Solution to Exercise 4: Confirmatory results in serial smears

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Key Learning Points

When you have a hypothesis to test, remember that it may be logical to:

    a. Create and use a subset of the working dataset

    b. Create new variable(s)

    c. Produce multiple frequencies of results with different selection criteria

    d. Make use of other software applications e.g. a spreadsheet to make calculations.

Exercise hypotheses

H_{01}:   At least 80 per cent of suspects with at least one scanty or positive smear result have a confirmatory scanty or positive result

H_{02}:   At least 90 per cent of suspects with three serial examination among which there is at least one scanty or positive smear result have a confirmatory scanty or positive result in another examination

Tasks:

- *Write a program C_EX04.PGM that determines the proportion of suspects who have a confirmatory examination, making a distinction between scanty and positive smears. Produce a table by country.*

- *Produce a second table in the same program to determine the proportion of suspects who have a confirmatory examination and who had a complete series of smears, making a distinction between scanty and positive smears.*

- *Interpret the findings.*

Solution

Producing the required results requires multiple frequencies with different selection criteria. The program C_EX04.PGM producing these is shown afterwards, followed by a summary table that is best made in a spreadsheet C_EX04.XLS.

Interpretation:

Moldova had the highest frequency of confirmatory results, in fact more than 95 per cent. As suggested in previous exercises, there might be considerable copying of results, thus it is doubtful to what extent the recorded confirmations correspond to actual results. The opposite is the case in Uganda, where fewer than 65 per cent had a confirmatory result (Table 1).

As shown in table 2, the absence of confirmatory results is simply attributable to the fact that once a smear is positive (or scanty), no further examination is being made. If such an examination is being made, then a confirmation was obtained in 90 per cent of more, with the exception of Zimbabwe, where it was just slightly below the critical proportion.

In summary, this exercise showed that confirmatory smears can generally be made, but in some countries, they are simply not sought. The more general question then is whether it is sensible to require such confirmatory smears, particular in the light that the treatment decision is not greatly affected by it, only the surveillance definition.

The program C_EX04.PGM:

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* Part C, Exercise 4
* This is b_ex04 EpiData Analysis program
* to determine the frequency of confirmatory smears

* Moldova, Mongolia, Uganda, Zimbabwe
* Data courtesy:
* Moldowa: Dumitru Laticevschi, OR Paris 2003
* Mongolia:  Nymadawa Naranbat, OR Paris 2004
* Uganda:    Achilles Katamba, OR Paris 2003
* Zimbabwe:   Biggie Mabaera, OR Paris 2004

* Written by:   Hans L Rieder
* First version: 17 Jan 2010
* Last revision: 29 Apr 2013

**********************************************
* Selection
cls
close
logclose

read "c_ex01.rec"

* Selection criteria:
* - At least 1 smear must be positive
* - Diagnostic examinees only

* Definitions:
* - Case: at least 1 AFB in at least 1 smear
* - Scanty: 1-9 AFB or "Scanty not quantified"
* - Positive: any non-scanty positive result
* - Scanty series: at least 1 smear is scanty
* - Positive series: at least 1 is positive, none is scanty

gen i case=0
if result1>0 and result1<9 then case=1
if result2>0 and result2<9 then case=1
if result3>0 and result3<9 then case=1

select case=1
select reason=0

keep country result1 result2 result3
savedata "temp_01.rec" /replace

**********************************************
* New variable definition
cls
close
logclose

read "temp_01.rec"

* code for scanty results in series
                        define scanty1 <A>
if result1=0            then scanty1="N"
if result1>0  and result1<1 then scanty1="S"
if result1>=1 and result1<5 then scanty1="P"
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```
if result1=5              then scanty1="S"
if result1=4              then scanty1="P"
if result1=9              then scanty1="9"

                    define scanty2 <A>
if result2=0              then scanty2="N"
if result2>0  and result2<1 then scanty2="S"
if result2>=1 and result2<5 then scanty2="P"
if result2=5              then scanty2="S"
if result2=4              then scanty2="P"
if result2=9              then scanty2="9"

                    define scanty3 <A>
if result3=0              then scanty3="N"
if result3>0  and result3<1 then scanty3="S"
if result3>=1 and result3<5 then scanty3="P"
if result3=5              then scanty3="S"
if result3=4              then scanty3="P"
if result3=9              then scanty3="9"

define scanty ___
scanty=scanty1+scanty2+scanty3

cls
gen i confirm=0
if substr(scanty,1,1)="N" and substr(scanty,2,1)="N" and substr(scanty,3,1)="P" then confirm=1
if substr(scanty,1,1)="N" and substr(scanty,2,1)="N" and substr(scanty,3,1)="S" then confirm=3
if substr(scanty,1,1)="N" and substr(scanty,2,1)="P" and substr(scanty,3,1)="9" then confirm=1
if substr(scanty,1,1)="N" and substr(scanty,2,1)="P" and substr(scanty,3,1)="N" then confirm=1
if substr(scanty,1,1)="N" and substr(scanty,2,1)="P" and substr(scanty,3,1)="P" then confirm=2
if substr(scanty,1,1)="N" and substr(scanty,2,1)="P" and substr(scanty,3,1)="S" then confirm=4
if substr(scanty,1,1)="N" and substr(scanty,2,1)="S" and substr(scanty,3,1)="9" then confirm=3
if substr(scanty,1,1)="N" and substr(scanty,2,1)="S" and substr(scanty,3,1)="N" then confirm=3
if substr(scanty,1,1)="N" and substr(scanty,2,1)="S" and substr(scanty,3,1)="P" then confirm=4
if substr(scanty,1,1)="N" and substr(scanty,2,1)="S" and substr(scanty,3,1)="S" then confirm=4

cls
if substr(scanty,1,1)="P" and substr(scanty,2,1)="N" and substr(scanty,3,1)="9" then confirm=1
if substr(scanty,1,1)="P" and substr(scanty,2,1)="N" and substr(scanty,3,1)="N" then confirm=1
if substr(scanty,1,1)="P" and substr(scanty,2,1)="N" and substr(scanty,3,1)="P" then confirm=2
if substr(scanty,1,1)="P" and substr(scanty,2,1)="N" and substr(scanty,3,1)="S" then confirm=4
if substr(scanty,1,1)="P" and substr(scanty,2,1)="P" and substr(scanty,3,1)="9" then confirm=2
if substr(scanty,1,1)="P" and substr(scanty,2,1)="P" and substr(scanty,3,1)="N" then confirm=2
if substr(scanty,1,1)="P" and substr(scanty,2,1)="P" and substr(scanty,3,1)="P" then confirm=2
if substr(scanty,1,1)="P" and substr(scanty,2,1)="P" and substr(scanty,3,1)="S" then confirm=4
if substr(scanty,1,1)="P" and substr(scanty,2,1)="S" and substr(scanty,3,1)="9" then confirm=4
if substr(scanty,1,1)="P" and substr(scanty,2,1)="S" and substr(scanty,3,1)="N" then confirm=4
if substr(scanty,1,1)="P" and substr(scanty,2,1)="S" and substr(scanty,3,1)="P" then confirm=4
if substr(scanty,1,1)="P" and substr(scanty,2,1)="S" and substr(scanty,3,1)="S" then confirm=4
if substr(scanty,1,1)="P" and substr(scanty,2,1)="9" and substr(scanty,3,1)="9" then confirm=1

cls
if substr(scanty,1,1)="S" and substr(scanty,2,1)="N" and substr(scanty,3,1)="9" then confirm=3
if substr(scanty,1,1)="S" and substr(scanty,2,1)="N" and substr(scanty,3,1)="N" then confirm=3
if substr(scanty,1,1)="S" and substr(scanty,2,1)="N" and substr(scanty,3,1)="P" then confirm=4
if substr(scanty,1,1)="S" and substr(scanty,2,1)="N" and substr(scanty,3,1)="S" then confirm=4
if substr(scanty,1,1)="S" and substr(scanty,2,1)="P" and substr(scanty,3,1)="9" then confirm=4
if substr(scanty,1,1)="S" and substr(scanty,2,1)="P" and substr(scanty,3,1)="N" then confirm=4
if substr(scanty,1,1)="S" and substr(scanty,2,1)="P" and substr(scanty,3,1)="P" then confirm=4
if substr(scanty,1,1)="S" and substr(scanty,2,1)="P" and substr(scanty,3,1)="S" then confirm=4
if substr(scanty,1,1)="S" and substr(scanty,2,1)="S" and substr(scanty,3,1)="9" then confirm=4
if substr(scanty,1,1)="S" and substr(scanty,2,1)="S" and substr(scanty,3,1)="N" then confirm=4
if substr(scanty,1,1)="S" and substr(scanty,2,1)="S" and substr(scanty,3,1)="P" then confirm=4
if substr(scanty,1,1)="S" and substr(scanty,2,1)="S" and substr(scanty,3,1)="S" then confirm=4
if substr(scanty,1,1)="S" and substr(scanty,2,1)="9" and substr(scanty,3,1)="9" then confirm=3

cls
label confirm "Confirmed by another positive"
labelvalue confirm /0="All negative"
labelvalue confirm /1="Pos not confirmed"
labelvalue confirm /2="Pos confirmed"
labelvalue confirm /3="Scanty not confirmed"
labelvalue confirm /4="Scanty confirmed"

cls
gen i scantpos=0
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```
* Scanty, not confirmed
if scanty="NNS" then scantpos=1
if scanty="NS9" then scantpos=1
if scanty="NSN" then scantpos=1
if scanty="S99" then scantpos=1
if scanty="SN9" then scantpos=1
if scanty="SNN" then scantpos=1

cls
* Positive not confirmed
if scanty="NNP" then scantpos=2
if scanty="NP9" then scantpos=2
if scanty="NPN" then scantpos=2
if scanty="P99" then scantpos=2
if scanty="PN9" then scantpos=2
if scanty="PNN" then scantpos=2

cls
* Positive, confirmed, no Scanty in series
if scanty="NPP" then scantpos=3
if scanty="PNP" then scantpos=3
if scanty="PP9" then scantpos=3
if scanty="PPN" then scantpos=3
if scanty="PPP" then scantpos=3

cls
* Scanty, confirmed, no Positive in series
if scanty="NSS" then scantpos=4
if scanty="SNS" then scantpos=4
if scanty="SSN" then scantpos=4
if scanty="SS9" then scantpos=4
if scanty="SSS" then scantpos=4

cls
* Scanty-Positive, mixed scanty and positive in series
if scanty="NPS" then scantpos=5
if scanty="NSP" then scantpos=5
if scanty="PNS" then scantpos=5
if scanty="PPS" then scantpos=5
if scanty="PS9" then scantpos=5
if scanty="PSN" then scantpos=5
if scanty="PSP" then scantpos=5
if scanty="PSS" then scantpos=5
if scanty="SNP" then scantpos=5
if scanty="SP9" then scantpos=5
if scanty="SPN" then scantpos=5
if scanty="SPP" then scantpos=5
if scanty="SPS" then scantpos=5
if scanty="SSP" then scantpos=5

cls
label scantpos "Confirmation of smears"
labelvalue scantpos /1="Single Scanty"
labelvalue scantpos /2="Single Positive"
labelvalue scantpos /3="Positive confirmed by Positive"
labelvalue scantpos /4="Scanty confirmed by Scanty"
labelvalue scantpos /5="Scanty confirmed by Positive"

cls
define confres #
if confirm=1 or confirm=3 then confres=0
if confirm=2 or confirm=4 then confres=1
label confres "Confirmed by another positive"
labelvalue confres /0="Not confirmed"
labelvalue confres /1="Confirmed"

savedata "temp_02.rec" /replace

*******************************************
* Output for C_EX04

cls
close

read "temp_02.rec"
```

```
* Table 1. Confirmatory smears among all cases
cls
logclose
set echo=off
logopen "c_ex04_1.txt" /replace
ciplot confres country /ng if confirm<>0
ciplot scantpos country /ng if confirm<>0

title "Confirmation in all countries"
freq confres /c /ci if confirm<>0
freq scantpos /c /ci if confirm<>0

title "Confirmation in Moldova"
freq confres /c /ci if confirm<>0 and country=1
freq scantpos /c /ci if confirm<>0 and country=1

title "Confirmation in Mongolia"
freq confres /c /ci if confirm<>0 and country=2
freq scantpos /c /ci if confirm<>0 and country=2

title "Confirmation in Uganda"
freq confres /c /ci if confirm<>0 and country=3
freq scantpos /c /ci if confirm<>0 and country=3

title "Confirmation in Zimbabwe"
freq confres /c /ci if confirm<>0 and country=4
freq scantpos /c /ci if confirm<>0 and country=4
logclose
set echo=on

* Table 2. Confirmatory smears among all cases with three examinations
cls
logclose
logopen "c_ex04_2.txt" /replace
select
select confirm<>0
select substr(scanty,2,1)<>"9"
select substr(scanty,3,1)<>"9"

set echo=off
cls

title "Confirmation in all countries"
freq confres /c /ci
freq scantpos /c /ci

title "Confirmation in Moldova"
freq confres /c /ci  if country=1
freq scantpos /c /ci if country=1

title "Confirmation in Mongolia"
freq confres /c /ci  if country=2
freq scantpos /c /ci if country=2

title "Confirmation in Uganda"
freq confres /c /ci  if country=3
freq scantpos /c /ci if country=3

title "Confirmation in Zimbabwe"
freq confres /c /ci  if country=4
freq scantpos /c /ci if country=4
logclose
```

Exercise 4. Table 1. Confirmatory smears among all cases

	Moldova			Mongolia			Uganda			Zimbabwe			Total		
	Number	%	(95% CI)	Number	%	(95% CI)	Number	%	(95% CI)	Number	%	(95% CI)	Number	%	(95% CI)
Total	1,131			1,717			7,280			3,449			13,577		
Not confirmed	151	13.4	(11.5-15.5)	89	5.2	(4.2-6.3)	2,804	38.5	(37.4-39.6)	672	19.5	(18.2-20.8)	3,716	27.4	(26.6-28.1)
Single scanty	27	2.4	(1.6-3.5)	24	1.4	(0.9-2.1)	43	0.6	(0.4-0.8)	98	2.8	(2.3-3.5)	192	1.4	(1.2-1.6)
Single positive	124	11.0	(9.3-12.9)	65	3.8	(3.0-4.8)	2,761	37.9	(36.8-39.0)	574	16.6	(15.4-17.9)	3,524	26.0	(25.2-26.7)
Confirmed	980	86.6	(84.5-88.5)	1,628	94.8	(93.7-95.8)	4,476	61.5	(60.4-62.6)	2,777	80.5	(79.2-81.8)	9,861	72.6	(71.9-73.4)
Positive+positive	843	74.5	(71.9-77.0)	1,502	87.5	(85.8-89.0)	4,342	59.6	(58.5-60.8)	2,563	74.3	(72.8-75.7)	9,250	68.1	(67.3-68.9)
Scanty+scanty	24	2.1	(1.4-3.1)	30	1.7	(1.2-2.5)	23	0.3	(0.2-0.5)	107	3.1	(2.6-3.7)	184	1.4	(1.2-1.6)
Scanty+positive	113	10.0	(8.4-11.9)	96	5.6	(4.6-6.8)	111	1.5	(1.3-1.8)	107	3.1	(2.6-3.7)	427	3.1	(2.9-3.5)

Exercise 4. Table 2. Confirmatory smears among all cases with three examinations

	Moldova			Mongolia			Uganda			Zimbabwe			Total		
	Number	%	(95% CI)	Number	%	(95% CI)	Number	%	(95% CI)	Number	%	(95% CI)	Number	%	(95% CI)
Total	904			1,503			3,778			2,829			9,014		
Not confirmed	92	10.2	(8.4-12.3)	55	3.7	(2.8-4.7)	184	4.9	(4.2-5.6)	358	12.7	(11.5-13.9)	689	7.6	(7.1-8.2)
Single scanty	19	2.1	(1.3-3.3)	19	1.3	(0.8-2.0)	17	0.4	(0.3-0.7)	44	1.6	(1.2-2.1)	99	1.1	(0.9-1.3)
Single positive	73	8.1	(6.5-10.0)	36	2.4	(1.7-3.3)	167	4.4	(3.8-5.1)	314	11.1	(10.0-12.3)	590	6.5	(6.1-7.1)
Confirmed	812	89.8	(87.7-91.6)	1,448	96.3	(95.3-97.2)	3,594	95.1	(94.4-95.8)	2,471	87.3	(86.1-88.5)	8,325	92.4	(91.8-92.9)
Positive+positive	688	76.1	(73.2-78.8)	1,337	89.0	(87.3-90.4)	3,470	91.8	(90.9-92.7)	2,308	81.6	(80.1-83.0)	7,803	86.6	(85.8-87.3)
Scanty+scanty	20	2.2	(1.4-3.4)	21	1.4	(0.9-2.1)	22	0.6	(0.4-0.9)	76	2.7	(2.2-3.3)	139	1.5	(1.3-1.8)
Scanty+positive	104	11.5	(9.6-13.7)	90	6.0	(4.9-7.3)	102	2.7	(2.2-3.3)	87	3.1	(2.5-3.8)	383	4.2	(3.9-4.7)