世代研究的描述性統計(1)

醫學研究部 醫學研究部 生統小組

徐倩儀

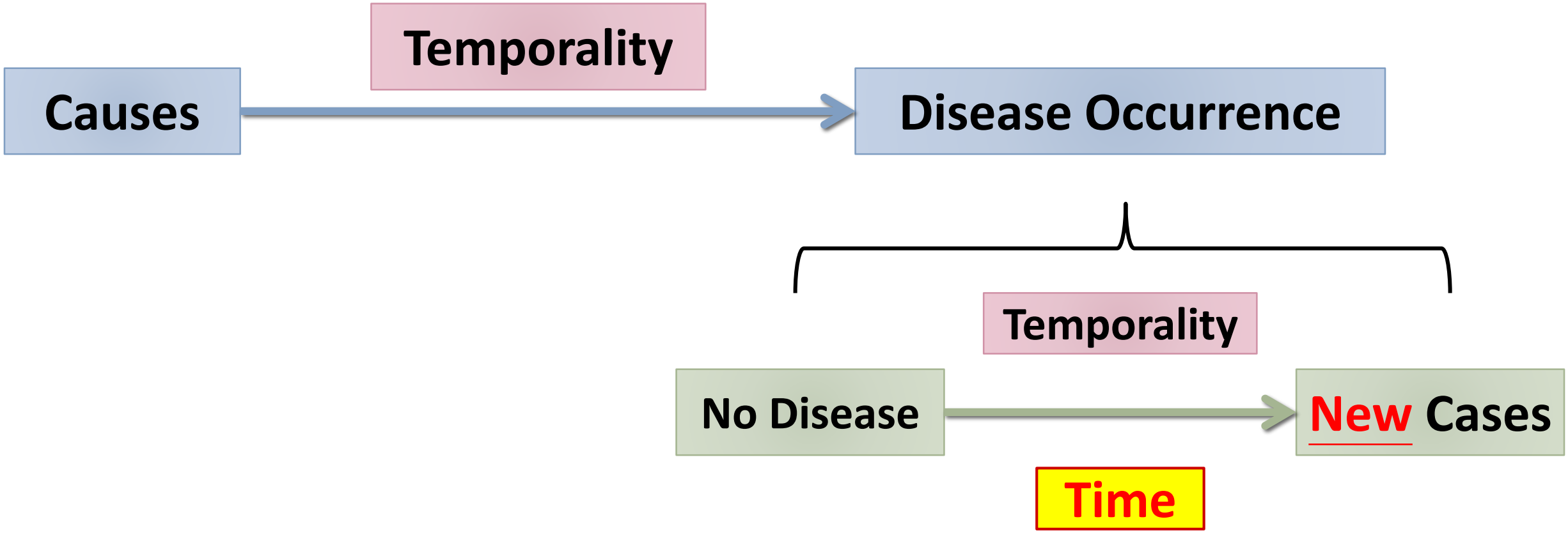
2024/11/12

內容大綱

- 如何製作「表1」
- 列聯表分析(卡方檢定、危險對比值odds ratio)
- 計算疾病的頻率(發生率)

世代研究：探討疾病的發生率及風險

判定因果關係的必要條件之一



定性資料

- 研究主題(流病)
  - 疾病、傷害、殘障、死亡
    - 兩分變項 (Binary variables)
- 頻率量數 (frequency measure)
  - 率、比率 (Rate)
  - 分率(Proportion)
  - 比值(Ratio)

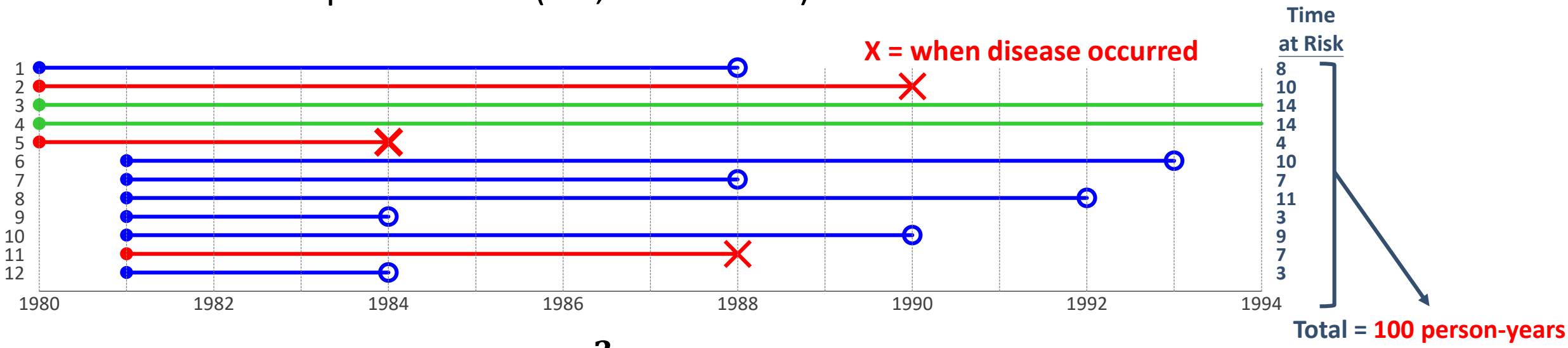
Rates

- Time into the denominator
  - speed (kilometers per hour)
    - 120 kilometers in 2 hours
      - average speed : 60 km/hr.
- Health outcomes
  - "rates" are actually proportions
    - mortality rate / attack rate / case-fatality rate

Lamorte, W.W. (2022). Basic Quantitative Concepts. Ratios, Proportion, and Rates. Retrieved November 3, 2022, from Boston University School of Public Health. Web site: http://sphweb.bumc.bu.edu/otlt/MPH-Modules/PH717-QuantCore/PH717_BasicQuantitativeConcepts/PH717_BasicQuantitativeConcepts4.html

Rates

- Like a true rate
  - incidence rates or incidence density
    - the number of health outcomes
    - the total exposure time (i.e., time at risk)



$$\text{IR} = \frac{3}{100\ PYs}$$

Incidence rate 專業期刊會如何呈現?

TABLE 2 | Incidence rates and effect sizes of outcomes by valve replacement status in ESRD group.

Outcomes	Variables	Total numbers	Event (%) / per 1,000 person-years	Models	Hazard ratios (95% CI)	*P* value
Total mortality	Patients with mechanical valve	456	412 (90.4%) / 457.4	0	1 (reference)	NA
				1		
				2		
				3		
	Patients with bioprosthetic valve	456	406 (89.0%) / 426.8	0	1.00 (0.95–1.06)	0.88
				1	0.98 (0.93–1.05)	0.55
				2	0.99 (0.93–1.05)	0.64
				3	0.88 (0.82–0.93)	<0.001
CV death	Patients with mechanical valve	456	236 (51.8%) / 262.0	0	1 (reference)	NA
				1		
				2		
				3		
	Patients with bioprosthetic valve	456	208 (45.6%) / 218.7	0	0.98 (0.90–1.06)	0.58
				1	0.96 (0.89–1.04)	0.29
				2	0.97 (0.89–1.05)	0.38
				3	0.83 (0.76–0.90)	<0.001

CI, confidence interval; CV, cardiovascular; ESRD, end-stage renal disease; NA, not available.
Model 0: crude effect size by the two groups.
Model 1: adjusted effect by age, sex.
Model 2: adjusted effect by age, sex, total number of valves replaced, hypertension, diabetes mellitus, congestive heart failure, coronary artery diseases, and chronic obstructive pulmonary disease.
Model 3: adjusted effect by age, sex, total number of valves replaced, hypertension, diabetes mellitus, congestive heart failure, coronary artery diseases, chronic obstructive pulmonary disease, and medications (antiarrhythmic agents of Ia Ib, Ic, III, calcium channel blockers, angiotensin receptor blockers, statins, insulin, oral hypoglycemic agents).

Incidence rate 如何計算?

$$\text{失智症的發生率 (per 1000 person-years)} = \frac{\text{失智症的發生數}}{\text{總追蹤人年}} * 1000$$

$$\text{Dementia (rate)} = \frac{\textit{Dementia}}{\textit{F/U dementia} \text{ year}} * 1000$$

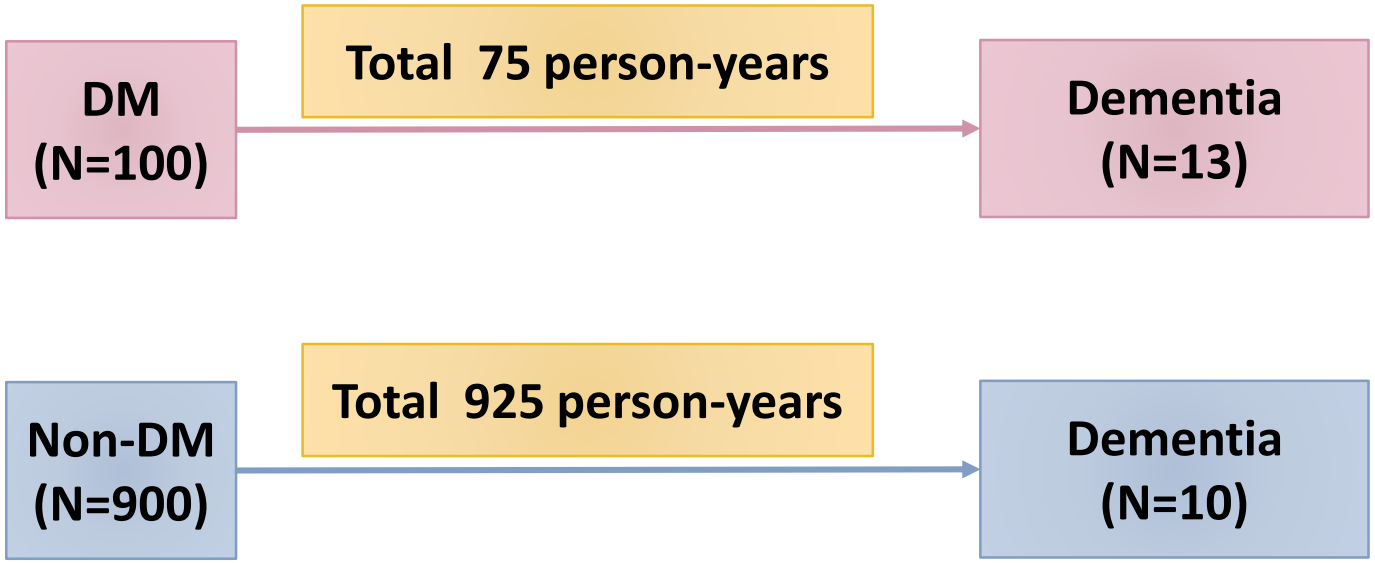
發生率的95% CI (Lower) = A × Lower → $\textbf{dementia} - (\sqrt{\textbf{demenita}} * \mathbf{1.96})$

發生率的95% CI (Upper) = A × Upper → $\textbf{dementia} + (\sqrt{\textbf{demenita}} * \mathbf{1.96})$

$$A = \frac{1000}{\textit{F/U dementia} \text{ year (總追蹤人年)}}$$

動手算算看 (Incidence rate)

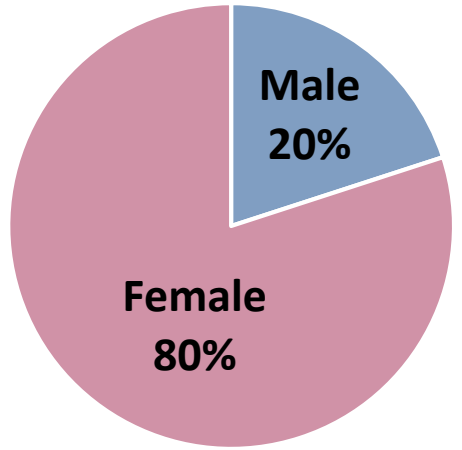
- Excel計算

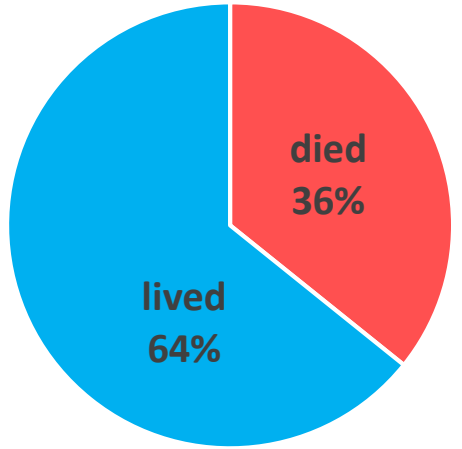


課程範例I-2.xlsx
【發生率計算】

Proportions

- Relates a part to a whole
- Total class size is 100 (20 male / 80 female)
  - The proportions of
    - Male is 20/100 or 20%
    - Female is 80/100 or 80%
- 44 died / 79 lived
  - Proportion (died) : 44/(44+79) = 0.36 or 36%
    - “case-fatality” rate





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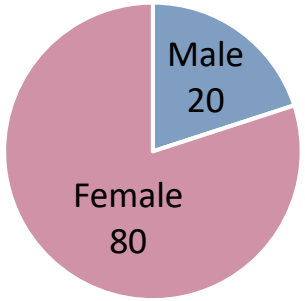
Prevalence (proportions)

$$\text{Period prevalence (proportion)} = \frac{\textit{Number of cases that existed in a given period}}{\textit{Number of people in the population during this period}}$$

- 點盛行率(期盛行率)
  - 某個時間點(或期間)，患某病的所有病例數佔全人口數的比例
  - 呈現方式
    - 百分比(%)或分數
    - 每一萬人或每十萬人患病的人數
- **Prevalence is low (<10%)**
  - **Prevalence = incidence × duration**

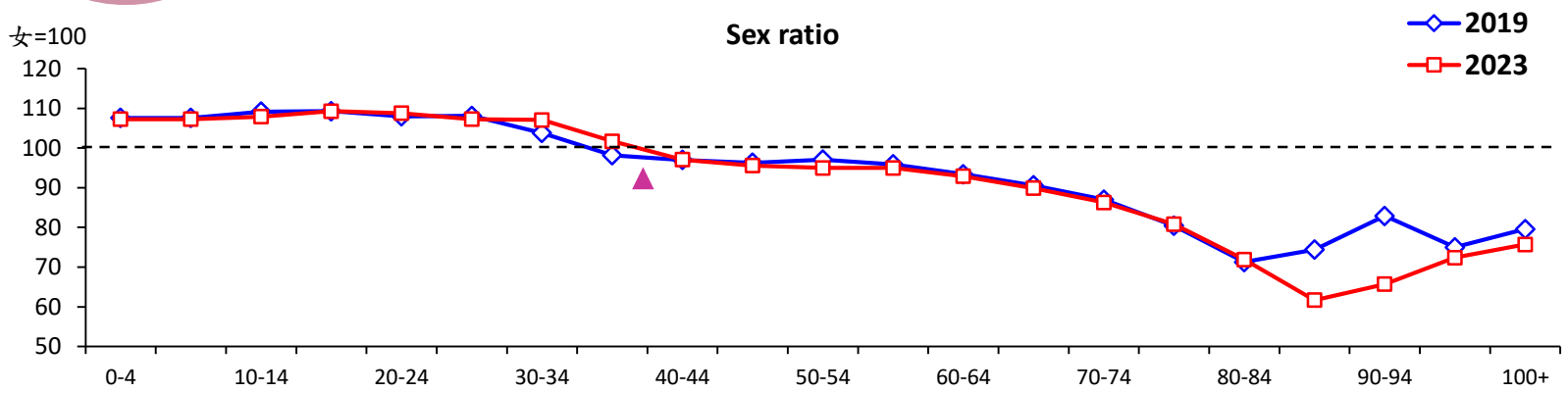
Simple Ratios

- A class
  - 20 male students and 80 female students
- The ratio of men to women
  - 20:80 (20/80)
  - 1:4 ratio (1/4 ratio)
  - 0.25



年	男嬰	女嬰	性比例
一〇八年	90812	84262	107.8
一〇九年	83748	77540	108.0
一一〇年	81220	75799	107.2
一一一年	71208	66205	107.6
一一二年	69453	64442	107.8
資料來源：內政部戶政司。			
更新日期：2024/6/10			

性比例=(男性人口數÷女性人口數)x100
意思：每一百個女性人口，有多少個男性人口?



資料來源：國家發展委員會中華民國人口推估(更新日期：2024/10/17) (下載日期：2024/11/07) (查詢年份：2019-2023)

頻率量數 (frequency measure)

	率、比率 (Rate)	分率 (Proportion)	比值 (Ratio)
	兩個數量**相除**所得的值		
分母	可以包含**時間**	可以包含**時間**	**不**包含時間
單位	**有單位** (人年數, 年$^{-1}$)	不一定有單位	無單位
定義	分子 < 分母	分子 < 分母	分子 ≠ 分母 (互斥)
範圍	零和無限大 ($0 \le Rate \le \infty$)	$0 \le Proportion \le 1$	無大小的限制
例子	發生率 **Incidence rate**	盛行率、死亡率、致死率 **Incidence proportion**, Prevalence rate (proportion)	比值、風險比 20:80 或 20/80 或 0.25

100 $\frac{cases}{person-year}$

10,000 $\frac{cases}{person-century}$

Probability that disease develops within a specified time interval

Incidence proportion = $\frac{\sum_{persons} individual\ proportions}{initial\ size\ of\ the\ population} = {}^{A}/_{N}$

Risk calculations in a cohort study

		Disease develops	Disease dose not develop	Totals	**Incidence Rates of Disease**
First select	Exposed	a	b	a + b	$\frac{a}{a+b}$
	Not exposed	c	d	c + d	$\frac{c}{c+d}$

$\frac{a}{a+b}$ = Incidence in exposed $\frac{c}{c+d}$ = Incidence in non-exposed

$$\text{Relative risk (RR)} = \frac{Incidence\ in\ exposed}{Incidence\ in\ non-exposed} = \frac{(\frac{a}{a+b})}{(\frac{c}{c+d})}$$

- RR=1, No association
- RR>1, Positive association (possibly causal)
- RR<1, Negative association (possibly protective)

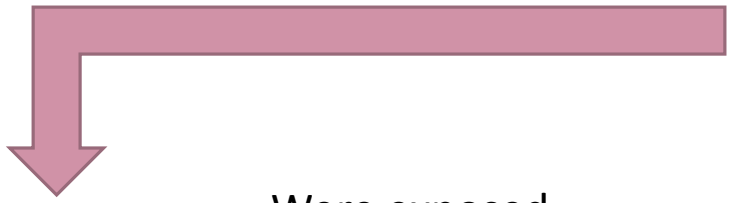
Risk calculations in a cohort study

Hypothetical cohort study, the relation of smoking to the development of coronary heart disease over a **1-year period**.

	CHD develops	CHD Dose not develop	Totals	Incidence per 1,000 per Year
Smoke	84	2,916	3,000	$\frac{84}{3000} * 1000$ = 28.0 per 1,000
Do not smoke	87	4,913	5,000	$\frac{87}{5000} * 1000$ = 17.4 per 1,000

$$\text{Relative risk (RR)} = \frac{Incidence\ in\ exposed}{Incidence\ in\ non-exposed} = \frac{28.0}{17.4} = 1.61$$

Case-Control study



Then Measure Past Exposure

First Select

	Cases (With Disease)	Controls (Without Disease)	Odds
Were exposed	a	b	$\frac{a}{b}$ (exposed)
Were not exposed	c	d	$\frac{c}{d}$ (non-exposed)
Odds	$\frac{a}{c}$ (case, disease)	$\frac{b}{d}$ (control, without disease)	

$$\text{Odds ratio (OR)} = \frac{Odds\ (exposed)}{Odds\ (non-exposed)} = \frac{a/b}{c/d} = \frac{ad}{bc}$$

$$\text{Odds ratio (OR)} = \frac{Odds\ (case,disease)}{Odds\ (control,without\ disease)} = \frac{a/c}{b/d} = \frac{ad}{bc}$$

- OR=1, No association
- OR>1, Positive association (possibly causal)
- OR<1, Negative association (possibly protective)

Relative risk & Odds Ratio

	Develop Disease	Do Not Develop Disease	
Exposed	200	9800	10,000
Not Exposed	100	9900	10,000

罕見疾病

Relative risk (RR) ≈ **Odds ratio (OR)**

$= \frac{200/10000}{100/10000}$

$= 2$

$= \frac{200*9900}{100*9800}$

$= 2.02$

	Develop Disease	Do Not Develop Disease	
Exposed	50	50	100
Not Exposed	25	75	100

Relative risk (RR) ≠ **Odds ratio (OR)**

$= \frac{50/100}{25/100}$

$= 2$

$= \frac{50*75}{25*50}$

$= 3$

a	b
c	d

Gordis, L. 2004. Epidemiology. ELSEVIER. Page 184

動手算算看 (Odds Ratio)

Case-Control Study

		First Select	
		CHD Cases	Controls
Past Exposure	Smokers	112	176
	Non smokers	88	224

Odds Ratio (OR) = ?

課程範例I-2.xlsx
【OR計算】

Gordis, L. 2004. Epidemiology. ELSEVIER. Page 186

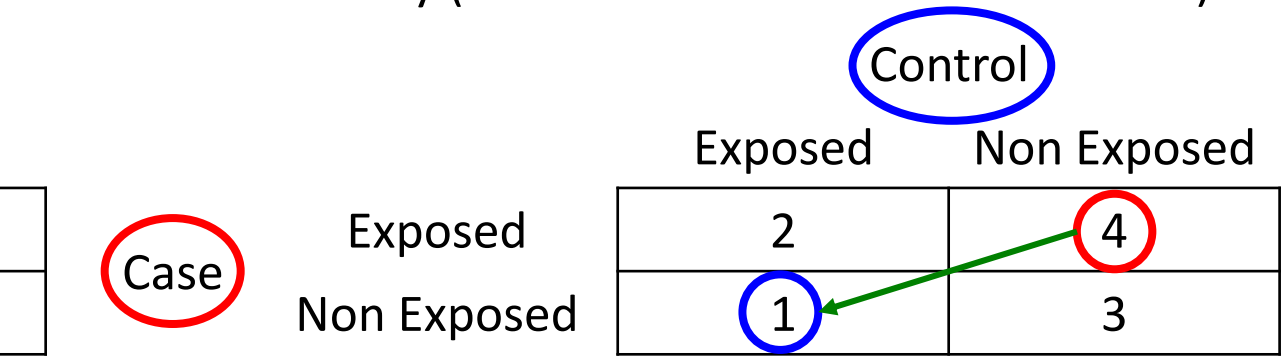
Odds Ratio

Unmatched study (10 cases and 10 controls)

	Cases	Control
Exposed	6	3
Non Exposed	4	7

Odds ratio = $\frac{ad}{bc} = \frac{6*7}{3*4} = 3.5$

Matched study (10 cases and 10 matched controls)

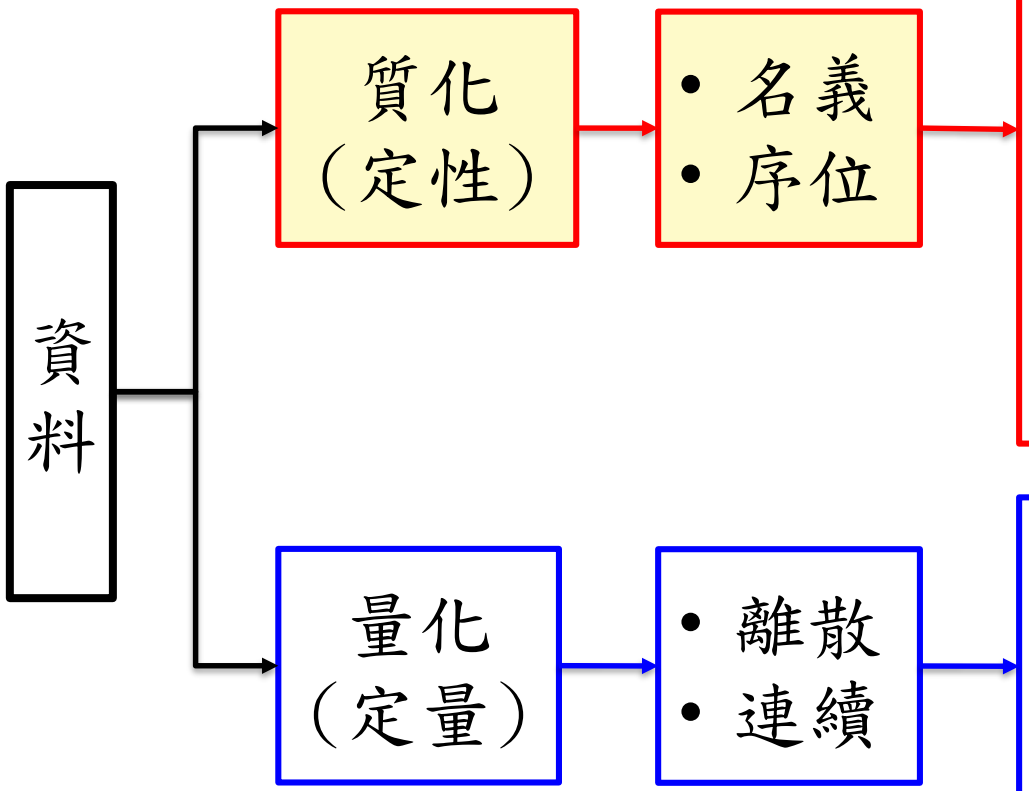


Odds ratio (matched pairs) = $\frac{b}{c} = \frac{4}{1} = 4$

a	b
c	d

資料分類

資料呈現



	n	(%)		n	(%)
CKD stage			Male	232	(70.1%)
CKD 3A	147	(44.4%)			
CKD 3B	101	(30.5%)	Medications		
CKD 4	52	(15.7%)	Diuretics	251	(75.8%)
CKD 5	31	(9.4%)	MRA	80	(24.2%)
Heart condition			β-blocker	209	(63.1%)
Non-HF	254	(76.7%)	ACEI or ARB	249	(75.2%)
HFpEF	45	(13.6%)	Anti-platelet agents	226	(68.3%)
HFrEF	32	(9.7%)	Anti-coagulants	62	(18.7%)

	mean ± SD	median (IQR)
Age	81.3 ± 6.6	82.7 (76.5-86.5)
eGFR (ml/min per 1.73m^2)	39.5 ± 14.9	43.4 (29.9-52.2)
MNA-SF	12.3 ± 2.1	13 (11-14)
Timed Up and Go test (sec)	20.7 ± 11.6	18 (14-24)

專業期刊中 Table 1如何呈現?

frontiers in Cardiovascular Medicine

ORIGINAL RESEARCH
published: 17 December 2021
doi: 10.3389/fcvm.2021.745370

Long-Term Outcomes of Bioprosthetic or Mechanical Valve Replacement in End-Stage Renal Disease: A Nationwide Population-Based Retrospective Study

Guan-Yi Li[1†], Yun-Yu Chen[1,2†], Fa-Po Chung[1,3], Kuo-Liong Chien[2], Chiao-Po Hsu[3,4*] and Yenn-Jiang Lin[1,3]*

OPEN ACCESS

TABLE 1 | Baseline characteristics of ESRD cohorts after propensity-score matching.

Variables	ESRD group (*N* = 912)		
	Mechanical valve (*N* = 456)	Bioprosthetic valve (*N* = 456)	*P* value
Age	67.4 ± 11.8	66.8 ± 11.9	0.51
Male gender	240 (52.6%)	254 (55.7%)	0.35
Valve location			
Aortic valve	242 (53.1%)	234 (51.3%)	0.60
Mitral valve	246 (53.9%)	254 (55.7%)	0.60
Tricuspid valve	13 (2.9%)	27 (5.9%)	0.02
Pulmonary valve	0 (0%)	3 (0.7%)	0.24
Total number of valves replaced	1.10 ± 0.30	1.14 ± 0.35	0.08
1	411 (90.1%)	395 (86.6%)	0.18
2	45 (9.9%)	59 (12.9%)	
3	0 (0%)	2 (0.44%)	
4	0 (0%)	0 (0%)	
Comorbidities			
ESRD (%)	456 (100%)	456 (100%)	>0.99
Diabetes mellitus (%)	16 (3.5%)	22 (4.8%)	0.32
Hypertension (%)	53 (11.6%)	62 (13.6%)	0.37
COPD (%)	4 (0.9%)	4 (0.9%)	>0.99
CHF (%)	118 (25.9%)	110 (24.1%)	0.54
Prior stroke (%)	16 (3.5%)	22 (4.8%)	0.32

資料整理

- 列聯表
  - 各分類次數

NO	CKD	HC	Death	sex	Med1	Med2	…
0001	3	1	0	1	0	0	
0005	3	1	0	0	0	0	
0013	2	3	0	1	1	1	
0018	2	1	0	1	0	0	
0021	2	1	0	1	0	0	
0023	4	1	1	1	1	1	
0024	2	1	0	1	0	0	
0027	4	1	0	0	1	0	
0029	4	1	1	0	1	0	
0052	2	1	0	0	1	0	

		CKD			
		CKD 3A	CKD 3B	CKD 4	CKD 5
Sex	Male	101	71	39	21
	Female	46	30	13	10

Chi-square (χ^2) test

- 獨立性檢定
  - 兩組類別變數是否獨立(是否有關聯)
- 適合度檢定
  - 分佈比例是否一致

Chi-square (χ^2) test

- 獨立性檢定
  - 兩組類別變數是否有關聯

觀察值(O)

	有病	沒病	
抽菸	A	B	A+B
不菸	C	D	C+D
	A+C	B+D	N

期望值(E)

	有病	沒病
抽菸	$\frac{(A+B)(A+C)}{N}$	$\frac{(A+B)(B+D)}{N}$
不菸	$\frac{(A+C)(C+D)}{N}$	$\frac{(B+D)(C+D)}{N}$

- 每一細格**觀察值(O)**偏離期望值(E)的程度=(O-E)/E
- 避免負號(取平方)
- $\chi^2 = \Sigma(O-E)^2/E$

- **80%**以上細格期望值**>5**
  - 小樣本或未達到
    - **Fisher's Exact test**

練習範例

frontiers in Cardiovascular Medicine

ORIGINAL RESEARCH
published: 04 June 2021
doi: 10.3389/fcvm.2021.680098

Impacts of Heart Failure and Physical Performance on Long-Term Mortality in Old Patients With Chronic Kidney Disease

*Shuo-Chun Weng[1,2], Yu-Chi Chen[3], Chiann-Yi Hsu[4], Chu-Sheng Lin[5], Der-Cherng Tarng[1,6,7,8] and Shih-Yi Lin[1,9]**

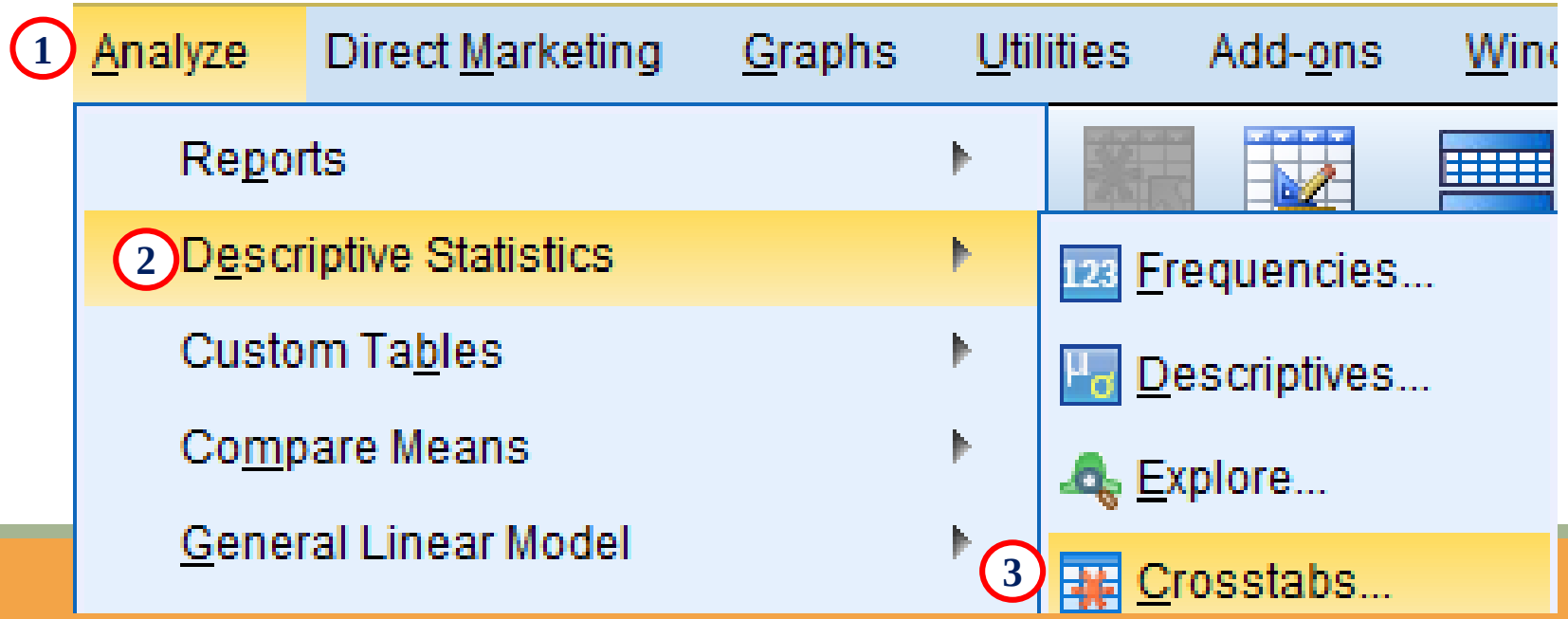
TABLE 1 | Baseline characteristics of older patients with different staging of CKD.

Characteristics	CKD stage 3A (n = 147)	CKD stage 3B (n = 101)	CKD stage 4 (n = 52)	CKD stage 5 (n = 31)	p-value
Age, years	83.1 (77.1–86.3)	81.8 (76.0–86.7)	83.2 (79.0–87.1)	78.8 (73.3–83.6)	0.043
Male	101 (68.7)	71 (70.3)	39 (75.0)	21 (67.7)	0.846
Heart condition					0.001
Non–heart failure	119 (81.0)	84 (83.2)	36 (69.2)	15 (48.4)	
HFpEF	15 (10.2)	12 (11.9)	10 (19.2)	8 (25.8)	
HFrEF	13 (8.8)	5 (4.9)	6 (11.5)	8 (25.8)	
Medications					
Diuretics	108 (73.5)	72 (71.3)	47 (90.4)	24 (77.4)	0.054
MRA	31 (21.1)	16 (15.8)	18 (34.6)	15 (48.4)	0.001
β-blocker	88 (59.9)	60 (59.4)	41 (78.9)	20 (64.5)	0.078
ACEI or ARB	110 (74.8)	77 (76.2)	43 (82.7)	19 (61.3)	0.183
Anti-platelet agents	95 (64.6)	66 (65.4)	44 (84.6)	21 (67.7)	0.052
Anti-coagulants	24 (16.3)	13 (12.9)	19 (36.5)	6 (19.4)	0.003

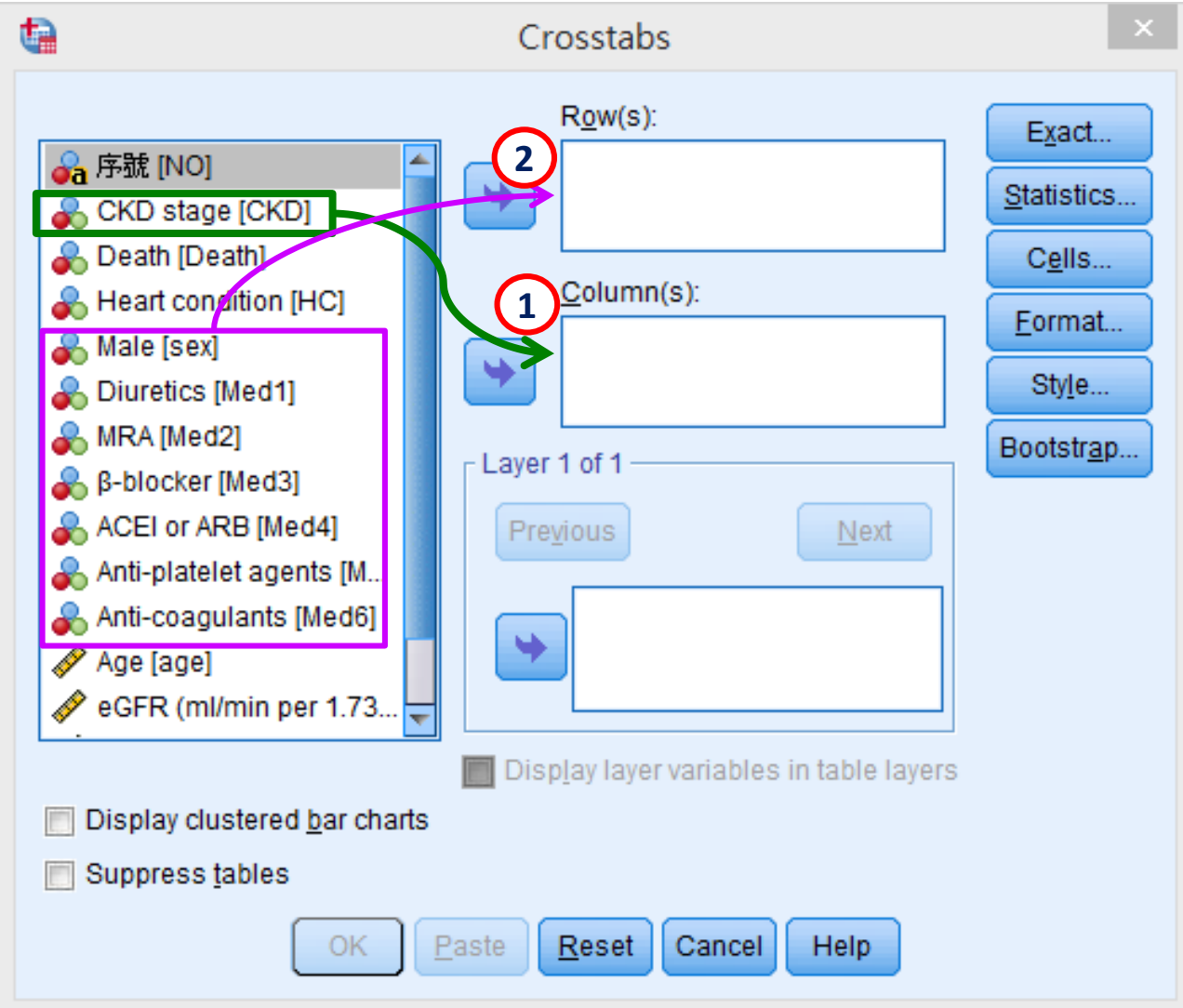
練習範例

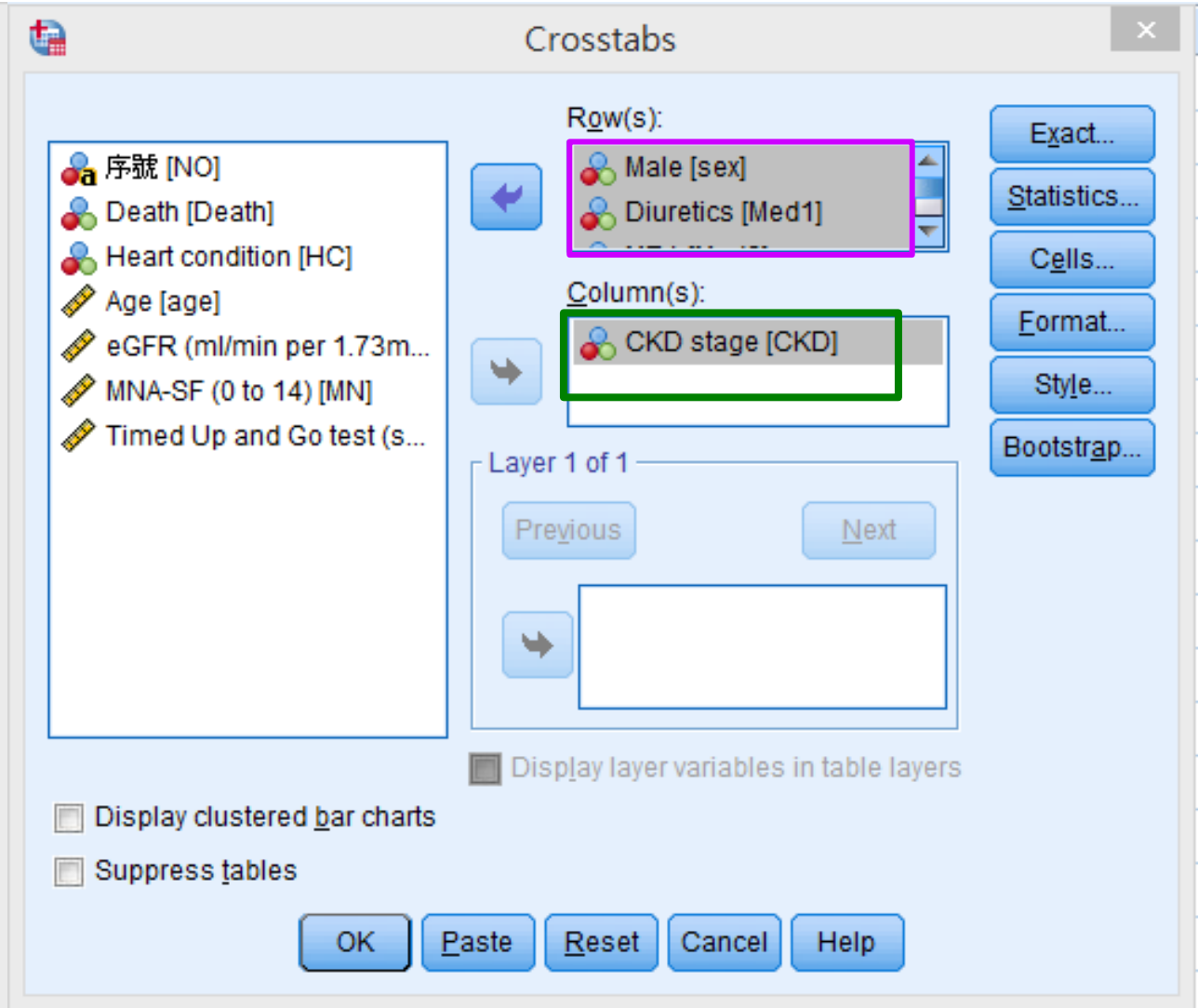
- Chi-square (χ^2) test
  - Excel
    - CHISQ.TEST()
  - SPSS
    - 分析→描述性統計→交叉表

課程範例I-2.xlsx
【OR計算】



練習範例-SPSS (Crosstabs)





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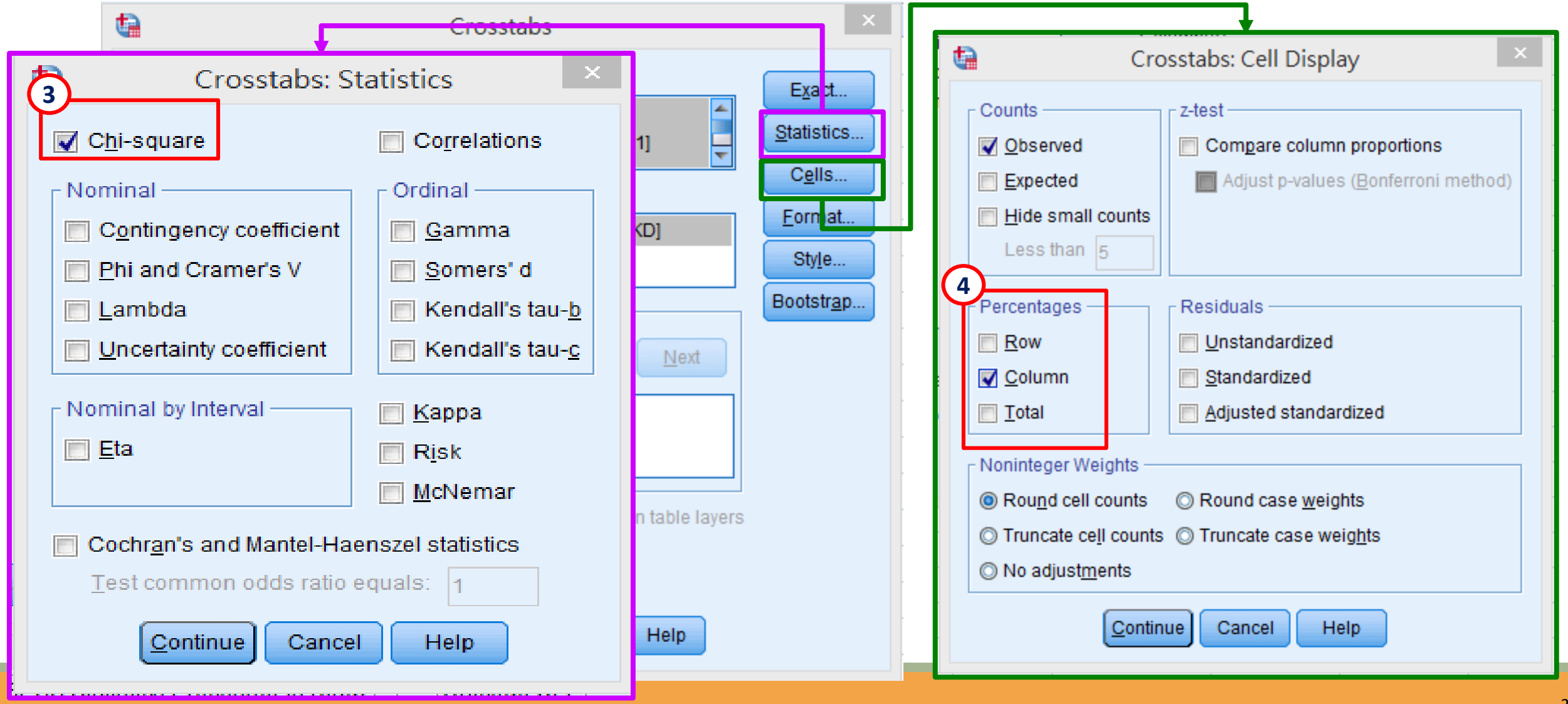
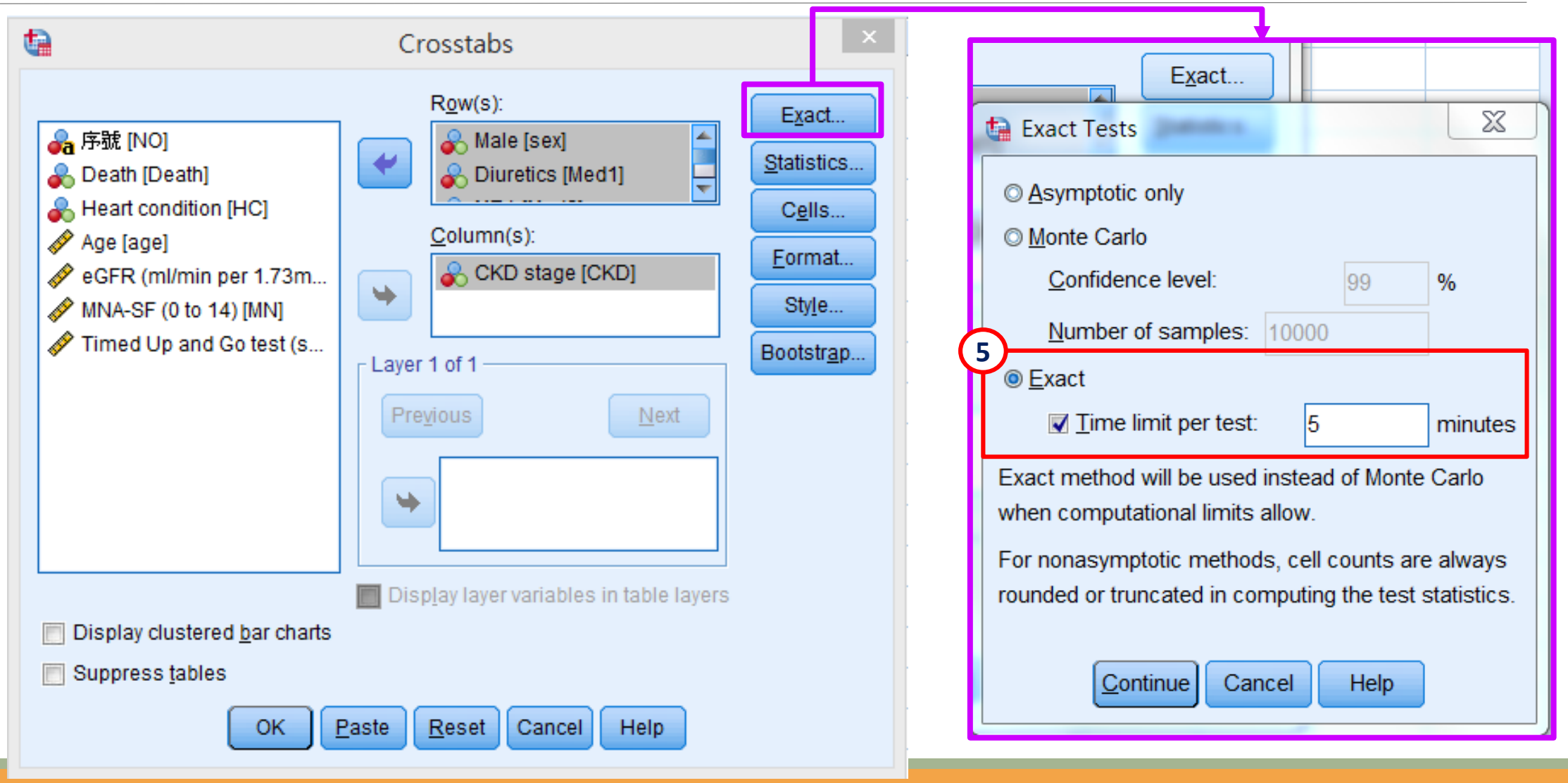


練習範例-SPSS (Crosstabs)



練習範例-SPSS (Crosstabs)

Crosstab

			CKD stage				Total
			CKD 3A	CKD 3B	CKD 4	CKD 5	
Heart condition	Non-HF	Count	119	84	36	15	254
		% within CKD stage	81.0%	83.2%	69.2%	48.4%	76.7%
	HFpEF	Count	15	12	10	8	45
		% within CKD stage	10.2%	11.9%	19.2%	25.8%	13.6%
	HFrEF	Count	13	5	6	8	32
		% within CKD stage	8.8%	5.0%	11.5%	25.8%	9.7%
Total		Count	147	101	52	31	331
		% within CKD stage	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	21.558[a]	6	.001
Likelihood Ratio	19.173	6	.004
Linear-by-Linear Association	11.965	1	.001
N of Valid Cases	331		

a. 2 cells (16.7%) have expected count less than 5. The minimum expected count is 3.00.

test * Death Crosstabulation

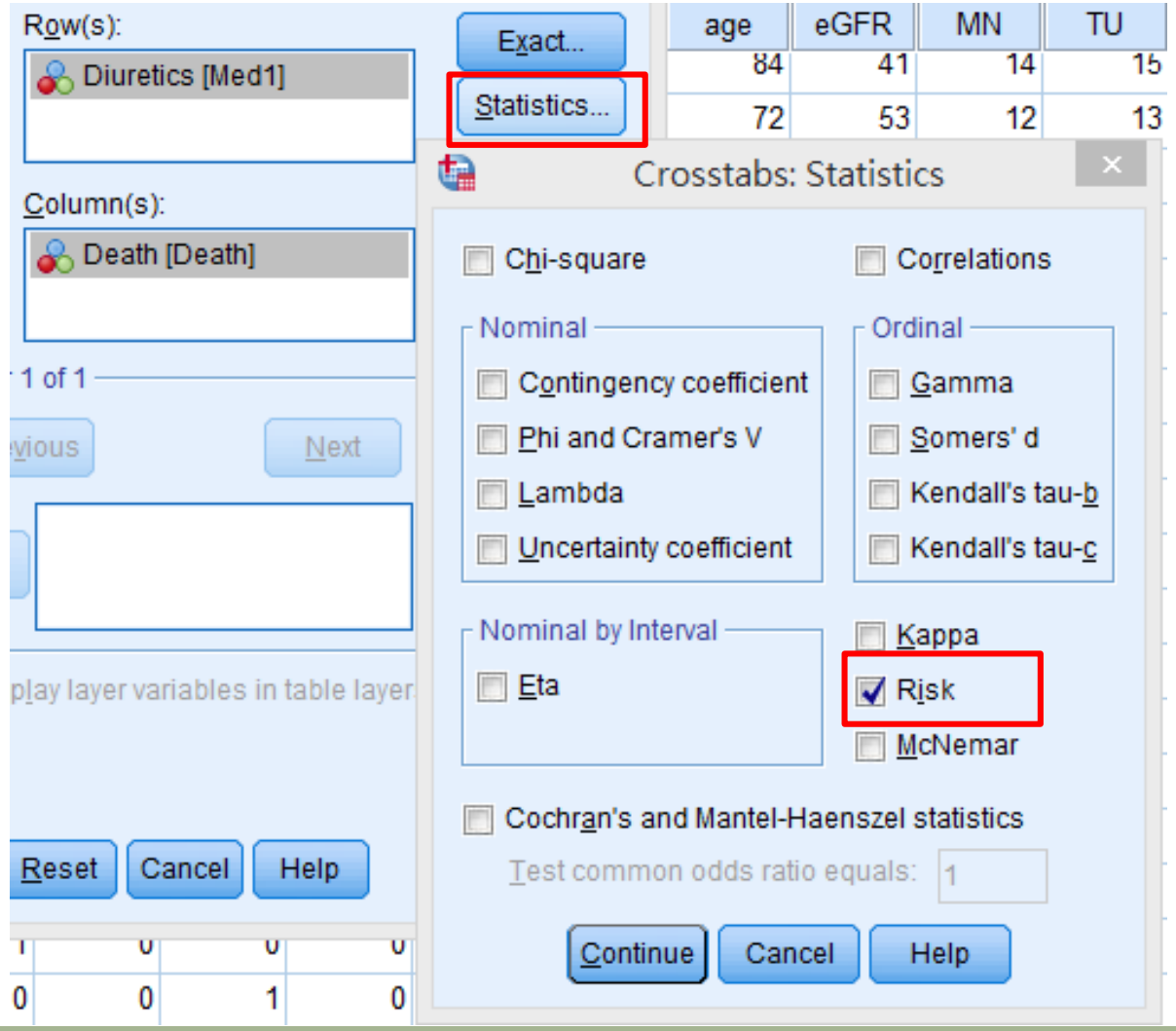
			Death		Total
			Alive	Death	
test	No	Count	30	4	34
		% within Death	10.5%	9.1%	10.3%
	Yes	Count	257	40	297
		% within Death	89.5%	90.9%	89.7%
Total		Count	287	44	331
		% within Death	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.077[a]	1	.782		
Continuity Correction[b]	.000	1	.992		
Likelihood Ratio	.079	1	.778		
Fisher's Exact Test				1.000	.517
Linear-by-Linear Association	.077	1	.782		
N of Valid Cases	331				

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.52.

練習範例-SPSS (Crosstabs-OR)



		Death		
		Death	Alive	Total
Diuretics	Yes	43	208	251
	No	1	79	80
Total		44	287	331

a	b
c	d

Risk Estimate

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for Diuretics (Yes / No)	16.332	2.211	120.612
For cohort Death = Death	13.705	1.918	97.941
For cohort Death = Alive	.839	.789	.892
N of Valid Cases	331		

Thank you

問卷調查

11/12問卷

For your attention!!