



臺中榮民總醫院
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Regression Analysis

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Outline



- 使用時機
- 結果解釋
- 方法撰寫參考
- 實作演練

Data type/Statistical method



Data type	Independent variable
Dependent variable	Continuous
Continuous	
-parametric	Pearson correlation Linear regression
-nonparametric	Spearman rank correlation
Nominal	Logistic regression

Correlation



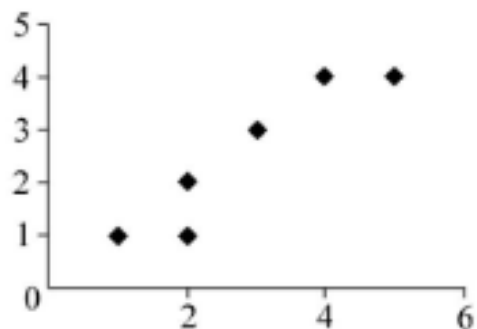
- Pearson correlation
 - Normal distribution
 - Continuous
- Spearman rank correlation
 - Skewed distribution
 - Ordinal/ Continuous

	LDL	HDL	HOMA	BMI z-score	WC	TG:HDL-C
TC	0.931**	0.523**	0.091	0.014	0.000	-0.01
LDL		0.238**	0.081	0.081	0.039	0.05
HDL			0.039	-0.12*	-0.161*	-0.468**
HOMA				0.202**	0.258**	0.134*
BMI z-score					0.547**	0.104
WC						0.173**

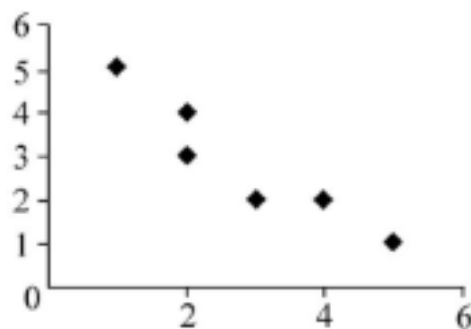
Table 4. Correlation between TG:HDL ratio and other parameters of insulin resistance (IR). TG: triglyceride, TC: total cholesterol, LDL: low-density lipoprotein, HDL: high-density lipoprotein, HOMA-IR: homeostasis model assessment of insulin resistance, BMI z-score: age and sex- corrected body mass index, TG:HDL-C ratio of TG to HDL. Correlation was estimated using Pearson correlation coefficient. * $P < 0.05$, ** $P < 0.000$.

說明：(相關係數數值範圍為-1~1)	
相關係數	相關程度
1	完全相關
0.7~0.99	高度相關
0.5~0.69	中度相關
0.25~0.49	低度相關
0~0.24	無相關

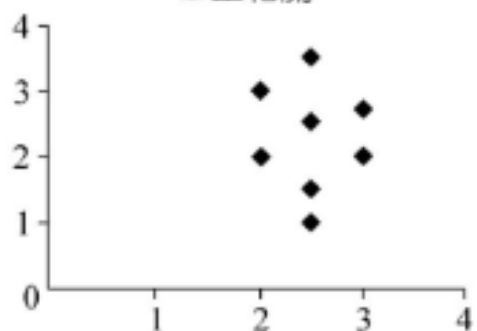
散佈圖



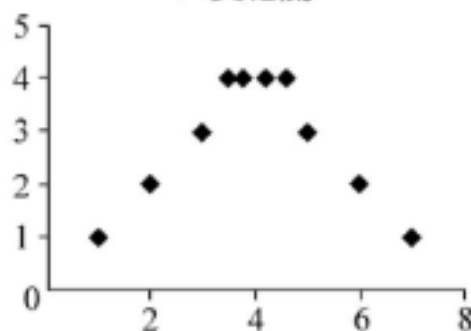
(1)正相關



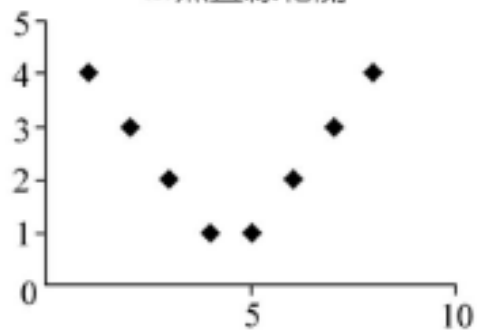
(2)負相關



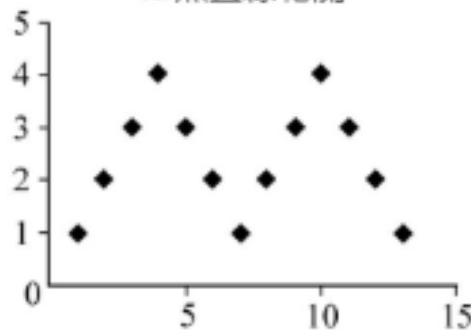
(3)無直線相關



(4)無直線相關



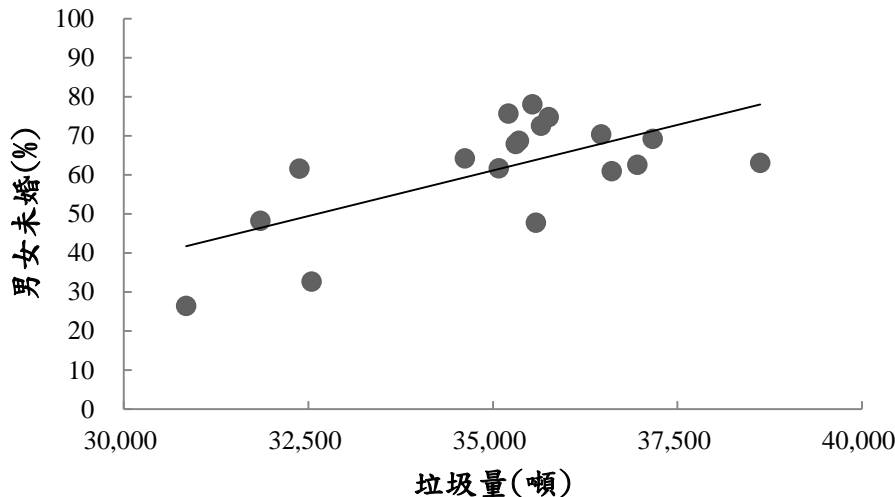
(5)無直線相關



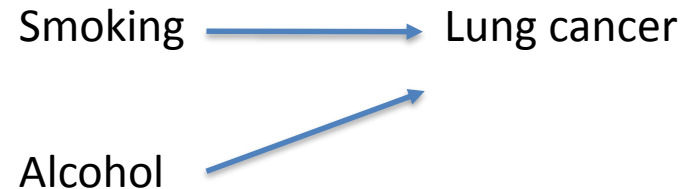
(6)無直線相關

相關≠因果

- 正確的時序性
- 重複研究的相關一致性
- 相關強度
- 相關特異性
- 相關的合理解釋(生物贊同性)



Hill法則



Regression使用時機

- | | |
|---|---|
| <ul style="list-style-type: none">• 結果變項為連續資料<ul style="list-style-type: none">– Linear regression• 需符合常態分佈• 自變項可為連續或類別變項<ul style="list-style-type: none">– 類別(三組以上)需設虛擬變項(dummy variable) | <ul style="list-style-type: none">• 結果變項為類別資料(二組)<ul style="list-style-type: none">– Logistic regression• 自變項可為連續或類別 |
|---|---|

多變項迴歸，每增加1個變項進入調整，樣本數需增加10-15人

Linear Regression

- 簡單迴歸表示式

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

β_0 為常數， β_1 為迴歸係數， ε 為誤差

- 複迴歸表示式

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon$$

β_0 為常數， $\beta_1 \dots \beta_n$ 為迴歸係數， ε 為誤差

Linear Regression前提假設



- 常態性
 - 常態檢定
- 獨立性
 - Durbin-Watson test
- 變異數同質性
 - Residual Plot

Linear regression-example



- 研究假設看電視時間較長者，血液中的膽固醇濃度會較高。因此探討膽固醇與觀看電視時間是否有關，並利用看電視時間預測膽固醇濃度。收集研究對象每天看電視時間和膽固醇濃度....

caseno	time_tv	cholesterol
1	168	4.60
2	170	4.80
3	170	5.39
4	164	5.16
5	159	5.09
6	168	5.70
7	165	5.25
8	156	4.89
9	172	4.90
10	170	4.68
11	165	4.77
12	168	4.65
13	171	5.61
14	168	4.81
15	166	5.64

Independent variable (X) : time_tv
Dependent variable (Y) : cholesterol

Linear regression-分析操作

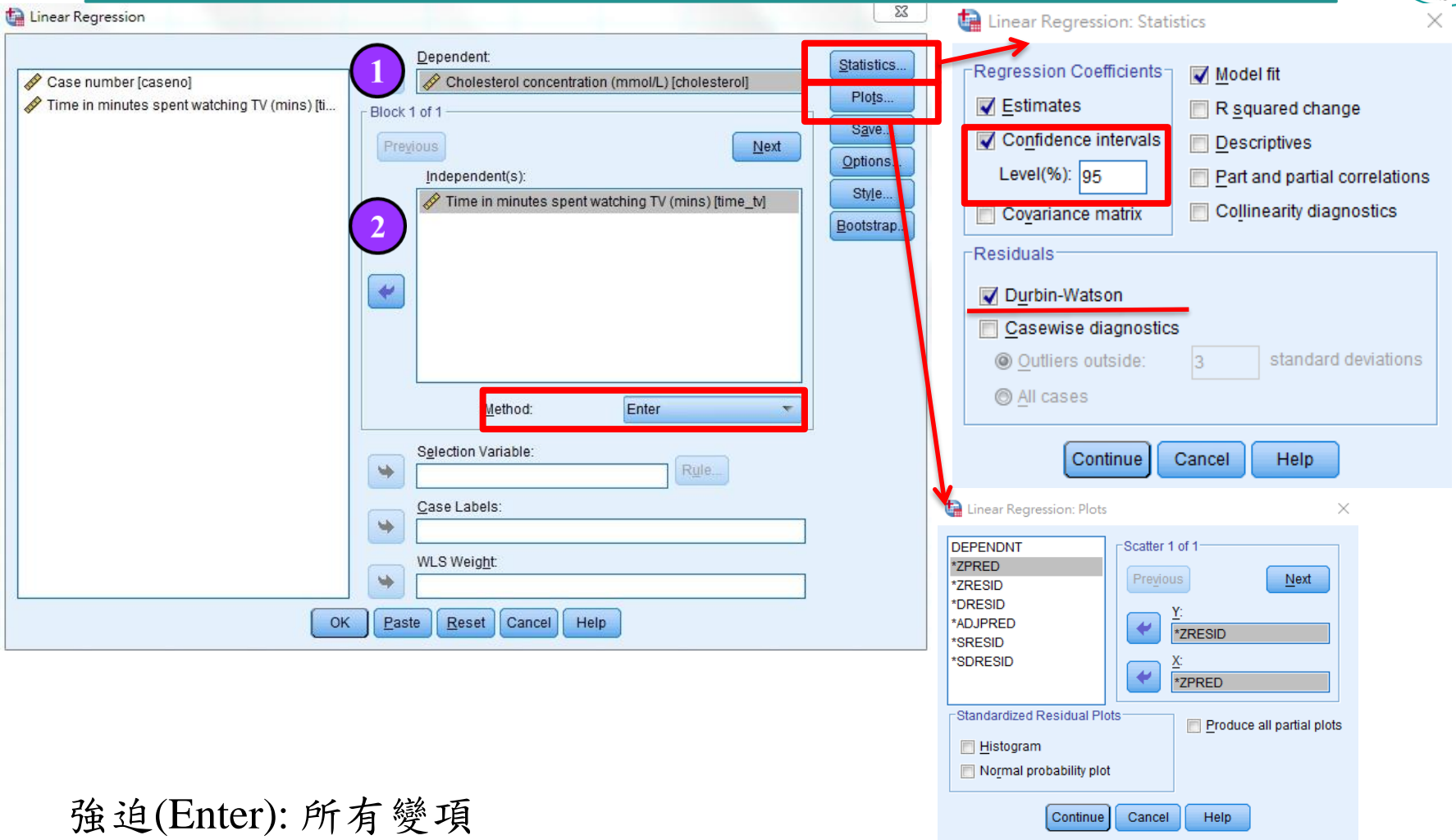


分析>迴歸>線性

The screenshot shows the SPSS software interface. The 'Analyze' menu is open, and the 'Regression' option is selected. The 'Linear...' option is highlighted within the 'Regression' submenu. The main menu bar includes 'Analyze', 'Direct Marketing', 'Graphs', 'Utilities', 'Add-ons', 'Window', and 'Help'. The 'Utilities' menu is open, showing icons for various tools. The 'Regression' submenu includes options like 'Automatic Linear Modeling...', 'Linear...', 'Residual Heteroscedasticity Test...', 'Regression Relative Importance', 'Curve Estimation...', 'Tobit Regression...', and 'Robust Regression...'.

var	var	var	var

Linear regression-分析操作



The image shows three overlapping SPSS dialog boxes for Linear Regression analysis. The main 'Linear Regression' dialog has 'Cholesterol concentration (mmol/L) [cholesterol]' as the dependent variable and 'Time in minutes spent watching TV (mins) [time_tv]' as the independent variable. The 'Method' is set to 'Enter'. A red box highlights the 'Statistics...' button, which opens the 'Linear Regression: Statistics' dialog. In this dialog, 'Confidence intervals' is checked with a level of 95%, and 'Durbin-Watson' is checked under the 'Residuals' section. A red box also highlights the 'Plots...' button, which opens the 'Linear Regression: Plots' dialog. In this dialog, the Y-axis is set to '*ZRESID' and the X-axis is set to '*ZPRED'. The 'Standardized Residual Plots' section has 'Histogram' and 'Normal probability plot' checked.

強迫(Enter): 所有變項

向前(Forward): 對於Y的貢獻(解釋力)由大到小挑選

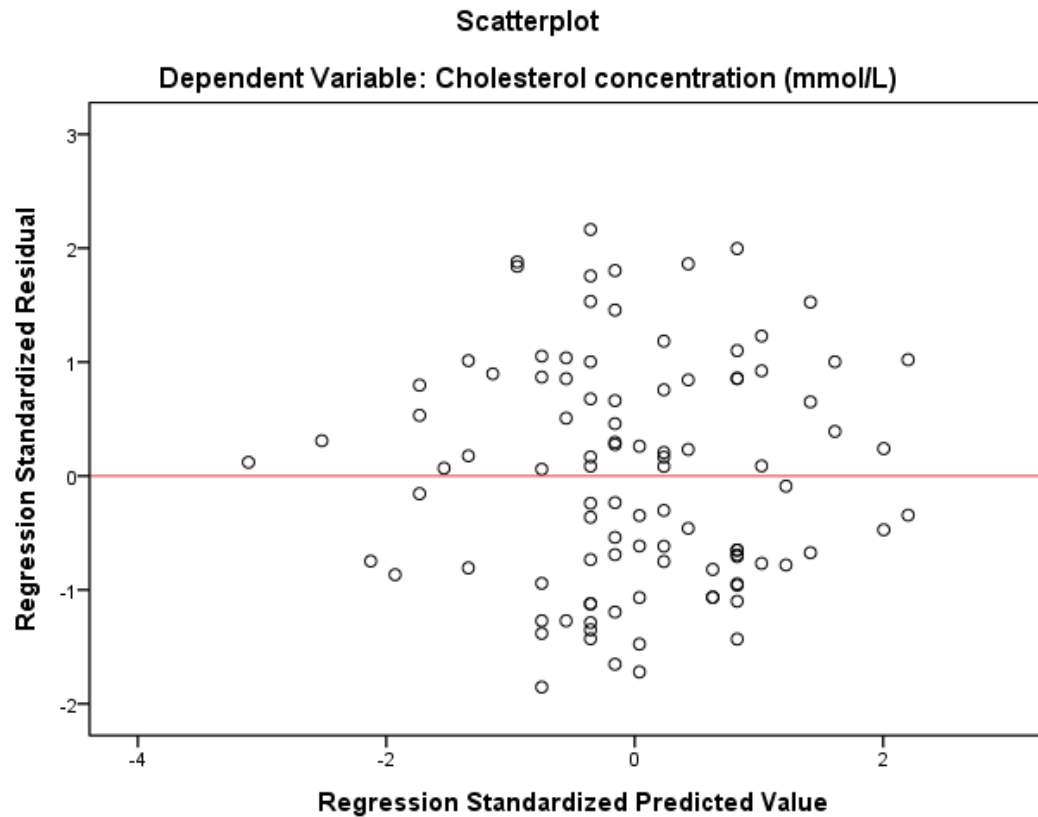
向後(Backward): 對於Y的貢獻(解釋力)由小到大刪除

逐步(Stepwise): 結合向前和向後的方式

Linear regression-Output



- 符合殘差變異數同質性



Linear regression-Output

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.389 ^a	.151	.143	.53759	1.957

a. Predictors: (Constant), Time in minutes spent watching TV (mins)

b. Dependent Variable: Cholesterol concentration (mmol/L)

當 DW 值愈接近 2 時，
殘差項間愈獨立

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.049	1	5.049	17.471	.000 ^b
	Residual	28.322	98	.289		
	Total	33.371	99			

a. Dependent Variable: Cholesterol concentration (mmol/L)

b. Predictors: (Constant), Time in minutes spent watching TV (mins)

Table. Outcome: cholesterol

	B	95%CI	P value
time_tv	0.044	(0.023,0.065)	<0.001**

Linear regression. * $P < 0.05$, ** $P < 0.01$

每看1分鐘電視，膽固醇濃度增加0.044 (95%CI: 0.023-0.065) mmol/L

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-2.135	1.813		-1.177	.242	-5.733	1.463
	Time in minutes spent watching TV (mins)	.044	.011	.389	4.180	.000	.023	.065

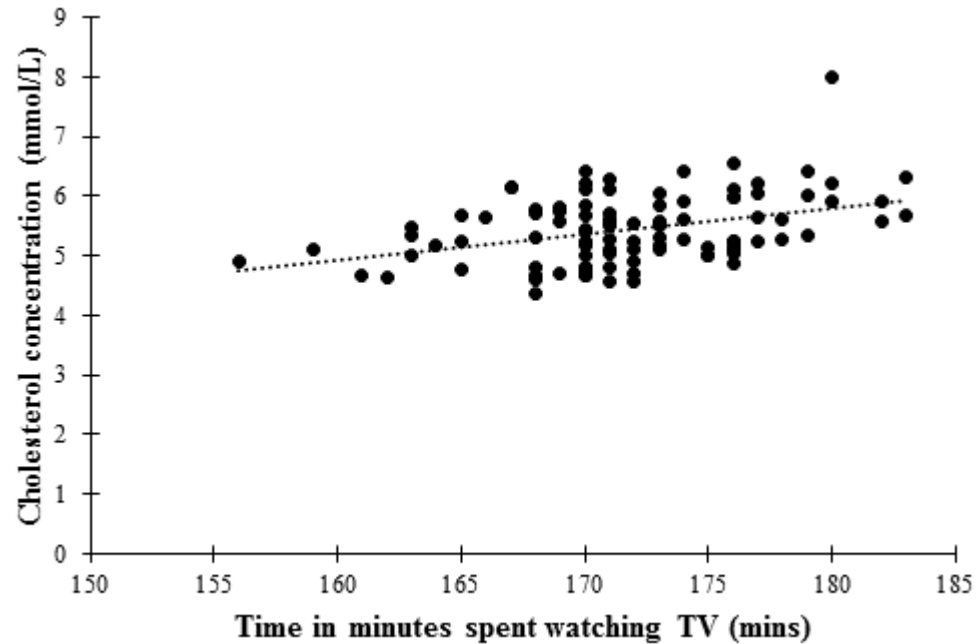
a. Dependent Variable: Cholesterol concentration (mmol/L)

Linear regression-scatter plot



time_tv	cholesterol
168	4.6
170	4.8
170	5.39
164	5.16
159	5.09
168	5.7
165	5.25
156	4.89
172	4.9
170	4.68
165	4.77
168	4.65
171	5.61
168	4.81
166	5.64
167	6.16
163	5.35

⋮



Linear regression-multivariable



- 增加性別及體重

Independent variable (X) : time_tv, gender and weight
Dependent variable (Y) : cholesterol

caseno	time_tv	cholesterol	Gender	weight
1	168	4.60	1	70.47
2	170	4.80	0	50.34
3	170	5.39	1	87.65
4	164	5.16	0	89.80
5	159	5.09	1	103.02
6	168	5.70	0	77.37
7	165	5.25	1	82.48
8	156	4.89	0	75.94
9	172	4.90	1	97.11
10	170	4.68	0	78.42
11	165	4.77	1	88.02
12	168	4.65	0	74.47
13	171	5.61	0	75.98
14	168	4.81	0	58.97
15	166	5.64	1	111.80

Linear regression-multiple



The 'Linear Regression' dialog box is shown. The 'Dependent' variable is 'Cholesterol concentration (mmol/L) [chol...]' and the 'Independent(s)' variables are 'Time in minutes spent watching TV (min...', 'Gender', and 'Weight [weight]'. The 'Method' is set to 'Enter'. The 'Statistics...' button is highlighted with a red box and a red arrow pointing to the 'Linear Regression: Statistics' dialog box.

The 'Linear Regression: Statistics' dialog box is shown. The 'Regression Coefficients' section has the following options checked: 'Estimates', 'Confidence intervals', and 'Collinearity diagnostics'. The 'Level(%)' is set to 95. The 'Residuals' section has 'Durbin-Watson' checked, and 'Outliers outside' is set to 3 standard deviations. The 'Collinearity diagnostics' option is underlined in red.

共線性診斷-1

- 容忍值(Tolerance) **< 0.1**
 - 0~1 之間，愈大愈好，容忍值愈大，代表共線性問題愈小
- 變異數膨脹因素 (VIF, variance inflation faction) **>10**
 - 愈小愈好，代表愈沒有共線性問題
- 條件指標 (CI, condition index) **> 30**

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	-2.660	1.804		-1.474	.144	-6.242	.922		
	Time in minutes spent watching TV (mins)	.045	.010	.397	4.323	.000	.024	.066	.997	1.003
	Gender	-.128	.116	-.105	-1.106	.271	-.359	.102	.929	1.076
	Weight	.006	.003	.201	2.118	.037	.000	.011	.931	1.074

a. Dependent Variable: Cholesterol concentration (mmol/L)

調整性別和體重後，每看1分鐘電視，膽固醇濃度增加0.045 mmol/L

Collinearity Diagnostics

Dimension	Eigenvalue	Condition Index	(Const)				
1	3.663	1.000					
2	.289	3.562					
3	.036	10.093	.02	.70	.30	.13	
4	.012	17.180	.97	.27	.69	.07	

a. Dependent Variable: Cholesterol concentration (mmol/L)

調整性別和體重後，看電視每增加1個標準差，膽固醇濃度增加0.397個標準差

共線性診斷-2

- 自變項間相關係數 >0.7 可能有共線性問題

Correlations

		VO2max	Weight	Age
VO2max	Pearson Correlation	1	-.307**	-.191
	Sig. (2-tailed)		.002	.057
	N	100	100	100
Weight	Pearson Correlation	-.307**	1	-.004
	Sig. (2-tailed)	.002		.972
	N	100	100	100
Age	Pearson Correlation	-.191	-.004	1
	Sig. (2-tailed)	.057	.972	
	N	100	100	100

** . Correlation is significant at the 0.01 level (2-tailed).

共線性影響

- 自變項與依變項的相關性顯著，但迴歸分析結果都不顯著
- 標準誤異常的高
- 自變項與依變項是正相關，但在迴歸分析得到負值的迴歸係數且達顯著差異

Dummy variable



- 探討壓力程度(X)對於睡眠時間(Y)的影響

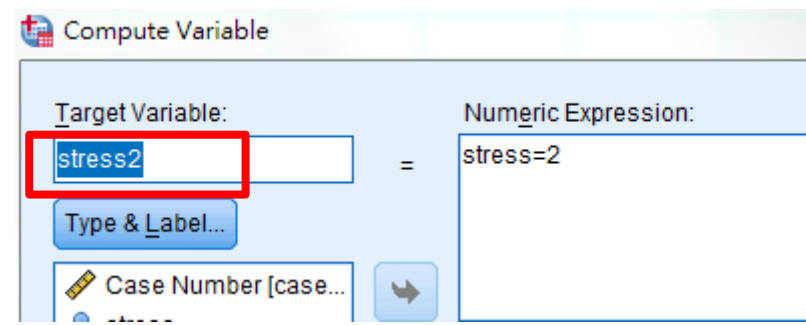
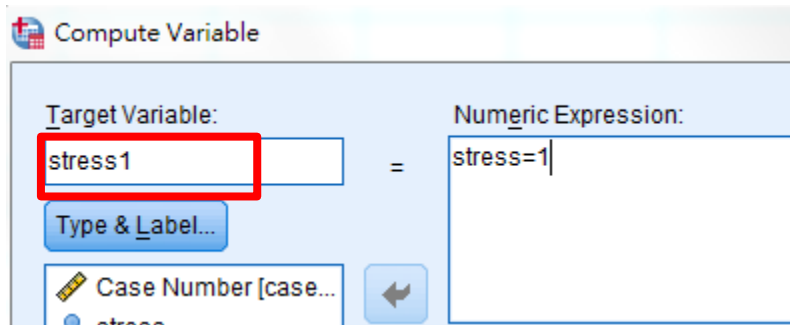
分組	原始編碼	dummy1	dummy2
無壓力	0	0	0
中度壓力	1	1	0
高度壓力	2	0	1

- $Y = \alpha + \beta_1 \times (\text{中度壓力}) + \beta_2 \times (\text{高度壓力})$
 - 無壓力: $Y = \alpha + \beta_1 \times (0) + \beta_2 \times (0)$
 - 中度壓力: $Y = \alpha + \beta_1 \times (1) + \beta_2 \times (0)$
 - 高度壓力: $Y = \alpha + \beta_1 \times (0) + \beta_2 \times (1)$

Dummy variable-操作

caseno	stress	hr	stress1	stress2
1	0	7.50	.00	.00
2	0	5.00	.00	.00
3	1	6.00	1.00	.00
4	0	7.00	.00	.00
5	2	7.00	.00	1.00
6	1	6.50	1.00	.00
7	2	7.00	.00	1.00
8	0	7.50	.00	.00
9	0	7.00	.00	.00
10	0	9.00	.00	.00

轉換>計算變數



Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.372 ^a	.138	.120	1.19702

a. Predictors: (Constant), stress2, stress1

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	22.263	2	11.131	7.769	.001 ^b
	Residual	138.987	97	1.433		
	Total	161.250	99			

a. Dependent Variable: hr

b. Predictors: (Constant), stress2, stress1

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	7.109	.212		33.597	.000	6.689	7.529
	stress1	-.449	.268	-.176	-1.676	.097	-.981	.083
	stress2	-1.476	.375	-.415	-3.941	.000	-2.219	-.733

a. Dependent Variable: hr

Linear regression-interaction

Interaction is not statistically significant



Interaction is statistically significant



Linear regression-interaction



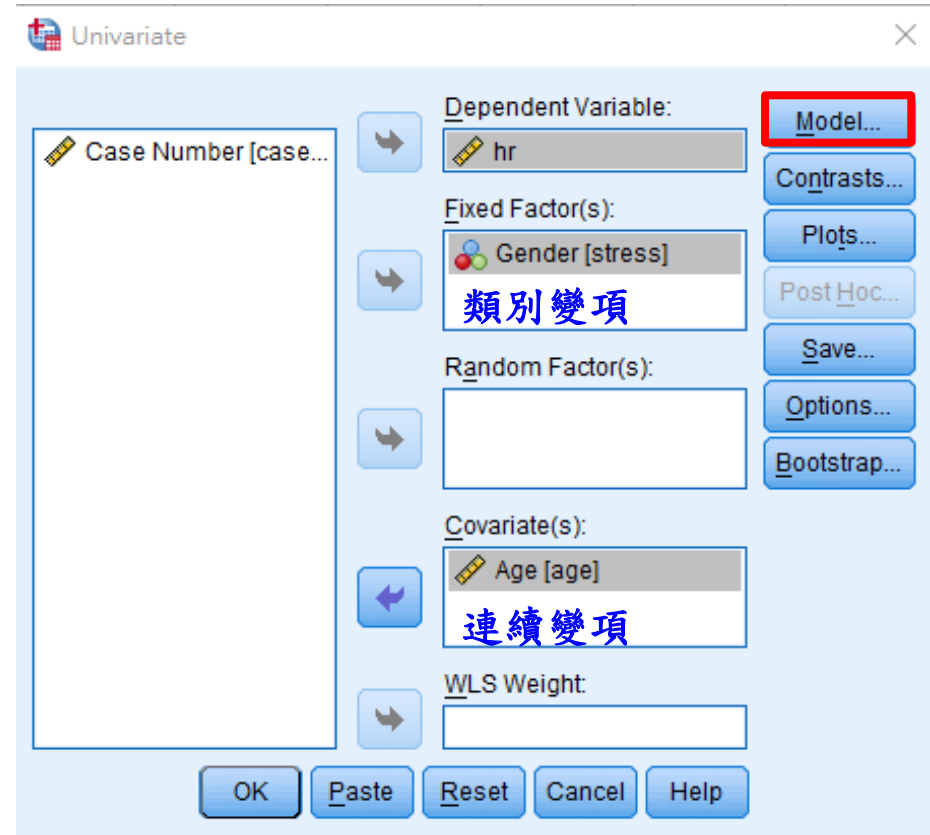
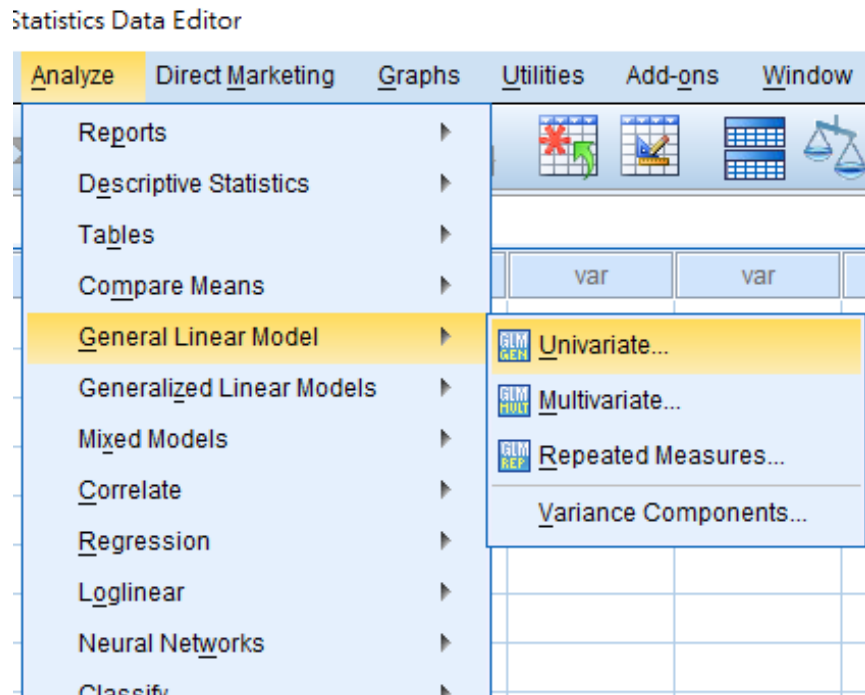
- 探討年齡(age)和壓力(stress)對於睡眠時數(hr)的影響

caseno	age	stress	hr
1	37	1	7.50
2	73	0	5.00
3	46	1	6.00
4	36	0	7.00
5	34	1	7.00
6	39	0	6.50
7	34	1	7.00
8	37	0	7.50
9	35	1	7.00
10	32	0	9.00
11	40	1	6.50
12	55	0	6.00
13	35	0	7.00
14	46	0	6.00
15	33	1	9.00

Linear regression-interaction



分析 > 一般線性模型 > 單變量



Linear regression-interaction



The image shows two overlapping SPSS dialog boxes. The 'Univariate: Model' dialog is in the foreground, and the 'Univariate: Options' dialog is partially visible behind it.

Univariate: Model

- Specify Model: Full factorial Custom
- Factors & Covariates: stress, age
- Build Term(s): Type: Interaction
- Model: stress, age, age*stress
- Sum of squares: Type III
- Include intercept in model
- Buttons: Continue, Cancel, Help

Univariate: Options

- Estimated Marginal Means: Factor(s) and Factor Interactions: (OVERALL), stress; Display Means for: (empty); Compare main effects; Confidence interval adjustment: LSD(none)
- Display: Descriptive statistics, Estimates of effect size, Observed power, Parameter estimates, Contrast coefficient matrix, Homogeneity tests, Spread vs. level plot, Residual plot, Lack of fit, General estimable function
- Significance level: .05; Confidence intervals are 95.0 %
- Buttons: Continue, Cancel, Help

Linear regression-interaction output



Tests of Between-Subjects Effects

Dependent Variable: hr

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	50.844 ^a	3	16.948	56.594	.000
Intercept	292.097	1	292.097	975.384	.000
stress	1.869	1	1.869	6.241	.016
age	32.272	1	32.272	107.764	.000
stress * age	1.327	1	1.327	4.431	.041
Error	13.776	46	.299		
Total	3091.040	50			
Corrected Total	64.620	49			

a. R Squared = .787 (Adjusted R Squared = .773)

Parameter Estimates

Dependent Variable: hr

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	10.990	.393	27.973	.000	10.199	11.780
[stress=0]	1.911	.765	2.498	.016	.371	3.451
[stress=1]	0 ^a	.	.	.	.	.
age	-.105	.011	-9.283	.000	-.127	-.082
[stress=0] * age	-.053	.025	-2.105	.041	-.104	-.002
[stress=1] * age	0 ^a	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

$$\mu_v = \beta_0 + \beta_1 * age + \beta_2 * stress + \beta_3 * age * stress$$

Linear regression-interaction output



Parameter Estimates

Dependent Variable: sleepHR1

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	11.347	.367	30.925	.000	10.609	12.085
[pressuID=0]	.342	.178	1.918	.061	-.017	.701
[pressuID=1]	0 ^a	.	.	.	.	.
age	-.115	.010	-11.023	.000	-.136	-.094

a. This parameter is set to zero because it is redundant.

$$\mu_y = \beta_0 + \beta_1 * age + \beta_2 * stress$$

		age=20	age=30	age=40
no interaction	stress=0	9.39	8.24	7.09
	stress=1	9.05	7.9	6.75
interaction	stress=0	9.74	8.16	6.58
	stress=1	8.89	7.84	6.79

Logistic regression

- 邏輯斯迴歸表示式

$$\ln \left(\frac{p}{1-p} \right) = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \dots + \beta_{k-1} X_{ik-1}$$

- Odds ratio, $OR = \frac{a/b}{c/d}$

	有病	沒病
暴露	a	c
非暴露	b	d

Odds ratio	意義
OR=1	暴露因子與疾病無關
OR>1	暴露因子可能為疾病的危險因子
OR<1	暴露因子可能為疾病的保護因子

Logistic regression-example



- 探討年齡、體重、性別和最大攝氧量是否預測罹患心臟病。收集個案完成最大攝氧量試驗，記錄年齡、體重和性別，並評估個案目前是否罹患心臟病。

caseno	age	weight	gender	VO2max	heart_disease
1	37	70.47	1.00	55.79	.00
2	73	50.34	.00	35.00	.00
3	46	87.65	1.00	42.93	1.00
4	36	89.80	.00	28.30	1.00
5	34	103.02	1.00	40.56	.00
6	39	77.37	.00	33.00	.00
7	34	82.48	1.00	43.48	.00
8	37	75.94	.00	30.38	.00
9	35	97.11	1.00	40.17	1.00
10	32	78.42	.00	36.01	.00
11	40	88.02	1.00	44.22	1.00
12	55	74.47	.00	38.76	1.00
13	35	75.98	.00	33.09	.00
14	46	58.97	.00	44.81	.00
15	33	111.80	1.00	31.94	.00

二元類別變項(0/1)

Logistic regression-分析操作



分析>迴歸>二元Logistic

The screenshot shows the SPSS software interface. The 'Analyze' menu is open, and the 'Regression' option is selected. The 'Binary Logistic...' option is highlighted within the Regression submenu. A data preview window is visible in the background, showing a table with columns 'heart_disease', 'var', and 'var'.

heart_disease	var	var
.00		
.00		
1.00		
1.00		
.00		

Logistic regression-分析操作



Logistic Regression

Dependent: Presence of Heart Disease [heart_disease]

Covariates: age, weight, gender, VO2max

Method: Enter

Buttons: OK, Paste, Reset, Cancel, Help

Logistic Regression: Define Categorical Variables

Covariates: Age [age], Weight [weight], VO2max [VO2max]

Categorical Covariates: gender(Indicator(first))

Change Contrast: Contrast: Indicator, Reference Category: Last, First

Logistic Regression: Options

Statistics and Plots: Classification plots, Hosmer-Lemeshow goodness-of-fit, Casewise listing of residuals, CI for exp(B): 95 %

Display: At each step, At last step

Probability for Stepwise: Entry: 0.05, Removal: 0.10

Classification cutoff: 0.5, Maximum iterations: 20

Logistic regression-Output



Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Step 1 ^a								
age	.085	.028	9.132	1	.003	1.089	1.030	1.151
weight	.006	.022	.065	1	.799	1.006	.962	1.051
gender(1)	1.950	.842	5.356	1	.021	7.026	1.348	36.625
VO2max	-.099	.048	4.266	1	.039	.906	.824	.995
Constant	-1.676	3.336	.253	1	.615	.187		

a. Variable(s) entered on step 1: age, weight, gender, VO2max.

年齡、性別和最大攝氧量有統計差異。男性罹患心臟病的風險是女性的7.026倍。年齡每增加1歲，罹患心臟病的風險增加1.089倍。最大攝氧量每增加1個單位，罹患心臟病的風險降低0.906倍。

Table.

	Univariate			Multivariable		
	Odds ratio	95%CI	P value	Odds ratio	95%CI	P value
Age	1.09	(1.03-1.15)	0.002**	1.09	(1.03-1.15)	0.003**
weight	1.04	(1.01-1.08)	0.006**	1.01	(0.96-1.05)	0.799
Male	2.72	(1.07-6.88)	0.035*	7.03	(1.35-36.63)	0.021*
VO2max	0.95	(0.90-1.00)	0.046*	0.91	(0.82-0.99)	0.039*

Logistic regression. * $P < 0.05$, ** $P < 0.01$.

Linear Regression vs Logistic Regression



	Linear Regression	Logistic Regression
Dependent	Outcome is continuous.	Outcome is binary.
Independent	Continuous or categorical Categorical → dummy	Continuous or categorical
e.g.	年齡預測 <u>血壓</u> 的變化	吸菸是否罹患 <u>肺癌</u> (有病/沒病)

Statistical Analysis



- Linear regression

Statistical Analysis

Statistical analyses were performed using IBM SPSS version 22.0; International Business Machines Corp, New York, USA. The continuous and categorical data were analyzed by the independent T-test, and chi-square test, respectively. The Pearson correlation test was employed to assess the correlation between CT and RE. Linear regression analysis was used to evaluate the independent variables of gender, age, BCVA and RE with respect to the dependent variable of CT. P-values less than 0.05 were considered statistically significant.

Seminars in Ophthalmology. Taylor & Francis, 2022. p. 1-8.

- Logistic regression

2.4. Statistical analysis

The demographic data and CTA/CTP postprocessing results were analyzed between the DP and non-DP groups. Numerical variables were presented as median and interquartile ranges; categorical variables as percentages. Numerical variables were tested by the Mann-Whitney *U* test; categorical variables evaluated by chi-square test. In logistic regression for the analysis of risk factors, the variables that were statistically significant ($p < 0.05$) in univariate model were further analyzed in the multivariable model. Odds ratios (ORs) and 95% CIs were presented. All analyses were performed with IBM SPSS Statistics Version 22 (Armonk, New York, USA).

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實作演練



Question-Correlation



- 探討CVVLT-T與Aβ42、t-tau、Aβ42*t-tau的相關性

Baseline	MMSE		CVVLT-T		CVVLT-10	
Biomarkers	r_s	p	r_s	p	r_s	p
Aβ42	-0.024	0.917	-0.555	0.032*	-0.393	0.147
t-tau	-0.138	0.539	-0.519	0.047*	-0.512	0.051
Aβ42 × t-tau	-0.061	0.786	-0.571	0.026*	-0.516	0.049*
Aβ42/t-tau	0.160	0.478	0.499	0.058	0.491	0.063
Annual changes	MMSE		CVVLT-T		CVVLT-10	
Biomarkers	r_s	p	r_s	p	r_s	p
Aβ42	-0.512	0.015*	0.009	0.975	-0.022	0.939
t-tau	-0.376	0.085	-0.070	0.805	0.005	0.985
Aβ42 × t-tau	-0.429	0.046*	-0.077	0.785	-0.029	0.919
Aβ42/t-tau	0.244	0.273	0.100	0.723	0.040	0.888

Table 2. Association between baseline plasma biomarkers and MMSE and CVVLT scores at baseline and follow-up (N = 22). Abbreviations: MMSE, Mini-Mental State Examination; CVVLT, Chinese Version Verbal Learning Test; t-tau, total tau. Note: Spearman's rank correlation coefficient was used to explore the correlation between plasma biomarker levels and MMSE and CVVLT scores at baseline and follow-up. * $p < 0.05$.

OPEN

Plasma A β 42 and Total Tau Predict Cognitive Decline in Amnesic Mild Cognitive Impairment

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Levels of amyloid- β (A β) and tau peptides in brain have been associated with Alzheimer disease (AD). The current study investigated the abilities of plasma A β 42 and total-tau (t-tau) levels in predicting cognitive decline in subjects with amnesic mild cognitive impairment (MCI). Plasma A β 42 and t-tau levels were quantified in 22 participants with amnesic MCI through immunomagnetic reduction (IMR) assay at baseline. The cognitive performance of participants was measured through neuropsychological tests at baseline and annual follow-up (average follow-up period of 1.5 years). The predictive value of plasma A β 42 and t-tau for cognitive status was evaluated. We found that higher levels of A β 42 and t-tau are associated with lower episodic verbal memory performance at baseline and cognitive decline over the course of follow-up. While A β 42 or t-tau alone had moderate-to-high discriminatory value in the identification of future cognitive decline, the product of A β 42 and t-tau offered greater differential value. These preliminary results might suggest that high levels of plasma A β 42 and t-tau in amnesic MCI are associated with later cognitive decline. A further replication with a larger sample over a longer time period to validate and determine their long-term predictive value is warranted.

Correlation



- Pearson correlation

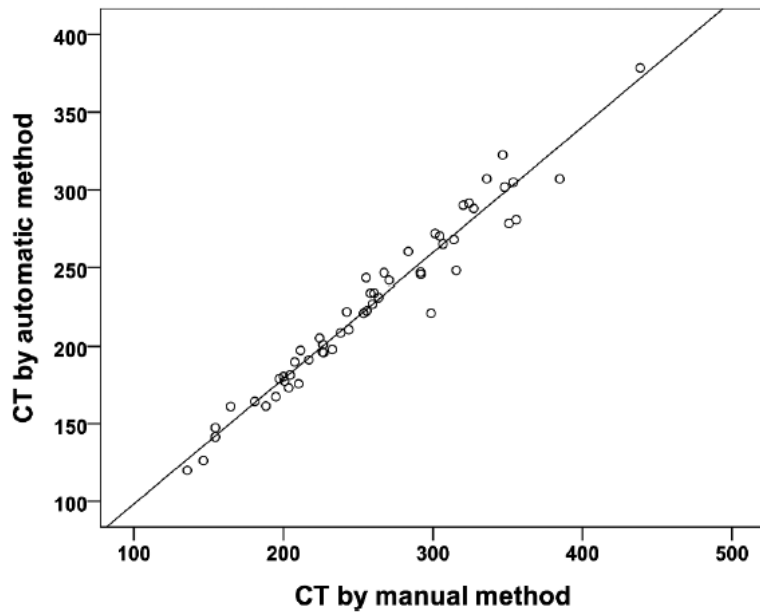
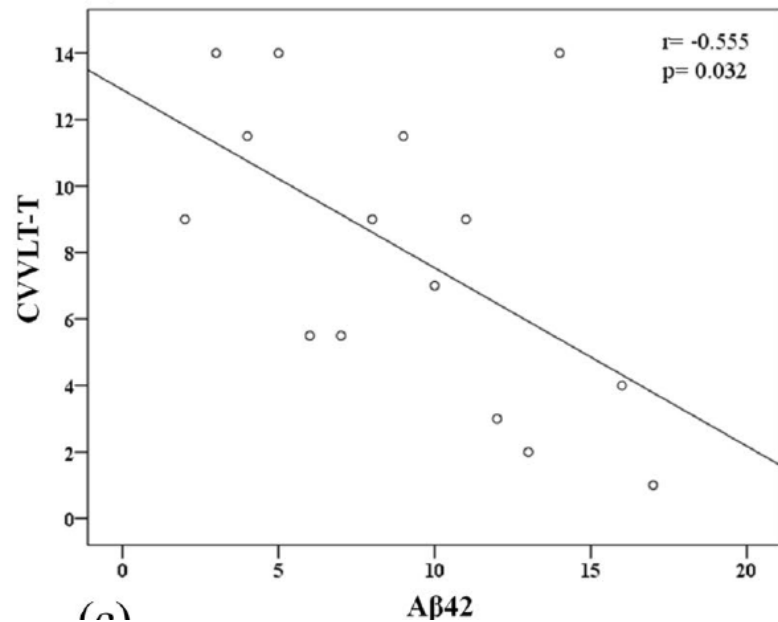


Figure 5. Correlation analysis was used between CT by the manual and automatic methods. ($r = 0.977$, $p < .01$) (CT = Choroidal thickness)

- Spearman rank correlation



Question- Linear regression



- 探討2021年COVID-19流行期間對於2019/2020年比較術前及術後1個月VAS和EQ5D的影響
 - Model 1: unadjusted
 - Model 2: adjusted for age and sex
 - Model 3: adjusted for age, sex, BMI and DM
 - Model 4: adjusted for age, sex, BMI, DM, admission and emergency diagnosis



The Impact of COVID-19 Surges in 2019–2021 on Patient-Reported Outcome Measures After Spine Surgery at an Academic Tertiary Referral Center in Taiwan: A Retrospective Observational Cohort Study

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Answer- Linear regression



- Model 1: unadjusted
- Model 2: adjusted for age and sex
- Model 3: adjusted for age, sex, BMI and DM
- Model 4: adjusted for age, sex, BMI, DM, admission and emergency diagnosis

TABLE 5 | Associations between the COVID-19 pandemic in 2021 and changes from baseline to 1-month follow-up in VAS and EQ-5D scores.

2021 vs. 2019/2020	Change in VAS score from baseline		Change in EQ-5D score from baseline	
	β coefficient (95% CI)	<i>p</i> -value	β coefficient (95% CI)	<i>p</i> -value
Model 1	1.563 (0.700, 2.427)	<0.001	-0.086 (-0.147, -0.025)	0.006
Model 2	1.527 (0.670, 2.384)	0.001	-0.088 (-0.150, -0.026)	0.006
Model 3	1.208 (0.324, 2.091)	0.008	-0.086 (-0.149, -0.023)	0.008
Model 4	1.239 (0.355, 2.124)	0.006	-0.095 (-0.155, -0.035)	0.002

Model 1, unadjusted. Model 2, adjusted for age and sex. Model 3, adjusted for variables in Model 2 plus body mass index and history of diabetes. Model 4, adjusted for variables in Model 3 plus admission identity (via emergency department or outpatient department) and whether the patient had an emergency diagnosis. CI, confidence interval; COVID-19, coronavirus disease 2019; EQ-5D, EuroQoL-5D; VAS, visual analog scale.





Question- Logistic regression



- 家族性高膽固醇血症對於心血管疾病的影響
 - Model 1: unadjusted
 - Model 2: adjusted for sex, SBP, DBP, LDL, eGFR, Smoking, DM and FH gene

Article

Familial Hypercholesterolemia Genetic Variations and Long-Term Cardiovascular Outcomes in Patients with Hypercholesterolemia Who Underwent Coronary Angiography

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Answer- Logistic regression



- Model 1: unadjusted
- Model 2: adjusted for sex, SBP, DBP, LDL, eGFR, Smoking, DM and FH gene

Table 4. Association between the variables and the incidence of cardiovascular disease or mortality as determined by univariate and multivariate regression analyses in the study cohort (n = 285).

Variables	Univariate Analysis			Multivariate Analysis		
	Odds Ratio	(95% CI)	<i>p</i> Value	Odds Ratio	(95% CI)	<i>p</i> Value
Age, years	1.02	(1.00–1.04)	0.090			
Sex, men	2.40	(1.35–4.28)	0.003 **	2.23	(1.06–4.68)	0.034 *
Body mass index, kg/m ²	1.04	(0.97–1.12)	0.253			
sBP, mmHg	1.01	(1.00–1.03)	0.097	1.02	(1.00–1.04)	0.081
dBp, mmHg	1.00	(0.98–1.02)	0.875	0.98	(0.95–1.01)	0.219
Triglycerides, mg/dL	1.00	(1.00–1.01)	0.123			
Cholesterol, mg/dL	1.00	(1.00–1.01)	0.262			
LDL-C, mg/dL	1.02	(1.00–1.03)	0.024 *	1.02	(1.00–1.03)	0.019 *
HDL-C, mg/dL	0.97	(0.95–1.00)	0.037 *			
HbA1c, %	1.67	(1.05–2.65)	0.032 *			
Creatinine, mg/dL	1.33	(0.91–1.94)	0.143			
eGFR, mL/min/1.73 m ²	0.99	(0.98–1.00)	0.011 *	0.99	(0.98–1.00)	0.079
Smoking	2.51	(1.41–4.46)	0.002 **	2.09	(1.04–4.19)	0.039 *
DM	2.93	(1.32–6.49)	0.008 **	2.42	(1.02–5.73)	0.045 *
Hypertension	2.38	(1.36–4.16)	0.002 **			
FH genetic variation						
Non-carriers	Reference			Reference		
Carriers	3.29	(1.13–9.59)	0.029 *	3.17	(1.01–9.92)	0.047 *



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感謝您的聆聽！

Thank you !

