Untitled

CVD\_All資料中包含66,489人的臨床檢驗數據、家族、行為數據、及是否罹患CVD的數據。

library(formattable)  
HW10 <- read.csv("D:/CVD\_ALL.csv", header = TRUE, sep = ",")  
HW10["diff\_pressure"] <- HW10["Compression"] - HW10["Depression"]  
names(HW10)

## [1] "ID" "CVD" "Age" "Sex"   
## [5] "X.lAU.E.." "Waistline" "Compression" "Depression"   
## [9] "Glucose" "X.a.K....3J.O" "Triglycera" "Ab.."   
## [13] "X...s" "X.a.U.f.v" "X.aμO" "X.aμO.q"   
## [17] "diff\_pressure"

1. 請將“壓差=收縮壓減舒張壓”當成依變數，針對壓差這個依變數，年齡和性別是否存有交互作用？

model <- lm(diff\_pressure ~ Age + Sex + Age\*Sex, data = HW10)  
summary(model)

##   
## Call:  
## lm(formula = diff\_pressure ~ Age + Sex + Age \* Sex, data = HW10)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -82.183 -8.742 -1.483 7.058 141.080   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 22.387522 0.231596 96.67 <2e-16 \*\*\*  
## Age 0.458871 0.004842 94.76 <2e-16 \*\*\*  
## Sex 10.658277 0.375450 28.39 <2e-16 \*\*\*  
## Age:Sex -0.148535 0.007601 -19.54 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 12.99 on 63196 degrees of freedom  
## (1289 observations deleted due to missingness)  
## Multiple R-squared: 0.1775, Adjusted R-squared: 0.1774   
## F-statistic: 4545 on 3 and 63196 DF, p-value: < 2.2e-16

在壓差的模型中，年齡和性別確實具交互作用關係，其係數為-0.148 (P-value << 0.05)。

1. 請檢定壓差是否為CVD發生的風險因子？性別是否為干擾因子？性別和壓差是否存在交互作用？

model\_diff <- glm(CVD ~ diff\_pressure, family = binomial(link = "logit"), data = HW10, na.action = na.exclude)  
summary(model\_diff)

##   
## Call:  
## glm(formula = CVD ~ diff\_pressure, family = binomial(link = "logit"),   
## data = HW10, na.action = na.exclude)  
##   
## Deviance Residuals:   
## Min 1Q Median 3Q Max   
## -1.9556 -0.4615 -0.4035 -0.3571 2.9121   
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -3.6207596 0.0446188 -81.15 <2e-16 \*\*\*  
## diff\_pressure 0.0281311 0.0008461 33.25 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 39037 on 63204 degrees of freedom  
## Residual deviance: 37993 on 63203 degrees of freedom  
## (1284 observations deleted due to missingness)  
## AIC: 37997  
##   
## Number of Fisher Scoring iterations: 5

壓差確實為CVD發生的風險因子，其係數為為0.0281 (P-value << 0.05)。

model\_diff\_sex <- glm(CVD ~ diff\_pressure + Sex, family = binomial(link = "logit"), data = HW10, na.action = na.exclude)  
summary(model\_diff\_sex)

##   
## Call:  
## glm(formula = CVD ~ diff\_pressure + Sex, family = binomial(link = "logit"),   
## data = HW10, na.action = na.exclude)  
##   
## Deviance Residuals:   
## Min 1Q Median 3Q Max   
## -1.9566 -0.4612 -0.4037 -0.3572 2.9120   
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -3.6202442 0.0450218 -80.411 <2e-16 \*\*\*  
## diff\_pressure 0.0281401 0.0008526 33.007 <2e-16 \*\*\*  
## Sex -0.0024380 0.0285401 -0.085 0.932   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 39037 on 63204 degrees of freedom  
## Residual deviance: 37993 on 63202 degrees of freedom  
## (1284 observations deleted due to missingness)  
## AIC: 37999  
##   
## Number of Fisher Scoring iterations: 5

性別造成壓差的因子變化為

percent((model\_diff$coeff[2] - model\_diff\_sex$coeff[2]) / model\_diff$coeff[2])

## diff\_pressure   
## -0.03%

<10%，非為confounding。

model\_interact <- glm(CVD ~ diff\_pressure + Sex + diff\_pressure\*Sex, family = binomial(link = "logit"), data = HW10, na.action = na.exclude)  
summary(model\_interact)

##   
## Call:  
## glm(formula = CVD ~ diff\_pressure + Sex + diff\_pressure \* Sex,   
## family = binomial(link = "logit"), data = HW10, na.action = na.exclude)  
##   
## Deviance Residuals:   
## Min 1Q Median 3Q Max   
## -1.9961 -0.4615 -0.4027 -0.3579 2.9271   
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -3.651271 0.055360 -65.955 <2e-16 \*\*\*  
## diff\_pressure 0.028779 0.001078 26.690 <2e-16 \*\*\*  
## Sex 0.084444 0.094263 0.896 0.370   
## diff\_pressure:Sex -0.001702 0.001761 -0.966 0.334   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 39037 on 63204 degrees of freedom  
## Residual deviance: 37992 on 63201 degrees of freedom  
## (1284 observations deleted due to missingness)  
## AIC: 38000  
##   
## Number of Fisher Scoring iterations: 5

在CVD發生模型中，壓差與性別並無關係，其係數-0.001702 (P-value = 0.334 > 0.05)。

1. 接續上題，針對性別做分層分析，並和上題的結論比較？

##   
## Call:  
## glm(formula = CVD ~ diff\_pressure, family = binomial(link = "logit"),   
## data = HW10[HW10$Sex == 0, ], na.action = na.exclude)  
##   
## Deviance Residuals:   
## Min 1Q Median 3Q Max   
## -1.9961 -0.4496 -0.3917 -0.3505 2.9271   
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -3.651271 0.055360 -65.95 <2e-16 \*\*\*  
## diff\_pressure 0.028779 0.001078 26.69 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 23783 on 39641 degrees of freedom  
## Residual deviance: 23114 on 39640 degrees of freedom  
## (796 observations deleted due to missingness)  
## AIC: 23118  
##   
## Number of Fisher Scoring iterations: 5

model\_male <- glm(CVD ~ diff\_pressure, family = binomial(link = "logit"), data = HW10[HW10$Sex == 1,], na.action = na.exclude)  
summary(model\_male)

##   
## Call:  
## glm(formula = CVD ~ diff\_pressure, family = binomial(link = "logit"),   
## data = HW10[HW10$Sex == 1, ], na.action = na.exclude)  
##   
## Deviance Residuals:   
## Min 1Q Median 3Q Max   
## -1.3814 -0.4735 -0.4217 -0.3775 2.8675   
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -3.566827 0.076294 -46.75 <2e-16 \*\*\*  
## diff\_pressure 0.027077 0.001393 19.44 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 15235 on 23562 degrees of freedom  
## Residual deviance: 14878 on 23561 degrees of freedom  
## (488 observations deleted due to missingness)  
## AIC: 14882  
##   
## Number of Fisher Scoring iterations: 5

性別確實不影響壓差。