Multiple Linear Regression: LDL and Risk Factors

Statisticians' World

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Introduction

In this project, we perform a multiple linear regression analysis to understand how several predictors — tobacco use, obesity, alcohol consumption, and age — influence LDL cholesterol levels.

Load Required Packages

```
# Install (if not already installed) - Run interactively only
# install.packages(c("tidyverse", "gtsummary", "ggplot2", "ggpubr",
#                    "GGally", "rsq", "broom", "broom.helpers", "labelled"))

library(tidyverse)
library(gtsummary)
library(ggplot2)
library(ggpubr)
library(GGally)
library(rsq)
library(broom)
library(broom.helpers)
library(labelled)
```

Import Dataset

```
# Set your working directory appropriately (edit as needed)
# setwd("C:/Users/O&1/OneDrive/Documents/R-Youtube")
data <- read.csv("CHDdata.csv")

# Data preview
dim(data)
```

```
## [1] 462  10
```

```
head(data)
```

```
##   sbp tobacco  ldl adiposity famhist typea obesity alcohol age chd
## 1 160   12.00 5.73     23.11 Present    49   25.30   97.20  52   1
## 2 144    0.01 4.41     28.61  Absent    55   28.87    2.06  63   1
## 3 118    0.08 3.48     32.28 Present    52   29.14    3.81  46   0
## 4 170    7.50 6.41     38.03 Present    51   31.99   24.26  58   1
## 5 134   13.60 3.50     27.78 Present    60   25.99   57.34  49   1
## 6 132    6.20 6.47     36.21 Present    62   30.77   14.14  45   0
```

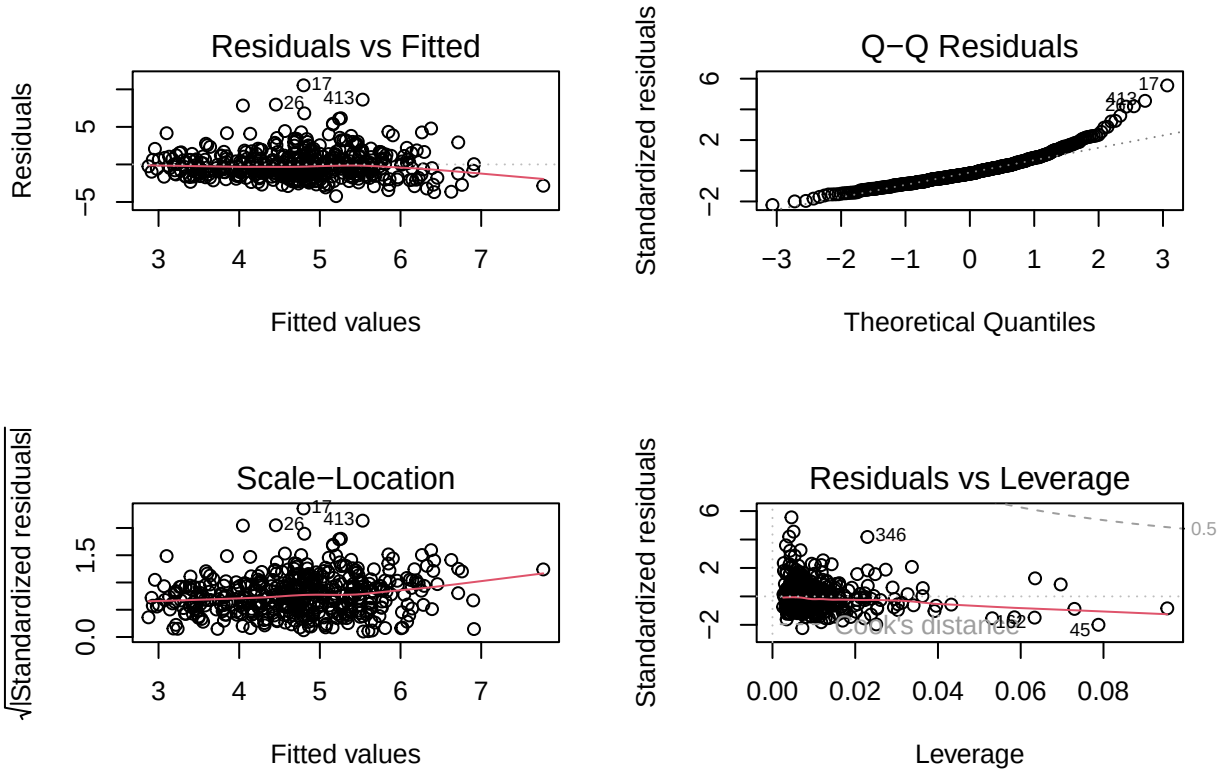
Fit the Multiple Linear Regression Model

```
mlr <- lm(ldl ~ tobacco + obesity + alcohol + age, data = data)
```

5. Assumption Checking

- Independence
  - Assumed, as each patient record is considered independent.
- Linearity, Normality, Homoscedasticity, and Outliers

```
# Show 2x2 diagnostic plots
par(mfrow = c(2, 2))
plot(mlr)
```




```
These plots help us evaluate:

  - Linearity (Residuals vs Fitted)
  - Normality (Q-Q Plot)
  - Homoscedasticity (Scale-Location)
  - Outliers (Residuals vs Leverage)
```

6. Model Summary & Inference

```
summary(mlr)
```

```
##
## Call:
## lm(formula = ldl ~ tobacco + obesity + alcohol + age, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.2215 -1.2359 -0.3413  0.8106 10.5324
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.045080   0.566582   0.080   0.9366
## tobacco      0.018324   0.021908   0.836   0.4034
## obesity      0.129752   0.021955   5.910 6.70e-09 ***
## alcohol     -0.006588   0.003690  -1.785   0.0748 .
## age          0.031802   0.007035   4.521 7.87e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.899 on 457 degrees of freedom
## Multiple R-squared:  0.1663, Adjusted R-squared:  0.159
## F-statistic: 22.78 on 4 and 457 DF,  p-value: < 2.2e-16
```

```
tidy(mlr, conf.int = TRUE)
```

```
## # A tibble: 5 x 7
##   term        estimate std.error statistic       p.value conf.low conf.high
##   <chr>          <dbl>     <dbl>     <dbl>         <dbl>    <dbl>     <dbl>
## 1 (Intercept)  0.0451    0.567      0.0796 0.937          -1.07    1.16
## 2 tobacco      0.0183    0.0219     0.836  0.403          -0.0247  0.0614
## 3 obesity      0.130     0.0220     5.91   0.00000000670   0.0866  0.173
## 4 alcohol     -0.00659   0.00369   -1.79   0.0748         -0.0138  0.000663
## 5 age          0.0318    0.00703    4.52   0.00000787      0.0180  0.0456
```

R-Squared

```
rsq(mlr)
```

```
## [1] 0.1662649
```

Summary Table

```
tbl_regression(mlr)
```

Residual Standard Error as % of Mean LDL

```
sigma(mlr) / mean(data$ldl)
```

```
## [1] 0.4006447
```

Characteristic	Beta	95% CI[1]	p-value
tobacco	0.02	-0.02, 0.06	0.4
obesity	0.13	0.09, 0.17	<0.001
alcohol	-0.01	-0.01, 0.00	0.075
age	0.03	0.02, 0.05	<0.001

[1]CI = Confidence Interval

Conclusion

This multiple regression model provides insight into how lifestyle and demographic factors relate to LDL cholesterol. Further diagnostics and interaction modeling could enhance interpretation in future work.

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