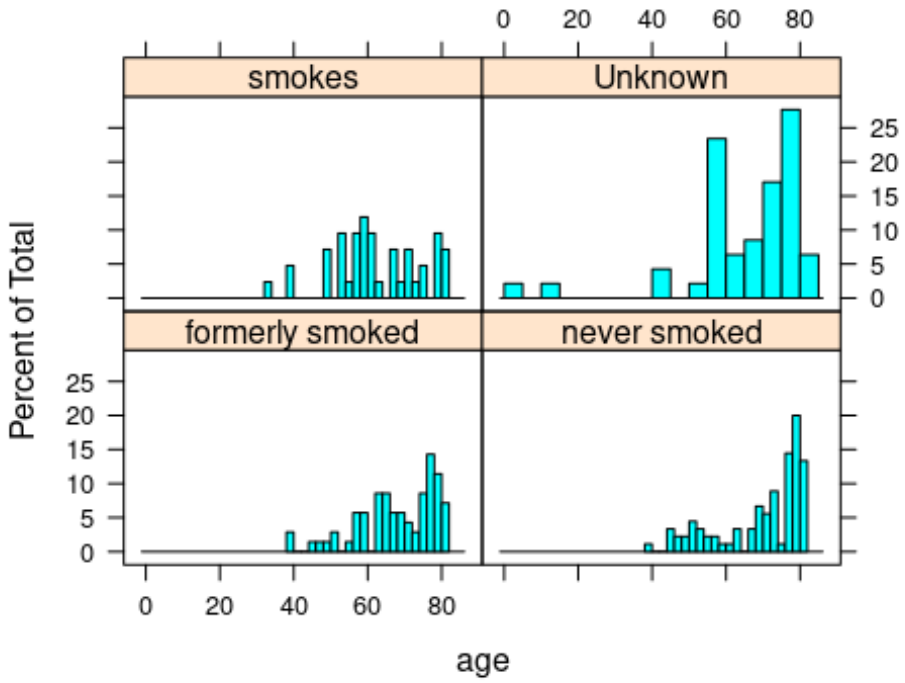

```
xyplot(avg_glucose_level~age,data=df)
```




```
df1=subset(df,stroke==1)
df1
```

```
## # A tibble: 249 × 11
##       id gender   age hypertension heart…¹ work_…² Resid…³ avg_g…⁴   bmi
smoki…⁵
##    <dbl> <chr>  <dbl>        <dbl>   <dbl> <chr>   <chr>     <dbl> <dbl>
<chr>
##  1  9046 Male      67            0       1 Private Urban     229.   36.6
former…
##  2 51676 Female    61            0       0 Self-e… Rural     202.   28
never …
##  3 31112 Male      80            0       1 Private Rural     106.   32.5
never …
##  4 60182 Female    49            0       0 Private Urban     171.   34.4
smokes
##  5  1665 Female    79            1       0 Self-e… Rural     174.   24
never …
##  6 56669 Male      81            0       0 Private Urban     186.   29
former…
##  7 53882 Male      74            1       1 Private Rural      70.1  27.4
never …
##  8 10434 Female    69            0       0 Private Urban      94.4  22.8
never …
##  9 27419 Female    59            0       0 Private Rural      76.2  28
Unknown
## 10 60491 Female    78            0       0 Private Urban      58.6  24.2
```

```
Unknown
## # … with 239 more rows, 1 more variable: stroke <dbl>, and abbreviated
variable
## #   names ¹heart_disease, ²work_type, ³Residence_type, ⁴avg_glucose_level,
## #   ⁵smoking_status

histogram(~age|smoking_status,data=df1,breaks=20)
```




```
count(df1,"smoking_status")

## # A tibble: 1 × 2
##   `"smoking_status"`     n
##   <chr>              <int>
## 1 smoking_status       249

df2=subset(df1,smoking_status=="never smoked")
count(df2,"work_type")

## # A tibble: 1 × 2
##   `"work_type"`      n
##   <chr>          <int>
## 1 work_type         90
```