

Survey of Statistical Methods and Type of Articles Published in the Selected Pakistani Medical Journals from 1999 to 2007

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ABSTRACT

Objective: To determine the frequency of type of articles and statistical methods used in 6 leading Pakistani medical journals of 1999 to 2007.

Methodology: All the original articles, case report, review articles and short communications published in 1999 to 2007 of those journals were reviewed. Total number of articles reviewed was 5001. The information recorded from these journals was: types of article; any statistical methods used and correctness of statistics.

Results: Out of 5001 articles reviewed, 1110 (22.2%) were case reports, 3395 (67.9%) were original articles, 213 (4.3%) were short communications, and 283 (5.7%) were review articles. The percentage of case reports was increased from 17.6% to 26.1%, while the percentage of original articles was reduced from 73.1% to 64.4%. Fifty nine percent of the original articles either did not contain any statistics or used only descriptive statistics. Seventy seven percent of the original articles have used appropriate statistics for making inferences.

Conclusion: There is a significant improvement in the use of statistics during the study period of 9 years. However with the introduction of systematic review, Chochran library and Meta Analysis, advanced techniques of biostatistics are needed to understand these types of articles.

Key words: Statistical methods, type of articles, medical journals, Pakistan.

INTRODUCTION

Statistical techniques are being used with increasing tendency in last few decades in all the medical journals. Furthermore, many authors are applying more complex statistics in their studies, sometimes with the help of statistical consultants. However, this rising trend and use of complex analyses are in contrast with relatively low knowledge of statistical concepts among medical faculty and average physicians, especially general practitioners.¹⁻³ However, the recent developments, in the form of systematic review of Chochran library, meta analysis and evidence based medicine, are compelling the academicians, clinicians and researchers to understand statistical techniques, not only to incorporate it in their own research papers/work, but also to correctly translate the published literature into improved patients care.⁴

To determine the changes of application of statistics and type of analysis used in medical journals many surveys have been conducted in different countries,

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especially in western world.^{1,4-12} Few reviews are also conducted for the journals of developing countries.¹³⁻¹⁵ All those studies show that there are increasing tendency in the use of statistical methods.

More than 60 medical journals are being published from Pakistan. It would be an important and interesting exercise to evaluate the progress with respect to application of statistics, if any, in Pakistani medical journals. Therefore, this study was conducted to review the six Pakistani medical journals in the last nine years (1999 to 2007). The objectives of the study were to determine the frequency of type of articles published and statistical techniques used.

METHODOLOGY

This survey covers the review of six leading Pakistani medical journals namely, (1) Journal of College of Physicians & Surgeons Pakistan (JCPSP). (2) Journal of Pakistan Medical Association (JPMA). (3) Journal of Ayub Medical College (JAMC). (4) Pakistan Journal of Medical Sciences (PJMS). (5) Pakistan Armed Forces Medical Journal (PAFMJ). (6) Pakistan Journal of Medical Research (PJMR).

First three are indexed in Pubmed (US National Library of Medicine) and the last three are the leading non-indexed Pakistani medical journals. All of them are

peer reviewed and have statistical consultants in their editorial/advisory boards. All the issues from 1999 to 2007 of these journals were reviewed. One of the authors (MHR) reviewed all the articles. JAMC and PAFMJ were publishing 2 issues per year until 1999 and 2004, respectively and are now publishing 4 issues annually. JCPSP and JPMA have published 12 issues in each year during the study period. Editorials, book review, and commentaries were not included in this survey. The information recorded from these journals was: types of article; any statistical methods used, types of statistics and p-value. Emerson and Colditz's⁵ classification was used for statistical methods categorization. If more than one statistical techniques were employed in one article, all of them were recorded; however, if the same statistical method was repeatedly used in the same article, the method was recorded only once. To make the statistics simple and understandable, the nine years period was divided equally into three groups: 1999-2001, 2002-2004, and 2005-2007 and named as P1, P2 and P3, respectively. Chi-square test was employed to compare the differences of percentages. The significant level was fixed at 5%.

RESULTS

Five thousand and one (5001) articles were reviewed from 346 journals issues. The total number of publications was 1264 (25.3%) in P1 period and increased to 2022 (40.4%) in P3 period. JCPSP published the maximum numbers of 1743 (34.9%) articles. PJMS published 126 articles during P1 period, which was 10% of the total publications, and increased to 341 articles during P3 period which was 16.9% of all the articles during this period. The share of PJMR was reduced from 9.7% to 4.5% in P1 to P3 period. These changes of percentage was statistically significant ($p < 0.0001$) (Figure 1). Out of 5001 total articles, 1110 articles (22.2%) were case reports, 3395 (67.9%) were original articles, 213 (4.3%) were short communications, and 283 (5.7%) were review articles. The percentage of 'case reports' was increased from 17.6% to 26.1%, while the percentage of 'original articles' was reduced from 73.1% to 64.4% from P1 to P3 period. This change of trend was statistically significant ($p < 0.0001$) (Figure 2). JCPSP was the major contributor for this reverse trend, where the case reports were increased from 23.6% to 30.9%, while the original articles were reduced from 69.4% to 55.0% (Table 1). Since the statistics are applied mostly in original articles. Therefore, only the original articles were used for further analysis in this survey.

Table 2 depicts the statistical comparisons in the 3 study periods. Out of 3395 original articles reviewed, 924 (27.2%) were belonged to P1 period, 1168 (34.4%) were printed in P2 period and 1303 (38.4%) published in P3 period. Fifty nine percent of the original articles did not contain any statistics or used only descriptive statistics. There was significantly decreasing trend of 68.1% to 51% from period P1 to period P3 ($P < 0.0001$). In P1 period 13.2% of the articles mentioned p-value for statistical inference, without mentioning the actual test of statistics, while this figure came down significantly to 7.4% in P3 period. Forty one percent of original articles have used some inferential statistics. This percentage increased significantly ($p < 0.0001$) from 31.9% to 49% from P1 to P3 period. Seventy seven percent of the articles that have used some inferential statistics were appropriate. t-test (one-sample, two-samples independent and paired-wise) and contingency table tests (chi-square and related tests) were the most commonly used inferential techniques. These tests were used in 14.2% and 16.2% of original articles, respectively. The application of these tests were increased significantly from period P1 to P3 ($p < 0.0001$). The use of non-parametric techniques was also increased significantly P1 to P3 ($p = 0.003$).

Table 3 depicts the cumulative percentages for minimum statistical methods used in the reviewed articles. The minimum statistical methods considered the fact that many articles used more than one statistical method. To understand this phenomenon, consider the first three items of P1 period: No statistical methods or descriptive statistics only, p-value without mentioning the test and t-test. Since the item 'p-value without mentioning the test' is disjoint with any other mentioned statistical test. Therefore the cumulative percentage of first 2 items will be 81.3% (68.1% + 13.2%). However, the articles that have used the third item t-test could also have used some other statistics. Therefore, 86.7% is less than the sum of three items (68.1 + 13.2 + 8.5), (see Table 3). The difference 5.4 (86.7 – 81.3)% is the number of articles that have used only 't-test'. The table indicates that the readers, who only knew descriptive statistics, could understand 68.1% of the articles in P1 period. However, in P3 period this percentage has been decreased significantly to 51% ($p < 0.0001$). In P1 period the readers who had knowledge of only t-test and chi-square test could able to understand 92.7% of the articles. However, this percentage decreased significantly to 88.5% in P3 period ($P < 0.0001$).

Table 1: Type of articles published in the selected journals from 1999 to 2007

Journal	Type of the article	1999-2001	2002-2004	2005-2007	Total	P-value
JAMC	Case Report	5 (3.5)	21 (10.7)	39 (14.3)	65 (10.6)	0.001
	Original article	131 (91.6)	166 (84.3)	220 (80.9)	517 (84.5)	
	Short Communication	0 (0.0)	0 (0.0)	7 (2.6)	7 (1.1)	
	Review article	7 (4.9)	10 (5.1)	6 (2.2)	23 (3.8)	
	Total	143 (23.4)	197 (32.2)	272 (44.4)	612 (12.2)	
JCPSP	Case Report	114 (23.6)	163 (26.9)	261 (39.9)	538 (30.9)	<0.0001
	Original article	335 (69.4)	374 (61.7)	360 (55.0)	1069 (61.3)	
	Short Communication	7 (1.4)	39 (6.4)	21 (3.2)	67 (3.8)	
	Review article	27 (5.6)	30 (5.0)	12 (1.8)	69 (4.0)	
	Total	483 (27.7)	606 (34.8)	654 (37.5)	1743 (34.9)	
JPMA	Case Report	65 (22.6)	102 (22.6)	110 (24.1)	277 (23.2)	0.003
	Original article	183 (63.5)	298 (66.1)	260 (57.0)	741 (62.0)	
	Short Communication	26 (5.8)	26 (5.8)	34 (7.5)	86 (7.2)	
	Review article	14 (4.9)	25 (5.5)	52 (11.4)	91 (7.6)	
	Total	288 (24.1)	451 (37.7)	456 (38.2)	1195 (23.9)	
PAFMJ	Case Report	22 (21.6)	38 (24.7)	56 (27.1)	116 (25.1)	0.477
	Original article	70 (68.6)	98 (63.6)	129 (62.3)	297 (64.1)	
	Short Communication	0 (0.0)	0 (0.0)	3 (1.4)	3 (0.6)	
	Review article	10 (9.8)	18 (11.7)	19 (9.2)	47 (10.2)	
	Total	102 (22.0)	154 (33.3)	207 (44.7)	463 (9.3)	
PJMR	Case Report	2 (1.6)	10 (7.9)	3 (3.3)	15 (4.4)	0.003
	Original article	111 (91.0)	104 (81.9)	83 (90.2)	298 (87.4)	
	Short Communication	5 (4.1)	0 (0.0)	4 (4.3)	9 (2.6)	
	Review article	4 (3.3)	13 (10.2)	2 (2.2)	19 (5.6)	
	Total	122 (35.8)	127 (37.2)	92 (27.0)	341 (6.8)	
PJMS	Case Report	15 (11.9)	26 (14.4)	58 (17.0)	99 (15.3)	0.318
	Original article	94 (74.6)	128 (71.1)	251 (73.6)	473 (73.1)	
	Short Communication	7 (5.6)	14 (7.8)	20 (5.9)	41 (6.3)	
	Review article	10 (7.9)	12 (6.7)	12 (3.5)	34 (5.3)	
	Total	126 (19.5)	180 (27.8)	341 (52.7)	647 (12.9)	
Total	Case Report	223 (17.6)	360 (21.0)	527 (26.1)	1110 (22.2)	<0.0001
	Original article	924 (73.1)	1168 (68.1)	1303 (64.4)	3395 (67.9)	
	Short Communication	45 (3.6)	79 (4.6)	89 (4.4)	213 (4.3)	
	Review article	72 (5.7)	108 (6.3)	103 (5.1)	283 (5.7)	
	Total	1264 (25.3)	1715 (34.3)	2022 (40.4)	5001	

(.) = percentage

DISCUSSION

Literature indicates that there is noticeable increase in the use of statistics in health related journals. Furthermore, latest and more complex techniques are being employed to make the inferences about the studies. Many reasons have been documented for these

changes, including: (i) researchers became conscious that analytical approaches to analyze their data have significant effect in publications;¹¹ (ii) the request of editors and referees of the journals to include statistical analysis for the data;¹⁶ (iii) Availability of menu-driven and friendly statistical soft-wares to the authors for easy computations of complex statistical techniques

Table 2: Statistical methods applied in selected medical journals from 1999-2007

Statistical method	1999-2001 n = 924	2002-2004 n = 1168	2005-2007 n = 1303	Total n = 3395	P-value
No statistical methods or descriptive statistics only	629 (68.1)	723 (61.9)	665 (51.0)	2017 (59.4)	<0.0001
P-value without mentioning the test	122 (13.2)	92 (7.9)	97 (7.4)	311 (9.2)	<0.0001
t-test	79 (8.5)	162 (13.9)	240 (18.4)	481 (14.2)	<0.0001
Contingency tables	70 (7.6)	187 (16.0)	292 (22.4)	549 (16.2)	<0.0001
Analysis of Variance	10 (1.1)	36 (3.1)	60 (4.6)	106 (3.1)	<0.0001
Pearson Correlation	9 (1.0)	17 (1.5)	31 (2.5)	57 (1.7)	0.030
Epidemiological ratios	17 (1.8)	30 (2.6)	28 (2.1)	75 (2.2)	0.521
Simple linear regression	3 (0.3)	12 (1.0)	24 (1.8)	39 (1.1)	0.004
Multiple regression	9 (1.0)	12 (1.0)	22 (1.7)	43 (1.3)	0.221
Nonparametric statistics	9 (1.0)	15 (1.3)	35 (2.7)	59 (1.7)	0.003
Non-Parametric correlation*	4 (0.4)	5 (0.4)	3 (0.2)	12 (0.4)	0.634
Survival analysis	3 (0.3)	10 (0.9)	2 (0.2)	15 (0.4)	0.026
Other statistics	11 (1.2)	18 (1.6)	17 (1.3)	46 (1.4)	0.773
Statistics used	295 (31.9)	445 (38.1)	638 (49.0)	1378 (40.6)	<0.0001
Statistics appropriate	138 (81.7)	271 (78.1)	400 (75.6)	809 (77.4)	0.245

(.) = percentage

* Expected frequencies were less than 5 in 20% of the cells

Table 3: Statistical methods applied in selected medical journals from 1999-2007

Statistical method	1999-2001 n = 924	2002-2004 n = 1168	2005-2007 n = 1303	Total n = 3395	P-value
No statistical methods or descriptive statistics only	629 (68.1)	723 (61.9)	665 (51.0)	2017 (59.4)	<0.0001
P-value without mentioning the test	751 (81.3)	815 (69.8)	762 (58.5)	2328 (68.6)	<0.0001
t-test	801 (86.7)	892 (76.4)	869 (66.7)	2562 (75.5)	<0.0001
Contingency tables	857 (92.7)	1040(89.0)	1107(85.0)	3004 (88.5)	<0.0001
Analysis of Variance	867 (93.8)	1067(91.4)	1156(88.7)	3090(91.0)	<0.0001
Pearson Correlation	874 (94.6)	1084(92.8)	1185(90.9)	3143(92.6)	0.005
Epidemiological studies	890 (96.3)	1111(95.1)	1210(92.9)	3211(94.6)	0.001
Simple linear regression	893 (96.6)	1121(96.0)	1228(94.2)	3242 (95.5)	0.017
Multiple regression	901 (97.5)	1130(96.7)	1250(95.9)	3281 (96.7)	0.122
Nonparametric statistics	909 (98.4)	1145(98.0)	1283(98.5)	3337 (98.3)	0.689
Non-Parametric correlation	913 (98.8)	1150(98.5)	1286(98.7)	3349 (98.6)	0.773
Survival analysis	913 (98.8)	1150(98.5)	1286(98.7)	3349 (98.6)	0.773
Other statistics	924(100)	1168(100)	1303(100)	3395(100)	1.00

for their data,¹⁶ and (iv) unintentional publication bias of accepting articles with statistical significant results, forcing the authors to use statistical methods, right or wrong, and get 'p' value lower than significant level.¹⁷⁻¹⁸

This study showed that there was almost 40% increase in the number of articles published during nine years period in those 6 journals. Many factors could be

attributed for this notable increase. Many new medical colleges were opened and some public administered medical colleges were up graded to the university level in Pakistan. Consequently, there was intensification of medical faculty to teach in those institutions.

Furthermore, Higher Education Commission of Pakistan and Pakistan Medical and Dental Council are

Figure 1: Percentage of publication in three period-intervals

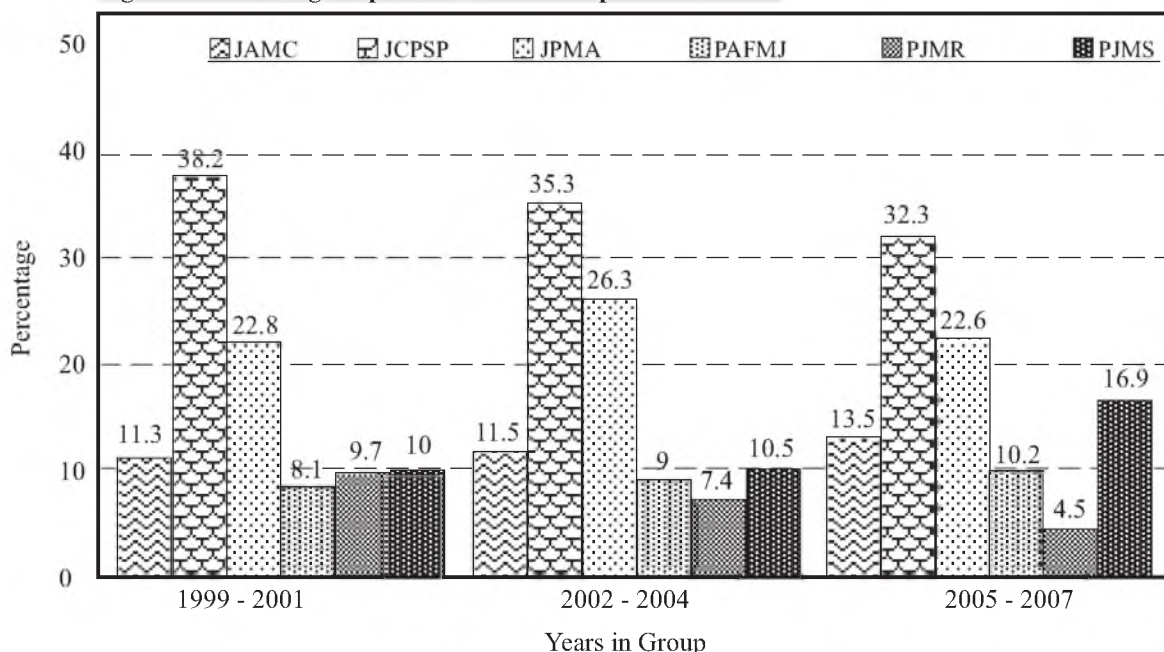
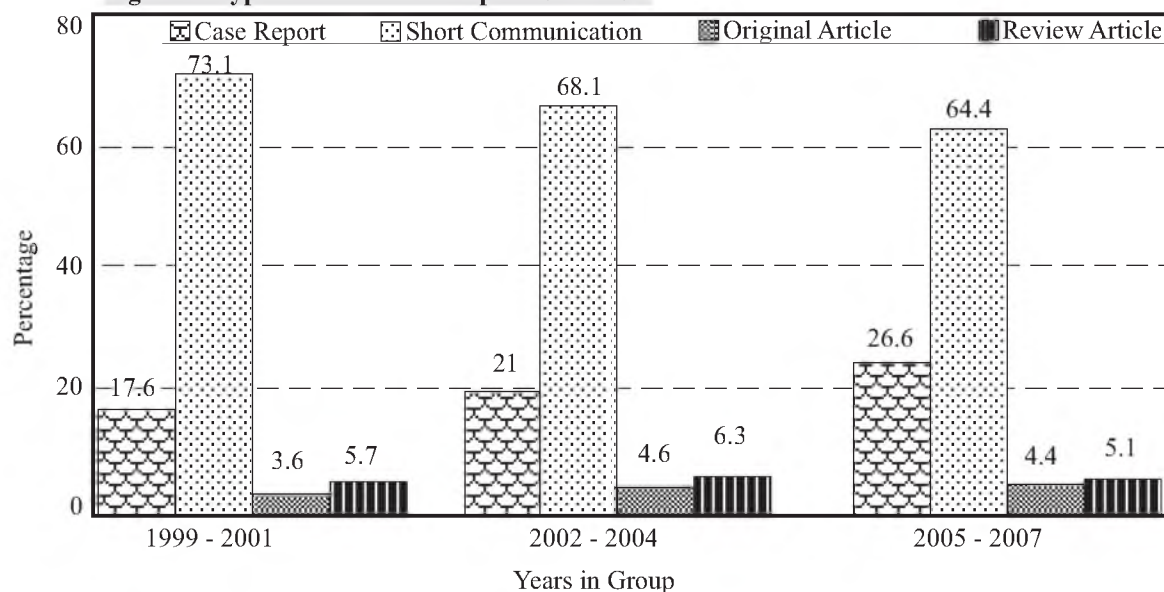


Figure 2: Type of article in three period-interval



demanding larger number of publications for promotion in academic ranking. These factors encouraged or forced the faculty members to publish more and consequently higher number of articles is being published in those journals. It should also be noted that there was an increasing tendency of publication of case reports. As it was mentioned before, teaching faculty was required to publish more for their promotions and case reports are easy to write and publish. Therefore, more case reports were published in place of original articles.

About sixty percent of the original articles, either did not use any statistics or only used descriptive statistics

(mean, median, SD and percentage). This percentage is much higher than majority of previous reported studies.^{1,4,9-10,12} However, few studies^{5,8,15} showed almost the same result. The percentages of articles without any statistics were significantly decreased during the study period. Even though the presenting the p-value without specifying the test is still a problem, but has been significantly reduced from 13.2% to 7.4% during the study period. The studies on medical journals of China⁴ and Ethiopia¹³ also showed the same problem. The most common statistical tests used by the authors were t-test, and contingency table (Chi-square, Fisher Exact test, McNemar etc.). Most of the studies^{4,6-7,9-10,12}

showed that these were the major test statistics applied in the biomedical journals. Analysis of variance, Epidemiological ratios (odd ratio, relative risk etc), correlation, simple and multiple regressions are also being used recently. However, the application of these statistical procedures is more common in other countries journals.^{4,6,10,12,14} The percentage of correct use of statistics was almost the same as in the studies of Kurichi & Sonnad⁶ and Wang & Zhang.⁴ However, it is lot more than reported appropriate percentage of Scales et al.¹¹

This report shows that if a reader knows descriptive statistics, concept of p-value, t-test and test related to contingency table, he/she can understand 85% of biomedical articles in period P3. However, this percentage was 92.7 in period P1. Emerson and Colditz⁵ showed that the 73% of the readers who know these statistical concepts can understand 'The New England Journal of Medicine'. Therefore, the knowledge of few basic statistics techniques; t and chi-square tests are still enough to understand about 85% of the articles of Pakistani medical journals. Nevertheless, with the introduction of systematic review, Cochran library and Meta analysis, advanced techniques of biostatistics are needed to understand these types of articles. Therefore, there is a need of teaching biostatistics in the education of doctors who wish to undertake research. The greater emphasis should be given to the statistics concerning dichotomous data (chi-square, logistic regression, odd ratio etc) along with methods concerned with continuous data, like multivariate regression, analysis of co-variance etc. As mentioned above the authors are forced some statistics in their articles due to publications (acceptance) bias and hence they do it whether it is right or wrong. However, due to shortage of medical statisticians, the appropriate statistics are not being used in the articles.

This study covered the articles of 6 leading Pakistani medical journals and showed the improvement took place in use of statistics. However, the results should be read with caution due to the top most positions of these journals among 62 medical journals published in Pakistan.

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