

Medical Statistics (MATH38071) Exercise Sheet 2
(Basic Analyses of Continuous Outcome Measures)

1. A randomised controlled trial was conducted comparing two treatments for pain relief during the recovery period following wisdom tooth extraction surgery. A new dual-therapy (Acetaminophen + Ibuprofen) was compared against a mono-therapy (Ibuprofen alone). Post-operative pain was measured at 15 minute intervals using a 100mm visual analogue scale with “100” representing the worst imaginable pain and “0” representing no pain. The table below gives the summary statistics for each follow-up time point.

Table: Visual analogue pain by time point and summary A.U.C.

Time (mins)	Ibuprofen			Acetaminophen + Ibuprofen		
	Mean (mm)	S.D. (mm)	N	Mean (mm)	S.D. (mm)	N
15	27.9	14.8	24	18.2	13.1	24
30	32.6	24.4	25	25.3	20.9	25
45	35.5	23.2	22	28.7	23.3	20
60	31.3	18.9	19	25.1	22.8	23
75	29.9	18.8	24	14.9	13.8	24
90	23.8	17.9	22	15	14.2	24
105	22.7	16.4	21	13.7	12.8	19
120	20.9	17.2	24	15.2	14.4	23
A.U.C.	27.9	13.6	25	19.5	12.3	26

S.D.=standard deviation, A.U.C.= Area under the curve.

- (i) Choose one of the eight time-points
- Calculate the point estimate of the treatment effect of acetaminophen + ibuprofen as compared to ibuprofen at that time point.
 - Using a two-sample t-test test whether there is a significant treatment effect using a 5% two-sided significance level at that time point.
 - Calculate the 95% confidence interval of the treatment effect at that time point.
 - Based on the data for your chosen time point, what do you conclude regarding the treatment effect of acetaminophen + ibuprofen as compared to ibuprofen
 - In carrying out this analysis what assumptions have you made? Are they plausible?
- (ii) Area under the curve (A.U.C) is a summary measure that was calculated for all patients. It is a weighted average of the time-point pain scores. Repeat the analysis of (i) for A.U.C.
- (iii) The p-values for the nine possible analyses computed using Excel are

Time (mins)	15	30	45	60	75	90	105	120	A.U.C.
p-value	0.0203	0.2616	0.3495	0.3497	0.0029	0.0703	0.0624	0.2254	0.0248

Why might it be inadvisable to carry out all 9 analyses? What type of bias might this cause?

- (iv) Which analysis do you feel gives the best estimate of the effect of Acetaminophen in reducing pain following wisdom tooth extraction surgery?