

# How to ensure your paper is rejected by the statistical reviewer

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## Introduction

It has long been assumed by the medical–scientific fraternity that the intended end-point of research is publication of results in a respected journal, there to be read and examined in perpetuity. This has been challenged by a distinguished ex-editor of this journal, who concluded that the primary aim of many authors was not to have their paper accepted for publication [1]. He outlined numerous creative opportunities in the presentation of the manuscript to antagonize the reviewer and editor. We contend that there are simpler, more compelling and less demanding means of antagonizing the statistical reviewer, thus ensuring certain rejection of the paper. We have outlined some of the possibilities available to the novice and experienced researcher alike, recognizing that it is never too late to learn and, indeed, Continuing Professional Development requires you to do so.

## Recommended techniques

### Title page and Introduction

These provide woefully few opportunities to antagonize statistical reviewers but may lull them into a false sense of security. Nevertheless, you should ensure no clear aim or study hypothesis is stated in the Introduction. However, your best chance to convince them that the paper is unpublishable lies in the Methods section.

### Methods

A fundamental precept for success is to provide so little information that the study could never be replicated. Never provide

information on the sampling frame for the study and always try to omit details of the inclusion and exclusion criteria. This ensures that the reader will have no idea of the generalizability of the findings. If possible, try to avoid stating what type of study design was used. If this is impossible, hopefully you will have used a novel or totally unsuitable design. For example, if the treatment effect is protracted, use a cross-over trial design and omit the wash-out period.

### Power calculations and sample size

It is important to exclude this section of the paper. Occasionally, your hand may be forced and you may have to justify your preferred number. Here, it is useful to state that you have chosen an integer less than 100 because a previous eminent author did so. If recruitment was difficult and you enrolled too few patients, then one-sided statistical tests are a useful ploy. An alternative, rather unimaginative ruse is to argue that restricted resources limited recruitment; you can then expose your parsimonious sponsor in the Acknowledgements. If you are at the cutting edge of blue-sky genetic research, you will have no compunction whatsoever in omitting the whole dreary process of the power calculation. If the heavens open and the reviewer demands a power calculation, do not lose heart, retrospective power calculations are a godsend. Remember, these should result in a sample size identical to those recruited or the reviewer may fail to smell a rat.

### Statistical analyses

These can provide endless entertaining opportunities. Remember the precept ‘rubbish in, rubbish out’. Never use a double-data entry system or you will risk entering valid data. Stick to single entry and studiously avoid performing any range or consistency checks on the data. If inadvertently you have obtained accurate data, do not use a standard statistical analytical package, instead use an Excel spreadsheet, which can interject

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refreshingly unexpected and erroneous results [2]. If time lies idly on your hands, as commonly occurs in the National Health Service, write your own Fortran program for the analysis. This should occupy several programmed activities (PAs) and is likely to produce spectacular results. Make sure there is no audit trail of the sequence of analyses performed and always overwrite the original data file when conducting the analyses. As the case report forms will not have been archived, no one will be any the wiser.

Do not use a consistent cohort of patients in whom all data items are available. Instead, use different combinations of patients for each analysis. Remember that each continuous variable can be dichotomised, which ensures a useful reduction in statistical power [3]. You should, of course, select several different cut-points until you have achieved a level of conventional statistical significance. Never reference any prior evidence for the chosen cut-point; this restricts your freedom of choice. Conversely, when dealing with categorical data, such as genotype, do not hesitate to enter them without justification as a continuous variable into a regression analysis.

Safeguard your findings. If you have undertaken a plethora of statistical tests on numerous subsamples without an *a priori* hypothesis, do not under any circumstances adjust for multiple tests (e.g. Bonferroni adjustment) or you may expunge a novel chance finding and seriously undermine a promising academic career. However, do not despair, if you perform enough subgroup analyses on clinical trial data an original chance finding will emerge [4]. Be warned, never use the Altman-Bland Method to assess the agreement of two methods of clinical measurement, instead calculate their correlation coefficient [5]. As two methods measuring the same variable will, by definition, be closely correlated, you are sure to achieve a highly significant *P*-value and provide precious little information about the extent of agreement of the methods.

## Results

The first thing you can do here is to ensure that the statistical reviewer has no idea of the population under consideration. Do not report the baseline characteristics of subjects included in the study. The reviewer will then search in vain for information on the number of subjects, their age distribution, the proportion of women, the proportion from minority ethnic groups, their blood pressure, previous clinical history, et cetera, et cetera. If you are forced to include a table of baseline characteristics, then report the mean and the standard error of the mean, thus ensuring that it is difficult to compare your population with those in previous papers. Always omit any information about how patients who were included in the study compared with those not included, so that the generalizability of the results remains in doubt.

Another appealingly simple means of increasing the chance of rejection is to ensure that the numbers do not add up, for example, the number of men and the number of women should not sum to the total. This technique can be applied to derived

data, for instance, the mean age at diagnosis of diabetes plus mean duration should not sum to mean age at entry to the study. Confidence in the reliability of the data and credibility of the researcher is further enhanced if you state that some baseline data are missing, for example, some patients could be of unknown gender.

The tables should, of course, be as large, complicated and as visually unappealing as possible. The smallest available font must be used. Report results in non-standard rather than SI units. Employ a plethora of daggers and stars to indicate different levels of statistical significance rather than exact *P*-values. If forced to use exact *P*-values, report all as  $< 0.01$ , which gives no indication of any greater level of significance. The table headings should be ambiguous and should never indicate whether the results are from univariate or multivariate analyses.

Graphics should be produced using Excel, and remember to use 3-D block charts where bar charts would do. Omit any measures of dispersion; this will certainly better your chances of rejection, or at least guarantee the paper is returned with a stiff warning. On no account take any advice from your local Medical Illustration Department, and do not read any insightful publications on the subject of graphical representation of data [6,7]. Replicating results in tables and in graphics is essential, and the use of block charts will make it difficult to check whether they are the same. Scrupulously avoid techniques such as 'box and whisker' plots or cumulative frequency plots, they convey far too much information in a readily assimilated form. If stumped for ideas, omit all tables and graphs and present the results in discursive paragraphs.

When reporting trends, it is important not to have assessed the strength of association with a statistical test and, if the reviewer obliges you to do so, give no indication of whether continuous or categorical data were used. Remember to display all the results of your over-inclusive statistical testing—reporting spurious confidence intervals around each and every estimate demonstrates your awareness of Gardner and Altman's contribution to medical statistics [8]. Further alienation of the statistical reviewer may be possible by the well-worn expedient of misspelling and failing to capitalize the names of statisticians (Fischer and gaussian). Finally, never reference or follow the CONSORT guidelines in reporting your study [9].

## Discussion

Ensure the principal findings of the study are obscured in the text towards the end of the Discussion. Never acknowledge the limitations of the study design and always over-emphasize its strengths [10]. Extrapolate wildly beyond your own population, formulate international guidelines, never suggest that a confirmatory study might be needed, and omit all reference to previous publications. Do not suggest that your findings, if novel and totally inconsistent with previous studies, might be due to pure chance. Never, under any circumstances, speak to a statistician before, during or after conducting the study.

## Competing interests

None declared.

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