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Statistical Methods Used in Iranian Red Crescent Medical Journal Articles and Their Relationship with Acceptance Period: A Review from 2014-2021

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Abstract

Context: Statistical methods as a complement to biomedical research have a major role to play in the design, management, analysis, and interpretation of scientific data. The present study aimed to determine the statistical methods, time-to-acceptance, and the associated factors in articles published in the Iranian Red Crescent Medical Journal (IRCMJ).

Evidence Acquisition: Original articles in the period 2014 to 2021 from volumes 16 to 23 and issues 1 to 12 were assessed (1,300 articles). Each article was assessed by a two-member team consisting of a statistician and an expert researcher in the field of medical research. Statistical methods, sample size, sampling method, statistical population, study design, and software were extracted. Frequency, Percentage, Median, Interquartile range, Multiple response analysis (MRA), Kruskal–Wallis test, and Spearman correlation coefficient were used for data description and analysis, respectively. All analyzes were performed in SPSS software (version 26) at a significance level of 5%.

Results: The statistical population of most published articles was related to patients (n=547; 41.2%). Most studies (n=565; 43.5%) had a sample size between 100 and 500 people. The majority of them were analytical interventions (n=535; 41.2%). The median (IQR) of the acceptance period was 94 (58-153.75) days. The results of MRA demonstrated that both among the total tests and the articles, the highest rate of statistical methods was related to the T-test, Chi-square test, and descriptive statistics. There was no statistically significant factor influencing the acceptance period (P>0.05), and no significant correlation was detected between the acceptance period and the sample size of published articles (r=-0.04; P=0.625).

Conclusion: The acceptance period is a key factor academic researchers should consider when selecting an academic journal for their research paper. Contrary to some novice researchers' beliefs, the acceptance period of the article was not affected by the design, statistical methods, and sample size of the study.

Keywords: Iranian red crescent medical journal, Original articles, Sample size, Statistical analysis, Study design

1. Context

Statistical methods as a complement to biomedical research have a major role to play in the design of scientific studies, management and analysis of scientific data, as well as data interpretation. Therefore, the use of appropriate statistical methods in the field of scientific research has become increasingly important. Moreover, the use of inappropriate statistical methods may lead to poor interpretation and wrong conclusions from a scientific study (1,2).

Medical journals have gained widespread popularity across the globe. The Iranian Red Crescent Medical Journal (IRCMJ) is a valid clinical resource that has been published monthly in Iran since 2011. This journal is affiliated with the Iranian Hospital of Dubai, which publishes scientific studies in English. The journal welcomes basic science studies in trauma management, trauma clinical and accident management, all areas of surgery, and humanitarian assistance. This international journal strives for professional advancement and improvement in medical practice. The publication of quality articles is the main goal of all journals, especially journals in the field of medical sciences, which require evaluating the articles published in the journal, reviewing the quality level of articles, identifying strengths and weaknesses, as well as improving the quality level of articles in subsequent editions (3).

The presence of a statistician in research teams has an effective role in the reduction of statistical errors and the methodology of articles. It is obvious that incorrect use of statistical methods will lead to a loss of researchers' efforts. One of the basic criteria for improving the quality of medical journals is accepting and publishing articles which use valid and efficient statistical tests. It seems that the type of statistical methods can play a pivotal role in accepting articles (4-6). To ensure the validity of statistical tests used in manuscripts and increase the quality of articles, reputable journals use referees with statistical expertise.

Some authors believe that if they use more advanced statistical methods instead of just conventional methods or use a more sophisticated study design or larger sample size, their manuscript acceptance period will be shortened. Therefore, it

seems necessary to investigate this claim in a study. Furthermore, the provision of information related to the history of used statistical methods and the length of the acceptance period, type of study design, statistical community, and type of software can be useful for self-evaluation and promotion of the journals. Moreover, after the identification of existing gaps, these data can increase the variety of articles. In this regard, some review articles have recently been published under the title of reviewing the statistical methods used in the original articles of scientific journals (7-13). In light of the aforementioned issues, the present study aimed to identify and assess statistical methods, sample size, type of study design, statistical population, type of statistical software, acceptance period, and related factors in the original articles published in the Iranian Red Crescent Medical Journal from 2014 to 2021.

2. Evidence Acquisition

In this review study, all original articles (n=1,300) published in volumes 16 to 23 and issues 1 to 12 of the Iranian Red Crescent Medical Journal from 2014-2021 were assessed. A total of 1,727 articles were published during the study period, of which 1,300 articles were original. In addition, 427 articles were non-originals (including 98 (22.9%) review articles, 179 (42%) Case reports, 138 (32.3%) Systematic reviews, 8 (1.86%) Short articles, and 4 (0.94%) Letters to the Editor) which were not included in this study (Figure 1). Each article was assessed by a two-member team consisting of a statistician and an expert researcher in the field of medical research. Statistical methods, sample size, statistical population, type of study design, type of software, and acceptance period (receiving time minus acceptance time) were extracted.

The list of all statistical methods used in the articles of the journal in the mentioned period was summarized in Table 1. Submission and acceptance dates of articles were mentioned on the first page of them; therefore, the acceptance period of the article was calculated using the difference between submission and acceptance dates.

In order to perform descriptive statistics, considering that it was possible to use more than one statistical method in each article, the Multiple Response Analysis (MRA) technique was applied, and the frequency and percentage were reported. One of the valuable statistical methods for analyzing questions with the possibility of more than one answer is the MRA method. The output of this method, which was used in the present study, unlike simple descriptive statistics tables, presents a table containing two absolute/relative frequencies, one for the sum of the answers and one for the cases. In this study, the answers were the tests used and the cases

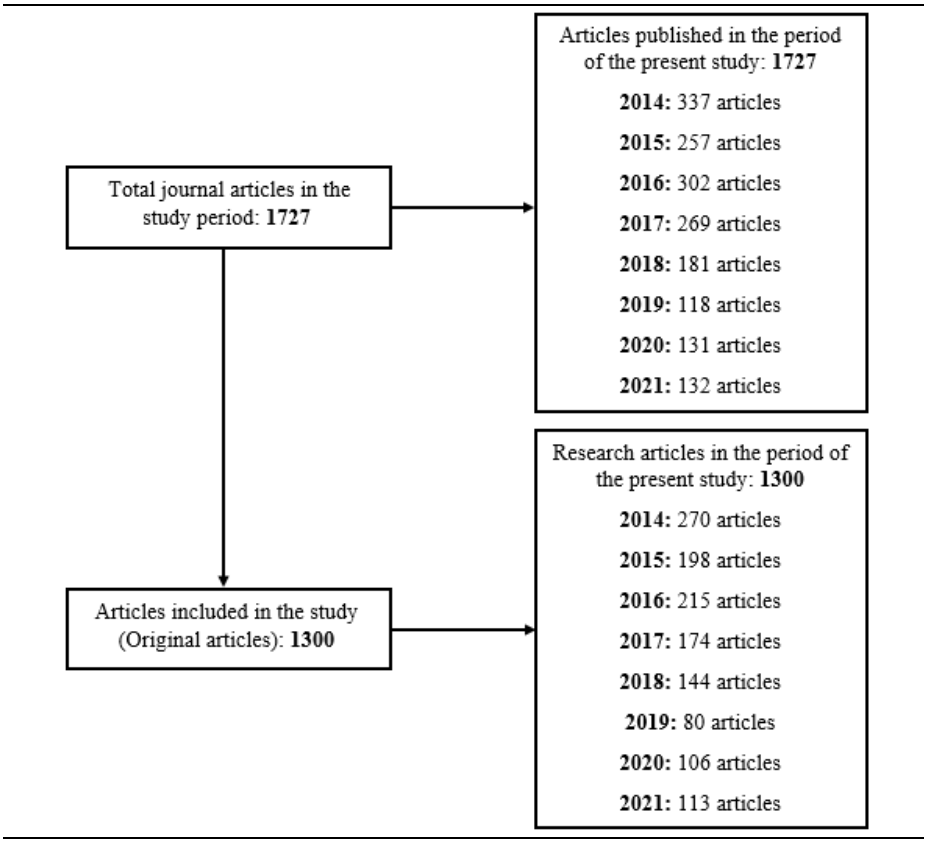

Figure 1. Process of extracting articles from IRCMJ; 2014-2021

Table 1. Statistical methods extracted from IRCMJ original articles during 2014-2021

ID	Method	Brief description
1	Descriptive statistics	Mean, Standard deviation, Percentage and Frequency, Minimum and Maximum, Median, Interquartile Range
2	T-test	Independent, Paired T-test
3	Regression	Linear Regression, logistic Regression
4	ANOVA- ANCOVA	One Way ANOVA, Two Way ANOVA
5	Multivariate Analysis	All types of factor analysis, Multivariate Regression, MANOVA[1]
6	Post Hoc Tests	LSD[2], Duncan Multiple Range Test, Bonferroni's, Tukey
7	Normality tests	Shapiro Wilks, Kolmogrov Smirnov
8	Assumption checking test	Levene's test
9	Nonparametric tests	Kruskal Wallis test, Mann Whitney U test, Friedman Test, Wilcoxon Test
10	Nominal variable tests	Cochran Q test, McNemar's test
11	Chi-square test	Fisher's exact test, Trend analysis
12	Repeated measurement	Muchly test, Bartlet test
13	Correlation analysis	Pearson, Spearman, Partial, Kendall (or Man Kendall), KMO[3]
14	Survival analysis	Cox regression[4], Kaplan Meier, Log Rank test
15	Reliability & Validity	CFA[5], CCFA[6], Cronbach's Alpha
16	Evaluating techniques	Roc curve analysis, sensitivity, specificity, RMSEA[7], CFI[8], AGFI[9], TLI[10], GFI[11]

1) Multivariate analysis of variance
2) Least Significant Difference
3) Kaiser-Meyer-Olkin's test
4) Cox regression: Semiparametric
5) Confirmatory factor analysis model
6) Categorical confirmatory factor analysis
7) Root Mean Square Error of Approximation
8) Comparative Fit Index
9) Adjusted Goodness of Fit Index
10) Tucker-Lewis Index
11) Goodness-of-Fit Index

were printed articles.

The normality of the error distribution in the quantitative variables was investigated by the Kolmogorov Smirnov test, and the results indicated that the distribution of errors in sample size and acceptance period variables were not followed by a normal distribution (P<0.05). The relationship of the acceptance period of the article with the type of statistical methods, software, statistical population, and type of study design was investigated by the Kruskal Wallis test. Following that, Bonferroni multiple comparison test with adjusting p-value was used for pairwise comparison. Spearman correlation coefficient was also used to assess the relationship between sample size and acceptance period. The data were analyzed in SPSS software (version 26) at a significance level of 5%.

3. Results

During the study period (2014-2021), 1, 300 original articles were evaluated. The statistical population in articles was related to patients and community-level subjects in 547 (41.2%) and 447 (34.4%) articles, respectively. The lowest statistical population was related to statistical data with 18 (1.4%) articles (Table 2).

Out of the articles assessed during the study period, 245 (18.8%) articles had a sample size of fewer than 100 people. Moreover, the sample size was between 100 and 500 in 565 (43.5%) articles (Table 3).Out of 1,300 original articles, the type of study design in most articles was analytical intervention (n=535; 41.2%), followed by analytical observational (n=37.3%; 485) (Table4).

Table 2. Description of the statistical population of the assessed articles

Statistical population	N	%	Acceptance period		P-value
			Median (days)	IQR (days)	
Patients	547	42.1%	95	57-155	0.537
Community-level examples	447	34.4%	89	58-151	
Laboratory samples	153	11.7%	104.5	63.25-158	
Occupations	95	7.3%	100	63-141	
Statistical data	18	1.4%	66	45.5-132.75	
Others	40	3.1%	66.5	43-116.5	
Total	1300	100.0%	94	58-153.75	

Community-level examples include students, women, men, adults, children, infants, couples, spouses, drug users, addicts, smokers, mothers, families, the elderly, middle-aged, adolescents, prisoners, veterans, boys, and single persons. Laboratory samples included laboratory animals such as mice, genes, chromosomes, blood samples, urine samples, serum samples, adipose tissue samples, infectious samples, and cells such as fibroblasts. Occupations included nurses, physicians, medical professionals, residents, health care providers, oncologists, specialists, staff, workers, teachers, soldiers, drivers, players, officials, and managers. Statistical data included information extracted from documents and records. Others included websites, articles, hospitals, provinces, suicides, road accidents, liver donors, transplants, mammograms, intraosseous lesions, teeth, plants, and the like

Table 3. Description of the sample size used in the assessed articles

Sample size	N	%	Acceptance period		P-value
			Median (days)	IQR (days)	
Less than 100	245	18.8%	86	50.5-143.5	0.480
100-500	565	43.5%	97	60-162.5	
500-1000	345	26.5%	94	60.5-155	
More than 1000	79	6.1%	86	52-175	
Unknown	66	5.1%	88.5	57-144.25	
Total	1300	100.0%	94	58-153.75	

Table 4. Description of the type of study design in the assessed articles

Type of study design	N	%	Acceptance period		P-value
			Median (days)	IQR (days)	
Descriptive	181	13.9%	78	53.5-145	0.770
Analytical-Observational	485	37.3%	94	57.5-160.5	
Analytical-Interventional	535	41.2%	97	61-150	
Methodology	22	1.7%	96	58.25-136.5	
Qualitative	77	5.9%	97	62.5-224	
Total	1300	100.0%	94	58-153.75	

The majority of articles (n=1,136l; 87.4%) had selected SPSS software for data analysis (Table 5).

The results of MRA indicated that among all the used tests in total, the highest rate of tests was related to the T-test (n=536; 19.3%), descriptive statistics (n=498; 17.9%), and Chi-square test (n=427; 15.4%). Moreover, based on the results of MRA, 42.4%, 39.4%, 33.8%, and 25.2% of articles used t-test, descriptive statistics, chi-square test, and one-way analysis of variance, respectively (Table 6).

The acceptance period of articles had a mean score of 130.25±118.84 days with a median (IQR) of 94 (58-153.75) days. The examination of the factors related to the acceptance period showed that there was no significant effect; therefore, the results of the Kruskal-Wallis test confirmed the non-significant relationship of acceptance period with the statistical population (P= 0.528), study design (P= 0.770), type of the used software (P= 0.657), and type of statistical methods (P=0.798). There was no significant correlation between the acceptance period and the sample size of published articles (r=-0.04; P=0.625).

Table 5. Statistical software used in the assessed articles

Type of software	N	%	Acceptance period		P-value
			Median (days)	IQR (days)	
SPSS software	1136	87.4%	94	57-155	0.547
R software	14	1.1%	69	44.75-114.25	
STATA software	22	1.7%	97	73.75-119	
MAXQDA software	84	6.4%	98.5	64.25-215	
Graph Pad Prism software	23	1.8%	113	67-147	
Other softwares*	21	1.6%	73	42.5-179.25	
Total	1300	100.0%	94	58-153.75	

*Excel, G power software, AMOS, Proplus software, MATLAB software, JASP program, LISREL software, Expert Choice software, Mplus software, Smart PLS software, EQS software, MLwiN software.

Table 6. Results of multiple response analysis

ID	Statistical methods	All methods		Acceptance period		Percent of all articles
		N	%	Median (days)	IQR (days)	
1	Descriptive statistics	498	17.9%	92	55-147.25	39.4%
2	T test	536	19.3%	97	56.25-155	42.4%
3	ANOVA- ANCOVA	319	11.5%	92	56-154	25.2%
4	Non parametric tests	286	10.3%	94.5	62-147.75	22.6%
5	Chi-square test	427	15.4%	96	56-154	33.8%
6	Normality tests	284	10.2%	94	59-145.75	22.5%
7	Post Hoc Tests	116	4.2%	89.5	57.25-138.78	9.2%
8	Regression	60	2.2%	94	61-151	4.7%
9	Correlation analysis	114	4.1%	85	52.5-137.75	9.0%
10	Survival analysis	37	1.3%	79	52.5-122.5	2.9%
11	Nominal variable tests	16	0.6%	83.5	46.75-172.5	1.3%
12	Assumption checking test	10	0.4%	64.5	37.25-115	0.8%
13	Repeated measurement	26	0.9%	74	55.25-114.25	2.1%
14	Multivariate Analysis	25	0.9%	92	63.5-146.5	2.0%
15	Reliability & Validity	11	0.4%	64	26-104	0.9%
16	Evaluating techniques	15	0.5%	70	36-160	1.2%
	Total	2780	100.0%	94	58-153.75	219.9%

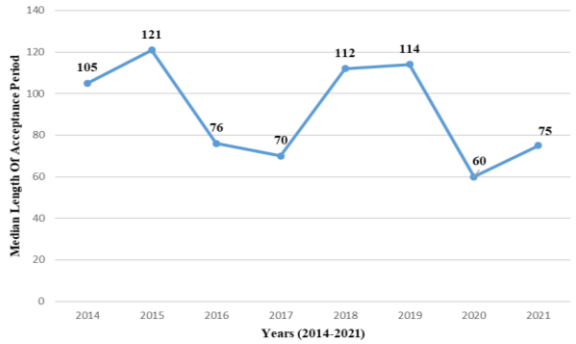

Figure 2. Median length of acceptance period during 8 years (2014-2021)

The results of the Kruskal-Wallis test pointed out that the median acceptance period had a significant difference during eight years (2014-2021).

As demonstrated in Figure 2, the median length of the acceptance period of articles has fluctuated during different times so that despite the declining trend from 2015 to 2017, in recent years, the median length of acceptance period has increased and reached 114 days in 2019. In 2020 and 2021, the median length of the acceptance period significantly decreased, and in 2021, it reached 75 days.

As presented in Figure 3, the trend of original articles published during our study has been increasing, and the Chi-square test confirmed this finding (P<0.001) so that the percentage of published original articles increased in 2020 and 2021, compared to the total number of articles published in these two years. Moreover, a large percentage of the articles published in 2020 and 2021 were related to the original articles.

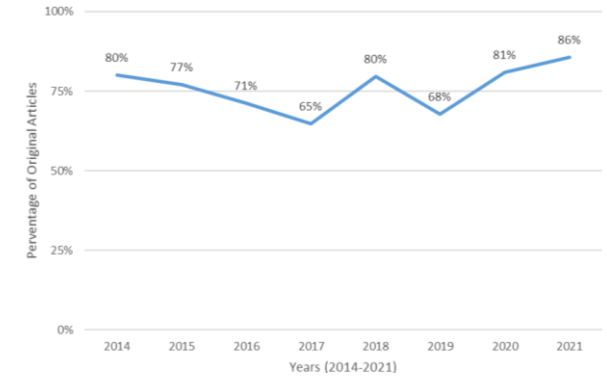

Figure 3. Percentage of original articles published every year

4. Discussion

Today, the use of statistical methods is expanding, and some researchers believe that if they use more sophisticated statistical methods for data analysis, their manuscripts will definitely be accepted. The editors of medical journals seek the help of statistical experts in judging statistical methods. Scientific journals need a general self-assessment in the field of published articles to identify the strengths and weaknesses, and improve the quality level and index in the valid scientific databases. Furthermore, Medical journals can increase citations and impact factors by accepting high-quality articles; therefore, while increasing credibility, they can gain the attention of numerous researchers.

The present study assessed the Iranian Red Crescent Medical Journal from 2014 to 2021 and extracted the necessary information from 1, 300 original articles. The results of this study pointed out that patients and community-level subjects (including students, women, men, adults, children, infants, couples, spouses, drug users, addicts, smokers, mothers, families, the elderly and middle-aged, adolescents, prisoners, veterans, boys, and single people) were the most statistical population used in the study. This issue signifies that the IRCMJ Journal has a special interest in accepting articles on clinical medicine, diseases, and health problems in the community. The lowest statistical population in the accepted articles was related to the data extracted from documents, records, and files. There was no similar study to compare the results of the current research. This information usually has the problem of data loss and despite the great efforts of researchers, it is examined by the reviewer team of the journal with great obsession and in case of incorrect results, the study will be rejected.

The results of this study also revealed that most of the articles published in the journal had a sample size of fewer than 500 cases. Although this finding was not investigated in similar studies, it may be argued that studies with smaller sample sizes are more cost-effective. Nonetheless, as a rule of thumb, in community-level studies, according to the subject under study, the larger sample size results in a higher power of statistical tests to identify significant relationships (14).

The findings of this study regarding study design indicated that most studies were analytical (observational and interventional), signifying that most articles had observational and interventional analytical study designs. The stated result confirmed the special attention of this journal to these study designs. Although methodological studies play an important role in attracting citations for the journal, they constituted 1.9% of articles in IRCMJ, requiring the attention of the editor of this journal to this important issue.

The SPSS software is one of the most popular and widely used statistical analysis software packages among researchers. Although it has very good coverage of common statistical methods, it is not a complete software and researchers should use R and MATLAB programming software or STATA and Minitab semi-programming software to use more

advanced statistical methods. The findings of the present study illustrated that the majority of articles published in IRCMJ used SPSS software and a small percentage of articles used programming or semi-programming software. The frequent use of this software can be ascribed to its user-friendliness and simplicity.

The results of MRA depicted that T-test and Chi-square test as simple statistical methods had the highest rate of use in articles. The ease of use and simplicity of these tests, as well as their availability in the user-friendly SPSS software, may lead to their widespread use. In the present study, paired test and independent test were considered T-test. The Fisher exact test was also included in the Chi-square test category. In line with the current research, the frequency of use of both of these tests was much higher in similar studies (15-19). T-test as a parametric test compares the mean of a quantitative normal variable in two groups. The Chi-Square test is also used as a non-parametric test to evaluate the relationship between two qualitative variables (20). Both of these tests are among the available statistical methods and are user-friendly, which can be easily used in most statistical software, so they have many fans.

The results of the Kruskal-Wallis test also pointed out that the type of statistical methods, sample size, type of statistical population, type of study design, and type of the used software had no significant effect on the acceptance period (P>0.05). This result was contrary to the expectations of some researchers who think that the use of a more advanced statistical method, a larger sample size, or a more complex study design can increase the chance of shortening the acceptance period.

The median time between the submission and acceptance of articles fluctuated widely from 2014-2019. The results of this study demonstrated a significant reduction in the median time of submission of articles from 2015 to 2017. Nonetheless, in recent years, the median time for the acceptance of articles has increased so that it reached 114 days in 2019, which may be due to the great number of articles submitted to this journal. The period of acceptance of articles decreased significantly in 2020 and 2021, demonstrating the special attention of the officials of the IRCMJ to this issue. The officials of the IRCMJ assessed and made useful corrections in this regard to reduce the time of judging and accepting articles.

The percentage of original articles published in 2020 and 2021 has increased significantly, compared to previous years, which could indicate the special interest of the IRCMJ judging team in accepting original articles, compared to other papers. In terms of strengths, it can be stated that this research was among the first studies in Iran (21, 22) that examined the statistical methods used in original articles in journals, especially IRCMJ. In this study, more variables were examined and analyzed, compared to similar studies around the world.

Among the notable limitations of this study, we can refer to the lack of access to articles rejected by the journal. Otherwise, based on advanced statistical analysis, we could calculate the odds of accepting the article based on the sample size, type of statistical method, and type of statistical population. Another limitation of the article was the lack of access to the time interval between article submission and the first decision of the journal, the time of the revision, and the time interval between the acceptance and publication of the article separately. Therefore, in the present study, only the difference between the time of submission and acceptance that was mentioned on the first page of the articles was used as the acceptance period.

5. Conclusion

The acceptance period is an important item for researchers to choose a journal and a key factor in the promotion of a journal. The results of this study confirmed that the IRCMJ admission period has been relatively low and contributes to the development of this valuable journal. The analytical design was the most widely used design, and patients were the most statistical population among the articles. It is recommended that articles with a variety of designs and statistical populations be accepted. The majority of articles used simple statistical methods. It would be useful to diversify the acceptance of articles with more advanced methods. Contrary to the beliefs of novice researchers, there was no statistically significant relationship between study variables (the type of test, sample size, type of community, type of study, and type of software used) and acceptance period.

Acknowledgments

None.

Footnotes

Conflicts of Interest: The authors declare that they had no conflicts of interest.

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