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Calculating P values and 95% confidence intervals from data presented

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Readers of research articles should be in a position to make maximum use of data presented to them. Evidence-based practice directs that treatments be substantiated by research evidence [1]. So whether readers are practitioners or researchers, a basic understanding of statistics is important [2]. Applying the data from research reports will be enhanced if both exact P values [3-5] and confidence intervals for differences are reported [5, 6]. Together, they provide complimentary information [2] which assists the reader and avoids misinterpreting findings [7]. If either the confidence interval (CI) or the P values are not reported, the reader could calculate them [6] if they possess the correct skills and tools.

The tools to compute CIs and P values are provided in many statistical packages such as SPSS, Minitab and R. Unfortunately, once an article has been published the data is in summary form, a reader will not have access to the data from which these statistics are calculated. In spite of requests from authors and editors [2, 5, 8, 9] information such as CIs are not always presented in research papers, but they could be calculated [6]. Similarly, P values are not always reported exactly, but as inequalities ($P<0.05$) [10]. The Cochrane collaboration [11] describes how data can be extracted from research reports so that it can be pooled with data from other papers into a single combined estimate for a meta-analysis. Similarly, Hozo [12] offers a technique for computing a mean and a standard deviation from a reported median and range. There is also a specialist software (Confidence Interval Analysis) available to calculate CIs for several statistics [8]. In addition there are articles that offer methods to calculate CIs from P values [13] and P values from CIs [10]. Both papers report a method originally designed for programmable calculators [14].

Altman [6] suggested that if they were not provided, CIs could be calculated from the data presented in an article However, producing them from summary published data is a little more complicated and the formulae a little more obscure, especially if the data presented is itself, limited. For example, to calculate a CI for a mean difference requires a t-value dependent on the sample size. Nevertheless, for a practitioner or researcher to get the most use from presented data engaging in this practice is important.

PandCI is a free Excel spreadsheet that seeks to make these calculations available to practitioners. It was designed so that minimal knowledge of the actual calculations is required. Bland has suggested that CI calculations in a spreadsheet can easily go awry [2]. However, it is hoped that the ease of use will help prevent this. If practitioners can obtain the required values easily, more effort can put into applying them to practice. The functions make use of statistical techniques that have been published previously [8, 10, 13] and some Excel functions as described by the Cochrane collaboration [11].

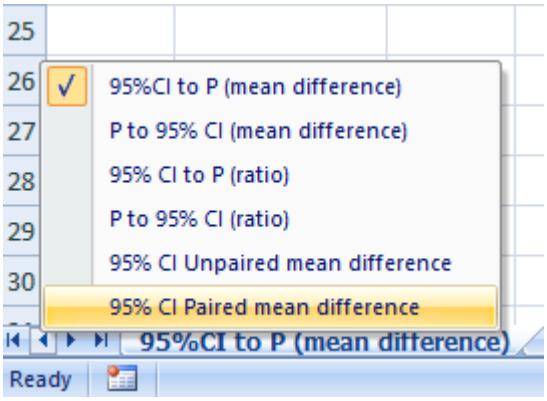
The calculations that PandCI will perform are shown in table 1, along with the parameters that need to be entered by the user, a maximum of three. To aid navigation in the spread sheet, go to the lower left hand corner of the spreadsheet and right click over the arrow buttons. A list of the available spreadsheets will appear (figure 1). Select your choice by clicking on it.

Table 1. Calculations performed and properties to be entered.

			95% CI				
	Mean difference	**N**	**Lower limit**	**Upper limit**	**P value**	**Ratio**	**SD**
A P value from a 95% CI for a mean difference	✓		✓	✓			
A 95% CI from a P value for a mean difference	✓				✓		
A P value from the 95% CI for a ratio			✓	✓	✓		

A 95% CI from a P value of a ratio			✓	✓	
A 95% CI for an unpaired mean difference	✓	✓			✓
A 95% CI for a paired mean difference	✓	✓			✓

Figure 1. Options available in PandCI.



Example 1: 95% CI from a P value

Daly et al., [15] reported on 8 patients with moderate to severe COPD before and after 8 weeks on neuromuscular stimulation training (NMES) training. A mean change of 89.16 s (P = 0.012) for six minute walk test was reported. No 95% CI was reported, but using PandCI, it was calculated as 19.56 to 158.76 s (Figure 2).

Example 2: P value from a ratio

Siva et al. [16] reported an odds ratio of 0.88 (95% CI 0.77 to 0.99) for anxiety as a predictor of NMES dose. No P value was reported, but PandCI calculated a P value of 0.013 (Figure 3).

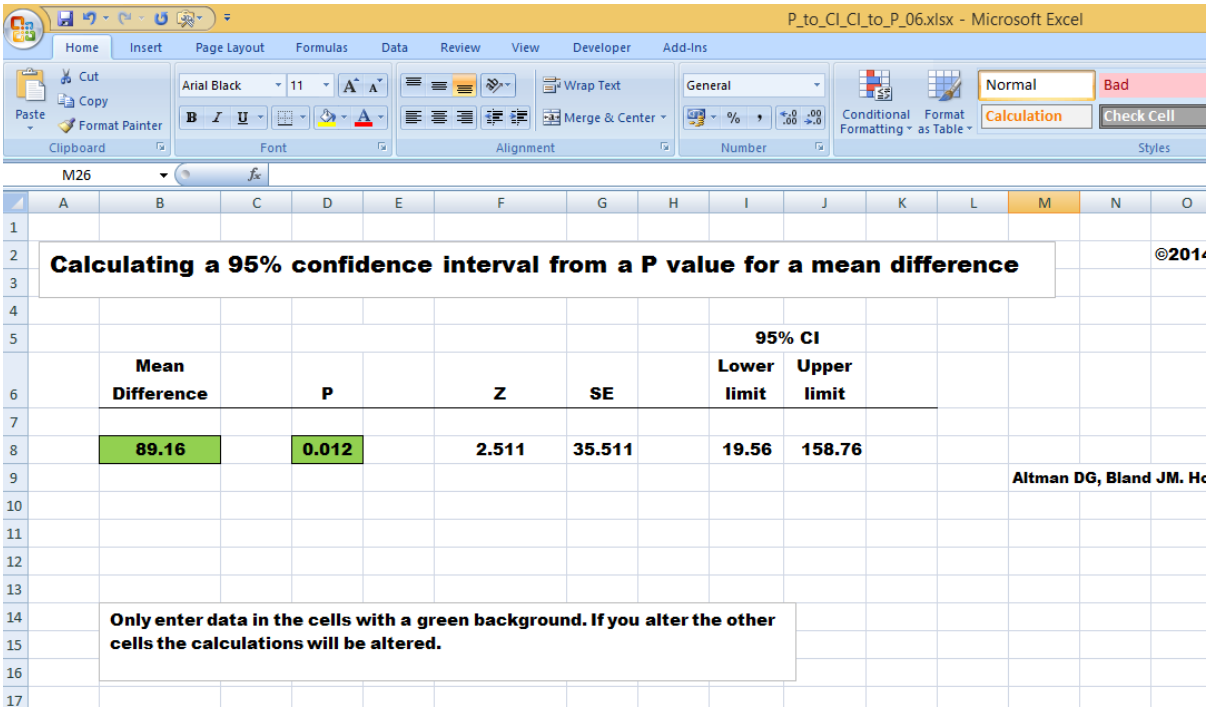


Figure 2. Screen shot for calculating a 95% CI from a P value.

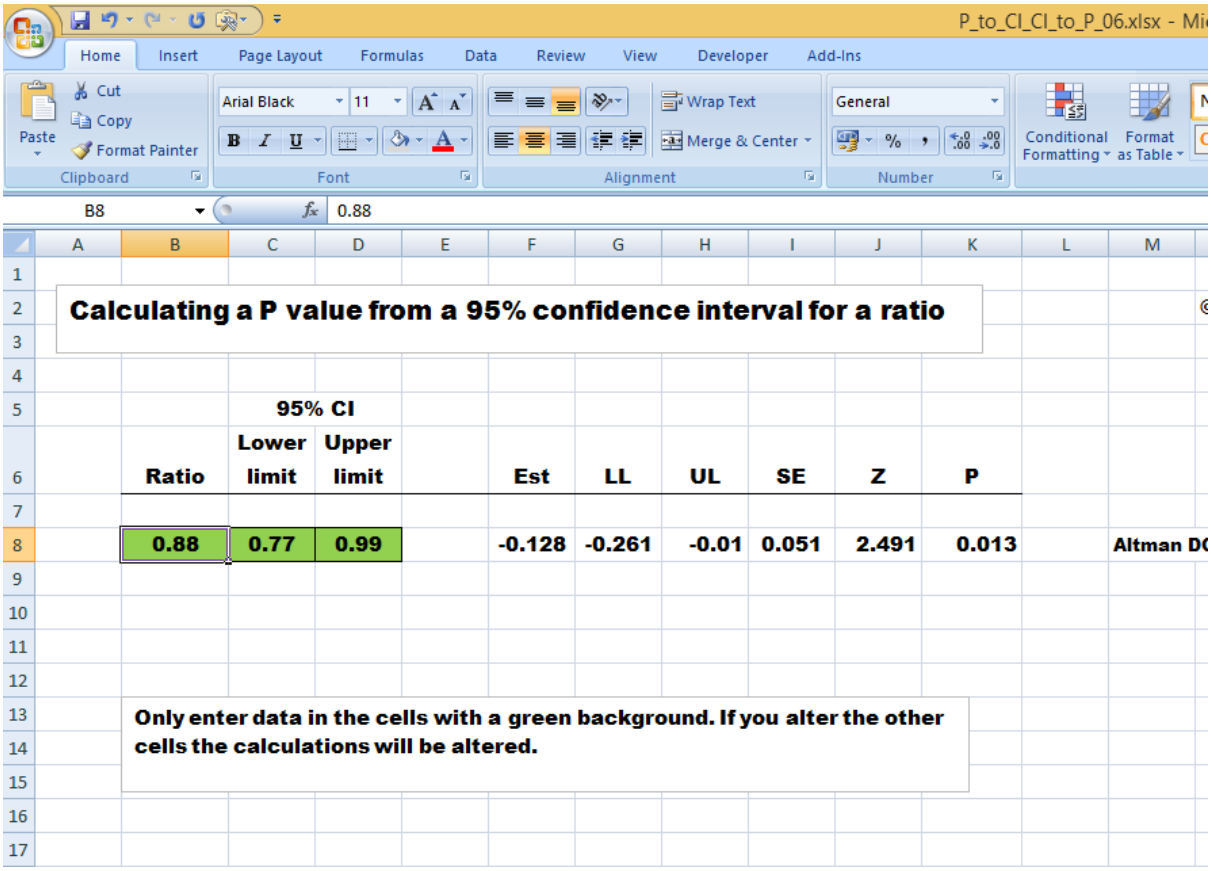


Figure 3. Screen shot for calculating a P value from a 95% CI for a ratio.

The author of the current paper is a habitual user of Confidence Interval Analysis [8]. It is user friendly and the book which it accompanies is an excellent text on the subject of CIs. However, the spreadsheet described in this paper seeks to extend the utility of such works by offering other methods to calculate other statistics. This is one way to make them more widely available and more often used. The calculations in the spreadsheet are not without limitations. As is the case with all statistics, larger samples will always provide better, more accurate estimates.

The plan for PandCI is that it should be an 'evolving' software. When new techniques are reported that offer calculations that can assist in the interpretation and implementation of research findings, they will be added to the calculations available.

Availability and requirements

The software is available to download from _____. The spreadsheet was constructed using Microsoft Office 2007 on a Windows 8 platform and it has been run successfully on a Window 7 platform.

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