












ESSENTIAL

# MEDICAL STATISTICS

Betty R. Kirkwood and Jonathan A.C. Sterne

SECOND EDITION



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## Updates

### Corrections to 2nd edition of Essential Medical Statistics

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### Corrections not yet published

**Page 52:** In line 7 change  $10\,000 \times 254/50 = 5080$  to  $10\,000 \times 25.4/50 = 5080$

**Page 285,** Table 26.3, change the heading for column 8 (second from right)

$$\text{from } U_i = d_i - \frac{d_i \times n_{1i}}{n_i} \text{ to } U_i = d_{1i} - \frac{d_i \times n_{1i}}{n_i}$$

**Page 352:** A number of entries in the second column of Table 30.6 are incorrect. The correct values, and corrected values for the medians and differences between medians, are highlighted in blue in the table below.

Original data			First bootstrap sample			Second bootstrap sample		
Obs. no.	Birth weight	Smoker	Original obs. no.	Birth weight	Smoker	Original obs. no.	Birth weight	Smoker
1	3.99	No	2	3.89	No	1	3.99	No
2	3.89	No	2	3.89	No	1	3.99	No
3	3.60	No	2	3.89	No	2	3.89	No
4	3.73	No	2	3.89	No	3	3.60	No
5	3.31	No	6	3.70	No	3	3.60	No
6	3.70	No	7	4.08	No	4	3.73	No
7	4.08	No	8	3.61	No	6	3.70	No
8	3.61	No	8	3.61	No	6	3.70	No
9	3.83	No	8	3.61	No	8	3.61	No
10	3.41	No	9	3.83	No	8	3.61	No
11	4.13	No	9	3.83	No	9	3.83	No
12	3.36	No	10	3.41	No	12	3.36	No
13	3.54	No	11	4.13	No	12	3.36	No
14	3.51	No	11	4.13	No	12	3.36	No
15	2.71	No	15	2.71	No	15	2.71	No
16	3.18	Yes	16	3.18	Yes	19	3.27	Yes
17	2.74	Yes	19	3.27	Yes	19	3.27	Yes
18	2.90	Yes	19	3.27	Yes	19	3.27	Yes
19	3.27	Yes	20	3.65	Yes	21	3.42	Yes



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20	3.65	Yes	20	3.65	Yes	22	3.23	Yes
21	3.42	Yes	20	3.65	Yes	22	3.23	Yes
22	3.23	Yes	20	3.65	Yes	23	2.86	Yes
23	2.86	Yes	21	3.42	Yes	25	3.65	Yes
24	3.60	Yes	24	3.60	Yes	25	3.65	Yes
25	3.65	Yes	26	3.69	Yes	25	3.65	Yes
26	3.69	Yes	28	2.38	Yes	26	3.69	Yes
27	3.53	Yes	29	2.34	Yes	27	3.53	Yes
28	2.38	Yes	29	2.34	Yes	27	3.53	Yes
29	2.34	Yes	29	2.34	Yes	29	2.34	Yes
Median in non-smokers = 3.61			Median in non-smokers = 3.83			Median in non-smokers = 3.61		
Median in smokers = 3.25			Median in smokers = 3.35			Median in smokers = 3.35		
Difference in medians = -0.36			Difference in medians = -0.48			Difference in medians = -0.26		

## Corrections made to fifth reprint

**Page 46**, Figure 5.3 (b): change both occurrences of "0.0375" to "0.0384"

**Page 47**: change top line to: "the area above  $z = 1.77$  and is 0.0384. Thus 3.84% of men are shorter than"

**Page 145**, line 7: Both occurrences of "0.106" in the expression should be changed to "0.0106"

**Page 151**, Table 16.3: last row right hand column is incorrect because 220 should be substituted for 120. The corrected row should read:

$$\text{Odds ratio} \quad \frac{d_1 / h_1}{d_0 / h_0} = \frac{d_1 \times h_0}{d_0 \times h_1} \quad \frac{20 / 220}{80 / 140} = \frac{20 \times 140}{80 \times 220}$$

**Page 217** line -2, change the value of the error factor from 1.193 to 1.800

**Page 218** line 1, change the the figures to "3.857/1.800 to  $3.857 \times 1.800 = 2.143$  to 6.943"

**Page 219** 2nd para from bottom, change the last sentence to:

"McNemar's  $\chi^2$  test gives:  $\chi^2 = (57-13)/2/(57+13) = 27.7$ ,  $P < 0.001$ , corresponding to strong evidence against the null hypothesis that there is no association."

**Page 244**, second shaded box, change  $\frac{\sum w_i \times RR_i}{\sum w_i}$  to  $\frac{\sum (w_i \times RR_i)}{\sum w_i}$

**Page 247**, second shaded box, change  $E_{1i} = \frac{d_i \times Y_{1i}}{Y_i}$  to  $E_{1i} = \frac{d_i \times T_{1i}}{T_i}$

**Page 266**, Table 25.4. In the third column, headed "Study population: Rates in 1979-81" the rounding to two decimal places meant that the final column did not appear to be the multiple of the two middle columns. In the corrected table below, the number of decimal places has been increased and multiplying the numbers on each row of the two middle columns gives the correct answer.

**Table 25.4** Calculating the age standardized rate of prostate cancer for 1979-81, using direct standardization with the person-years during 1985-87 as the standard population

Standard population:

Estimated number of cases

Age group	Study population: Rates in standard population, $w_i \lambda_i$		
	thousands of person-years in 1985-87, $w_i$	in 1979-81, $\lambda_i$	$\lambda_i$
65-69	2686	0.6805	1827.8
70-74	2272	1.4864	3377.1
75-79	1980	2.8086	5561.0
80-84	1189	4.6812	5565.9
<sup>3</sup> 85	616	6.8473	4217.9
All ages	$\sum w_i = 8743$	$\sum w_i \times \lambda_i = 20549.8$	
		Age adjusted rate	2.35

**Page 266**, paragraph below Table 25.4. Change some figures to correspond to those obtained by multiplying the rounded numbers in Table 25.4. The revised paragraph should read as follows:

For example, Table 25.4 shows the details of the calculations for the age-standardized rate for 1979-81, using the person-years in 1985-87 as the standard population. In the 65 to 69-year age group, applying the rate of 0.6805 per 1000 person-years to the 2686 person-years in that age group in the standard population gives an estimated number of cases in this age group of  $0.6805 \times 2686 = 1827.8$ . Repeating the same procedure for each age group, and then summing the numbers obtained, gives an overall estimate of 20549.8 cases out of the total of 8743 thousand person-years in the *standard* population: an age-standardized rate for the *study* population of 2.35 per 1000 person-years.

**Page 249**, 3 lines from bottom, "Part B" should read "Part C"

**Page 265**, Table 25.3, the standardized rate (bottom row) for 1991-93 should be 2.54 not 2.64

**Page 265**, in the shaded box, change  $\frac{\sum w_i \times \lambda_i}{\sum w_i}$  to  $\frac{\sum (w_i \times \lambda_i)}{\sum w_i}$

**Page 266**, Table 25.4, right hand column, change  $\sum w_i \times \lambda_i$  to  $\sum (w_i \times \lambda_i)$

**Page 266**, in the shaded box, the equation for the standard error of standardized rate on the left hand side should be  $\frac{1}{\sum w_i} \sqrt{\sum \frac{w_i^2 d_i}{(pyar_i)^2}}$ , not  $\frac{1}{\sum w_i} \sqrt{\sum \frac{w_i^2 d_i}{pyar_i}}$

**Page 362**, paragraph 2 line 4, delete "robust" at the end of the line.

**Page 362**, in the last paragraph "budenoside" should be "budesonide"

**Page 415**, Figure 35.1, lower panel (c). Insert the figures 0.38 and 0.62 below the dashed vertical lines (in the same way as the figures below the dashed vertical lines in (a) and (b)).

**Page 422**, step 3 of example: the equation  $\frac{2.2769}{0.17^2}$  should read  $\frac{2.2769^2}{0.17^2}$

**Page 435**, lines 4 and 5 under Table 36.2, change two occurrences of "119" to "179". The revised text should read "...that is  $115/179 \times 93 = 59.7$  classified as normalisers on both occasions, and  $115/179 \times 86 = 55.3$  of those classified ..."

**Page 436**, line 5 under table 36.3, change "123/179" to "102/179". The corrected line should read:

$$A_{obs} = (76+0+15+11)/179 = 102/179 = 0.570 \text{ (57.0\%)}$$

## Corrections made to second reprint

**Page 77**, Table 8.2: Trial 2 CI for difference should be "-47.8 to -32.2" (not -47.8 to 32.2)

**Page 139**, paragraph 3: change "3.1459" to "3.14159"

**Page 147**: reference to incidence rate should be to chapter 22, not chapter 23.

**Page 154**, Table 16.4, in the rightmost column change "39/29961" to "39/30000" and change "6/59994" to "6/60000".

**Page 180**, change the equation

$$\text{Weighted average OR} = \frac{\sum w_i \times OR_i}{\sum w_i}$$

to:

$$\text{Weighted average OR} = \frac{\sum (w_i \times OR_i)}{\sum w_i}$$

**Page 182**, first shaded box, change  $\frac{\sum w_i \times OR_i}{\sum w_i}$  to  $\frac{\sum (w_i \times OR_i)}{\sum w_i}$

**Page 244**, second shaded box, change  $\frac{\sum w_i \times RR_i}{\sum w_i}$  to  $\frac{\sum (w_i \times RR_i)}{\sum w_i}$

**Page 357**: the units for the level of Compound X in the right hand column were divided by 10 in the analyses on subsequent pages. In the headings for tables 31.1 and 31.2, please change "(100 ppm)" to "(1000 ppm)". The numbers in the right hand column should then all be divided by 10. The revised tables are as follows:

Table 31.1

Data on the first 20 children in a study of the relationship between rates of dental treatment and the level of compound X in drinking water.

Child's id	Years of follow up	Required dental treatment during follow up?	School number	Level of compound X in school's water supply (1000 ppm)
1	4.62	No	1	7.1
2	3.00	No	1	7.1
3	4.44	No	1	7.1
4	3.89	No	1	7.1
5	3.08	No	1	7.1
6	2.45	Yes	1	7.1
7	2.64	Yes	1	7.1
8	4.16	No	1	7.1
9	4.25	No	1	7.1
10	2.02	Yes	1	7.1
11	3.13	No	1	7.1
12	3.49	No	1	7.1
13	4.75	No	1	7.1
14	2.39	Yes	1	7.1
15	3.66	No	1	7.1
16	3.43	No	1	7.1
17	2.63	Yes	1	7.1
18	4.21	No	1	7.1
19	2.63	Yes	1	7.1

20      2.74      No      1      7.1

Table 31.2.

Total child-years of follow-up, treatment rate per 100 child-years and the level of compound X in each school's drinking water, from a study of the effect of compound X in drinking water on the 832 children attending eight primary schools.

School	Number of children requiring dental treatment	Child-years of follow-up	Rate per 100 child-years	Level of Compound X (1000 ppm)
1	46	456.3	10.08	7.1
2	19	215.1	8.83	7.6
3	17	487.8	3.49	8.2
4	46	459.9	10.00	5.4
5	15	201.2	7.46	8.4
6	20	187.7	10.66	6.8
7	58	399.1	14.53	6.2
8	20	212.5	9.41	8.9

**Page 362**, in the last paragraph "budenoside" should be "budesonide", (two occurrences in the first sentence).

**Page 363**, in point 1 "budenoside" should be "budesonide".

**Page 364**, in the header for Table 31.8 "budenoside" should be "budesonide".

**Page 365**, in the header for Table 31.9 "budenoside" should be "budesonide".

**Page 375**, first shaded equation on page, replace:

$$\frac{\sum w_i \times \log(OR_i)}{\sum w_i} \text{ with } \frac{\sum [w_i \times \log(OR_i)]}{\sum w_i}$$

**Page 378**, first shaded equation on page, replace:

$$\frac{\sum w_i^* \times \log(OR_i)}{\sum w_i^*} \text{ with } \frac{\sum [w_i^* \times \log(OR_i)]}{\sum w_i^*}$$

**Page 380**, last two lines: replace the sentence: "We also saw earlier that random-effects meta-analysis weights studies more equally than fixed-effect analysis." with "We also saw earlier that in a random-effects meta-analysis the studies are weighted more equally than in a fixed-effect analysis."

## Corrections made to first reprint

**Title page**, Add FMedSci to honours after Kirkwood

**Page viii** (preface), please add Seif Shaheen to the list of people who are thanked for providing datasets. The revised sentence in the preface should now read "We are grateful to James Carpenter, Erik Christensen, Shah Ebrahim, Alison Elliot, Richard Hayes, David Kessler, Carl-Johan Lamm, Debbie Lawlor, Steven Oliver, Mary Penny, Seif Shaheen and Bianca de Stavola, who generously provided datasets for use as examples."

**Page 73**, in shaded box first s.e. should not be in italics

**Page 76** line 2, insert comma after "... difference shown by the confidence interval".

**Page 161**, Table 16.6 contains errors in the rightmost of the two columns labelled "Risk in the unexposed group". The corrected table is below, with the corrected cells highlighted.

Odds ratio = 2		Risk ratio=2	
Risk in the unexposed group	Corresponding risk ratio	Risk in the unexposed group	Corresponding odds ratio
0.001	1.998	0.001	2.002
0.005	1.99	0.005	2.010
0.01	1.980	0.01	2.020
0.05	1.905	0.05	2.111
0.1	1.818	0.1	2.25
0.5	1.333	0.3	3.5
0.9	1.053	0.4	6.0
0.95	1.026	0.45	11.0
0.99	1.005	0.5*	

**Page 209**, Table 20.5. The last row should be labelled as "Constant" not "Baseline" for consistency with regression output elsewhere in the book. The footnote should read "Constant (baseline odds) = estimated odds of *mf* infection for 5-9 year olds living in the savannah areas, assuming no interaction between the effects of area and age group."

**Page 294**, Collett (1993) should be Collett (2003) to match bibliography

**Page 313**, please indent the bulleted list, as was done elsewhere (e.g. pages 315/316)

**Page 391**, replace four occurrences of "marginal" with "conditional". Revised text should read as follows:

In recent years there has been a resurgence of interest in Bayesian statistics. This has been based less on arguments about approaches to statistical inference than on a powerful means of estimating parameters in complex statistical models based on the Bayesian approach. The idea is that if we know the values of all the parameters except for one, then we can derive the conditional distribution of the unknown parameter, conditional on the data and the other (known) parameter values. Such a conditional distribution can be derived for each parameter, assuming that the values of all the others are known.

The Markov Chain Monte-Carlo (MCMC) procedure is used to generate a value for each parameter, by sampling randomly from its conditional distribution. This then acts as the "known" value for that parameter. This process is carried out iteratively. A new parameter value is sampled from the distribution of each parameter in turn, and is used to update the "known" values for the conditional distribution of the next parameter. The phrase "Markov Chain" refers to the fact that the procedure is based only on the last sampled values of each parameter, while "Monte-Carlo" refers to the random sampling of the parameter values.

**Page 487**, in the reference to Ananth C.V. & Kleinbaum D.G. replace 2000 with 1997.

**Page 502** (opposite the inside back cover), please insert "(Continued from inside front cover)" below "Summary methods of analysis II". One of our colleagues emailed us to say that he couldn't find "Summary methods of analysis I". Note that this text was included in the manuscript but not in the final printed version. The revised layout should be:

## SUMMARY GUIDE TO METHODS OF ANALYSIS: II

(Continued from inside front cover)

The summary guide on the back inside cover should be lined up with the summary guide on the facing page (page 502)