Reporting quality of statistics in Indian journals: Analysis of articles over a period of two years

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ABSTRACT

Statistics has always been ignored by both clinical researchers as well as journal editors. We undertook this study to find out the quality of statistical reporting in some of the Indian journals. A sample of eight Indian medical and surgical journals that publish original articles - Journal of Association of Physicians of India, Indian Pediatrics, Indian Journal of Surgery, Indian Journal of Orthopedics, Indian Journal of Ophthalmology, Neurology India, Indian Journal of Dermatology, National Medical Journal of India were chosen for the study. Only original studies were considered for analysis and were appraised for quality of reporting of descriptive statistics and inferential statistics, sample size calculation, and correction for multiplicity of statistical tests. A total of 415 original articles were identified during the specified period from all the eight journals. Major findings include no mention about sample size calculation (199/415, 48%) and normality check a priori to the use of parametric tests (140/415, 33.7%), use of multiple statistical tests (ranging between 14 and 126 times) without adjusting the P value (116/415, 28%), and no mention of confidence intervals at least for the primary endpoint (85/415, 20.5%). To conclude, we found poor quality of statistical reporting in some of the Indian journals and considering the seriousness of this issue, it is high time for both the researchers and journal editors to consult statistical experts, while the study is being carried out and at the time of publishing the same, respectively.

Keywords: Misuse of statistics, statistical errors, statistics reporting quality

INTRODUCTION

Statistics plays a key role in designing a study and also in the analysis and interpretation of study results. Most medical researchers have a faint knowledge about basic statistics, which leads to poor quality of statistical reporting. As regards to the publication, statistics performed by the author unguided by trained statistician coupled with no proof check from the publisher as well, increases the chance of errors.[1,2] Moreover, the use of statistical test in original

articles has increased considerably with the availability of more sophisticated tests.[3] Most readers assume that when an article is published it has been scrutinized in every aspect including statistical methods. Unfortunately, this is not so. Studies in the past have shown that only a few journals have statistical reviewing policies and out of these only 10% have written guidelines on statistical reporting.[4-6] It is unethical to use inappropriate statistical method for data analysis.[1] Furthermore, certain basic statistical measures in any original research article have to be represented in specified conventional manner. It has been reported that almost 50% of medical literature has statistical flaws.[7] Studies from other parts of the world indicate that statistical errors or underreporting in journals varied from 28% to 78%[3,8-12] and only 10–60% of papers submitted to a journal were statistically acceptable.[13] Considering the increasing number of journals published from India, this study is envisaged to study the statistical errors (both misuse and underreporting) in a sample of eight Indian medical and surgical journals over a period of 2 years.

METHODS

The study was conducted from July to November 2011. Eight Indian medical and surgical journals associated with any of the professional bodies that publish original articles and which are widely read and peer-reviewed had been selected for the study. All original articles that were published in these journals over a period of 2 years (2005 and 2006) were retrieved from their respective journal websites viz. Journal of Association of Physicians of India - http://www.japi.org/previous_issue.html, Indian Pediatrics - http://www.indianpediatrics.net/jafe.htm, Indian Journal of Surgery - http://www.bioline.org.br/toc?id = is, Indian Journal of Orthopedics - http://www.ijoonline.com/backissues.asp, Indian Journal of Ophthalmology - http://www.ijo.in/backissues.asp, Neurology India - http://www.neurologyindia.com/backissues.asp, Indian Journal of Dermatology - http://www.e-ijd.org/backissues.asp, National Medical Journal of India - http://www.nmji.in/archives/All-Archives/archives-volume-22.asp. Only original studies were considered for analysis. Short communications, research letters and letter to editors were not taken into account. All these articles were appraised for quality of reporting descriptive and inferential statistics. Descriptive statistics was evaluated by mean, median or frequency with the central tendencies. Inferential statistics was evaluated on the basis of reporting of assumptions of statistical tests and inappropriateness of statistical tests. Appropriate method of descriptive statistics of ratio and interval data following the normal distribution is mean (standard deviation [SD]) or mean ± SD For ordinal data and for ratio and interval data not following the normal distribution, appropriate descriptive statistics is median and interquartile range and for nominal data, frequency and percentage are appropriate. Appropriate statistical tests are selected on the basis of aim of the study and types of data. Once the statistical test is selected, all the assumptions for that particular statistical test should be checked before applying the test. Statements about method of randomization sequence generation, sample size calculation, and hypothesis in case of randomized controlled studies, confidence intervals, total number of times statistical analyses were performed and whether any measures have been taken care to prevent or ameliorate the inflation of P value were some of the additional measures that were looked at.

RESULTS

Demographics

A total of 415 original articles were identified during the specified period from all the 8 journals. Of these, 195 (47%)

were published in the year 2005 and the remaining (53%) in the year 2006.

Statistical reporting

Figure 1 displays the summarized findings of the key statistical parameters of the assessed journals in the respective years. Major findings include no mention about sample size calculation (199/415, 48%), not mentioning the normality check prior to parametric tests (140/415, 33.7%), use of multiple statistical tests (ranging between 14 and 126 times) without adjusting the P value (116/415, 28%), and no mention of confidence intervals at least for the primary endpoint (85/415, 20.5%). The proportion of journal articles mentioning each of the different statistical parameters is represented in Table 1.

One article each had the following errors: Mention on the statistical tests in the methods without mentioning any significant values in the results or discussion section; only the significance value (P value) was mentioned without mentioning the name of the statistical test employed; P value has been mentioned as 1.3 (maximum P value is 1.0); Student's t and ANOVA tests were used to assess correlation; linear regression was employed for a categorical outcome variable.

DISCUSSION

Statistics is a double-edged sword. When used appropriately, we arrive at correct conclusions but at the same time,
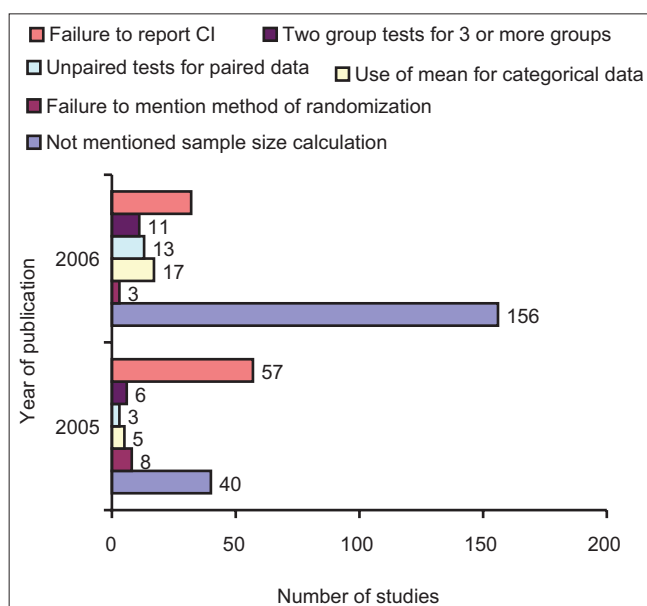
Figure 1: Summary of key findings of statistical errors in 2005 (*n* = 195) and 2006 (*n* = 220)

Table 1: Assessment of statistical reporting in the Indian journals

Findings	2005								2006							
	IJS	IJO	IJOrtho	IJD	JAPI	NMJI	NI	IP	IJS	IJO	IJOrtho	IJD	JAPI	NMJI	NI	IP
No formal sample size calculation mentioned	5	3	5	7	7	-	9	4	20	22	42	19	41	11	1	2
Failure to mention about the underlying hypothesis	7	7	5	7	6	-	7	6	18	21	42	19	41	-	1	2
In case of RCT's, failed to mention about method of generation of random sequence	2	1	-	2	-	-	-	3	-	-	-	1	-	-	-	2
In non-RCT's, failed to check statistically the baseline characteristics	1	2	2	4	-	-	-	-	20	22	42	-	1	-	-	-
Check of baseline characteristics was performed in a RCT	2	-	-	2	1	-	-	4	-	1	-	1	-	-	1	1
Statistical test for baseline were not appropriate	2	1	-	5	-	-	-	-	-	1	-	-	-	-	1	-
Use of mean (SD) for ordinal data	2	2	-	-	-	-	1	-	-	15	1	-	-	-	-	1
SE instead of mentioning SD	1	1	-	2	-	-	-	-	-	15	1	-	2	-	1	1
Failure to define ±	4	10	1	1	2	-	10	3	-	15	2	-	-	-	-	1
Parametric data used for ordinal data	2	-	-	1	-	-	-	-	1	8		1	2	1	1	1
Unpaired test for paired data	2	1	-		-	-	-	-	1	5	1	1	2	1	1	1
In case of paired data studies, no mention of within pair changes in group means	2	-	-	3	-	1	-	4	-	2	-	-	5	-	1	1
In case of use of any parametric tests, assumption that normal distribution was met was not mentioned	5	10	5	5	11	3	17	11	1	11	3	5	21	4	16	12
Multiple comparison was performed without taking into account inflation of type 1 error	7	1	1	3	9	6	7	14	-	12	2	3	19	7	19	16
Two group test was employed for 3 or more group studies	1	2	-	3	-	-	-	-	-	1	1	1	4	1	2	1
In case of Chi-square studies, when numbers are very small, Yates correction has not been used	3	1	1	4	2	1	3	1	-	4	2	3	16	3	14	1
Use of Chi-square when expected number in any cell is <5	1	-	-	2	1	-	4	1	-	2	1	2	5	1	14	1
Use of correlation for comparing different methods of measurement	-	3	-	-		-	-	-	-	1	1	1	2	1	7	1
Failure to define number of tails	7	11	1	8	10	6	16	12	5	14	6	4	28	7	26	18
Failure to report exact P value	2	5	3	8	-		6	1	5	18	6	6	29	6	28	17
Failure to report CI at least for the primary endpoint	5	8	2	8	8	1	10	13	5	6	1	4	12	1	2	1
In case of group comparisons, failure to report CI for each group independently	4	3	1	6	3	-	5	6	3	1	1	3	3	1	2	4
Complete information in the table is absent	1	-	-	-	-	-	-	-	17	3	18	2	29	1	1	1
No mention about measure of variability in the graph	1	1	-	-	-	-	-	-	-	3	-	-	1	-	2	5
Total number of original articles assessed	15	26	36	17	36	14	33	18	20	23	42	22	41	11	40	21

SD=Standard deviation, RCT=Randomized controlled trial, IJS=Indian Journal of Surgery, IJO=Indian Journal of Ophthalmology, IJD=Indian Journal of Dermatology, JAPI=Journal of Association of Physicians of India, NMJI=National Medical Journal of India, NI=Neurology India, IP=Indian Pediatrics, IJOrtho=Indian Journal of Orthopaedics, SD=Standard deviation, SE=Standard error, CI=Confidence interval

misuse of statistics may distort the results. In the present study, we found that statistics has been inappropriately used/poorly reported in many of the important parameters that are crucial for the interpretation of the findings in renowned, widely read Indian journals. As the practice of medicine in the current situation is mainly based on evidence, this may lead to wrong implementation of an ineffective therapy or cloud the judgment of safety or tolerability issues of a drug/device and mislead other scientific researchers.

Researchers have to be adequately trained in the application of statistics for biomedical research. Further journals need to have appropriate statistical reviewing policy guidelines as suggested by one of our previous studies, which identified only one-tenth of the journals in India with laid down policies.[14] Furthermore, the journal editor should make sure that all the original articles are being screened for statistical reporting quality by a trained biostatistician whilst preventing nearly 40% of the errors as shown by Lukic and Marusic.[15] Many journals from the West have quoted various statistical practice guidelines that can be incorporated in Indian journals. Furthermore, a statistical checklist can be circulated among peer reviewers of the concerned manuscript to check for appropriateness of the statistical tests.

The study is limited in just assessing the reporting quality from published article and not contacting the author for the unpublished details; although few studies have used complex statistical tools, we did not try to evaluate whether their assumptions have been checked. To conclude, we found poor quality of statistical reporting in some of the Indian journals and considering the seriousness of this issue, it is high time for both the researcher and journal editors to consult statistical experts, while the study is being carried out and at the time of publishing the same.

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