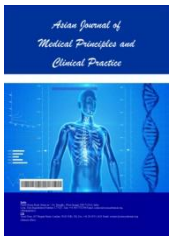

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Research Designs and Statistical Methods in Myanmar Health Sciences Research Journal: A Review of Articles Published during 2010 to 2019

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Authors' contributions

This work was carried out in collaboration among all authors. The principal author MK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author LLW designed the study, performed the statistical analysis and revise the first draft of the manuscript. Authors KMO, SS and YH managed the literature searches and took part in the writing of the protocol and revision of the manuscript. Authors AMM and HW took part in the collection of articles for categorization and data management. All authors read and approved the final manuscript.

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ABSTRACT

Aim: Several reviews had been reported on the design and statistics of medical journals worldwide. However, assessment on the quality of research articles in a peer-reviewed health research journal locally widely published in Myanmar has never been carried out.
Study Design: Retrospective cross sectional study.
Methodology: The research designs and statistical procedures used in all research articles (n=391) published in the Myanmar Health Sciences Research Journal (MHSRJ) from 2010 to 2019 were studied using a standardized checklist.
Results: Among the publications, commonly used study designs were descriptive (cross-sectional) studies (n=191,49%) and basic science (laboratory-based) studies (n=129, 33%). The remaining were analytical observational studies (n=49, 12%) and clinical trials (n=22,

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6%). Statistical analysis was not carried out in 89 studies (22%) of the published articles as the data generated from those studies were mainly qualitative data. Parametric data analysis methods were used in 206 papers (64%). Most of the statistical methods used were basic statistics, contingency table analyses, epidemiological statistics, *t*-test, correlation and regression analysis, totaling 77% of the statistically tests. Assumption was not mentioned in 60% of papers using non-parametric analysis. Although, it was observed that over 92% (n=363) of the articles fully reported the sampling unit and study area/site, only a few (16%, n=57) mentioned the sample size calculation.

Conclusion: Our findings indicated that a reader with knowledge on descriptive statistics, analysis of contingency tables, epidemiological methods, *t* – tests and regression analysis will then have complete statistical access to 77% of the articles published in the MHSRJ. Deficiencies in the research design and statistical analysis need to be corrected for the improvement in the quality of articles.

Keywords: Research designs; sampling; statistical analysis; parametric; Myanmar.

1. INTRODUCTION

Publications on epidemiological and clinical research are vital for researchers and scholars for use in the preventive and curative aspects of diseases and medical conditions. Basic research articles also contribute towards the development of technology for use in the management of several health conditions and diseases. In Myanmar, research publications could be also used as vehicles for sending essential information to the health administrators and policy makers. However, it is essential that the methodology is correct to achieve quality information. Not all the articles may be perfect in terms of adequacy for proper study design and/or statistical methods. Globally, several reports have stated that there is a need for improvements regarding study designs in some medical journals [1-2].

The Myanmar Health Sciences Research (MHSR) Journal is published by the Department of Medical Research, Ministry of Health, Republic of the Union of Myanmar. It publishes original articles, review articles, short reports and correspondences in the field of biomedical and health sciences. It has been published quarterly (i.e. April, August and December) since April 1989 with International Standard Serial No. (ISSN) 1015-0781. The journal is distributed to researchers, scholars and academicians throughout Myanmar and to some international institutions and libraries [3].

Till now, the assessment on the quality of research articles published in peer-reviewed academic journals of Myanmar has never been carried out. The present study was carried out to collate all evidences on the study design and statistical analyses used in the research articles published in the MHSRJ. It is expected that from the findings we will be able to judge the accessibility of the general readers to the articles published in MHSRJ in terms of understanding the statistical content of the articles. The findings of any deficiencies in the aspects of research design, sample size determination, sampling procedures and statistical analysis could also upkeep the improvement of the quality of the MHSRJ.

2. MATERIALS AND METHODS

A retrospective cross-sectional descriptive study design was used. All original articles and short reports published in MHSRJ from 2010 to 2019 (Volume 22 to 31) were included in the review. A total of 391 articles were studied. The research designs and statistical procedures used in the articles were reviewed independently by two groups of investigators. Each group consisted of senior researchers among which at least one senior researcher has creditable knowledge of statistical methods. The review was carried out using a standard check list. The check list consisted of two parts. Part one captured data describing the type of study, study design, sampling unit, sampling procedure and sample size, data collection methods, and statistical tests. Part two included the quality and appropriateness of the statistical methods in relation to the objectives of research, assumptions and the presentation of the results. Crossover review of the findings among the two groups were carried out and the final results were agreed upon. Any discrepancies between the authors were resolved by a consensus process.

Data was compiled using Microsoft Excel and later transferred to SPSS data base. Analyses was carried out using IBM^R SPSS^R software version 23.0. The number of publications were grouped into two groups of 5-year period (2010 to 2014 and 2015 to 2019) for categorical analysis. Descriptive statistics were calculated. Study designs were recorded and grouped as Descriptive study, Analytical study, Clinical Study or Basic Science study. Categorizing of statistical methods was also carried out. The first category "Basic Statistics" identified articles that present only percentages, means, medians, standard deviations and standard errors. The category "Contingency Tables" referred to articles that reported chi-squared test, Fischer's exact test, Mantel-Hazel test. The third category "Epidemiological Statistics" included relative risk, odds ratio, log odds, specificity, sensitivity, and rates. T-tests (one-sample, matched pair, and two samples) were included as the fourth category. The fifth category was "Correlation" which included the Pearson product movement correlation and kappa statistics. "Simple linear regression" and "Analysis of Variance (ANOVA)" were included as sixth and seventh categories. The eighth category was the "Non-parametric" tests which included Sign tests, Wilcoxon signed-rank test, Mann Whitney U test and Kruskal-Wallis test. The ninth category "Advanced Statistics" included statistical methods such as multiple comparisons and survival Analysis methods. To determine the associations between category dependent variables, chi-squared tests were carried out and $P<0.05$ was considered significant.

3. RESULTS AND DISCUSSION

3.1 Number of Publications and Types of Studies and Study Designs

During 2010 to 2019, a minimum of 37 publications and a maximum of 45 publications were published annually with a total of 391 publications during the 10-year period. Of them, 367 were original articles and 24 were short reports. Although more articles were published in the second 5-year period (2015 to 2019) than the first 5-year period (2010 to 2014) (206 articles *vs* 185 articles), the difference was not statistically significant. 367 papers were full papers and 24 papers were classified as short reports. The ratio between the original articles and short reports (7:1) was slightly higher in the first 5-year period as compared to 6.2:1 in the second 5-year period (Table 1).

Table 2 revealed that among the publications, the most common study design used was descriptive (cross-sectional) studies (n=191) followed by basic science (laboratory-based) studies (n=129). A slight increase in the number of research studies using descriptive and analytical designs were observed in the second 5-year period. The number of clinical trials also increased in the second 5-year period but the difference was not significantly different. Four studies used the combination of cross sectional and analytical observational study designs.

3.2 Sampling (Study) Unit, Sample Size Determination and Sampling Procedure

It was observed that over 92% (n=363) of the articles fully reported the sampling unit and study area/site. Among them sampling procedure for the determination of study unit was clearly described in 57 (15.7%) of the articles. Surprisingly, it was found that sample size calculations were regarded as not relevant in 170 (76.9%) of the published papers and were fully reported in 38 papers (9.7%) only. Describing description of sample size calculation and sampling procedures were not found in most of the articles.

3.3 Statistical Analysis and Assumptions

Statistical analysis was not carried out in 89 studies (22.76 %) of the published articles as the data generated from those studies were mainly qualitative data. Among the remaining studies, parametric data analysis methods were used in 206 papers (65%), but among them only 43 papers (20.6%) mentioned underlying assumption. A few studies used non-parametric method (6 articles) or both parametric and non-parametric methods (5 papers). Assumption was not mentioned in 60% of papers using non-parametric analysis and also not mentioned in 60 % of papers using both parametric and non-parametric analysis. In general, the majority of the research papers failed to consider the underlying assumptions in choosing appropriate statistical methods (Table 3).

Several reviews had been reported on the design and statistics of several medical journals

in Asia countries [2,4-7] but the type of research designs and statistical methods used in Myanmar medical journals had not been assessed. Although there are a number of journals published in Myanmar, Myanmar Health Sciences Journal was chosen because of it has been in wide circulation among the Myanmar readers for over three decades.

Table 1. Number of published papers by year of publication

Year	Type of publication		Total	%
	Original Articles	Short Reports		
2010	42	3	45	11.5
2011	22	1	23	5.9
2012	31	1	32	8.2
2013	41	5	46	11.8
2014	37	2	39	9.9
2015	39	0	39	9.9
2016	38	1	39	9.9
2017	38	1	39	9.9
2018	38	7	45	11.5
2019	41	3	44	11.2
Total	367 (93.9%)	24 (6.1%)	391	100

Table 2. Study designs by 5-year periods

Type of study design	5-year period		Total (%)
	2010 – 2014	2015 – 2019	
Descriptive (Cross-sectional)	92	99	191 (48.9%)
Analytical Observational (Cohort, Survival, Case-Control, Cross sectional Analytical)	20	29	49 (12.5%)
Clinical (Clinical Trials, Vaccine Trials, Cross Over, Quasi-Experimental, Case studies, Community-based Experimental studies)	7	15	22 (5.6%)
Basic Sciences (Laboratory-based studies)	66	63	129 (33%)
Total	185	206	391

Table 3. Statistical methods used in the published articles of Myanmar Health Sciences Research Journal by 5-year periods

Type of statistical method	5-year period		Total (%)
	2010 – 2014	2015 – 2019	
Not done	44	45	89 (22.76 %)
Basic statistics	28	28	56 (14.32 %)
Contingency analyses	32	56	88 (22.51 %)
Epidemiological statistics	21	24	45 (11.51 %)
Student t-test	29	44	73 (18.67 %)
Correlation	10	10	20 (5.12 %)
Logistic Regression	9	10	19 (4.86 %)
Analysis of Variance	17	18	35 (8.95 %)
Non-parametric methods	2	4	6 (1.53 %)
Multiple Regression Analysis	0	2	2 (0.51 %)
Survival Analysis	2	2	4 (1.02 %)

Studies that addressed statistical methods in the Western medical literature have been reported. In a review of the 760 research articles in Volumes 298 to 301 of *The New England Journal of Medicine*, it was found that original articles used statistical techniques more extensively than other articles in the J*ournal*. It was also reported that a reader who was conversant with descriptive statistics had statistical access up to 58 per cent of the articles [8].

In the present study, nearly half of articles used the cross-sectional research design (n=191, 49%) and this wide use of cross-sectional study design in research publications was consistent with a published study based on three UK general practice journal where the commonest design (39%) was cross-sectional surveys [9], and also with the findings of the high percentage of cross-sectional study designs published in the Journal of Family Practice [10]. It was slightly less than the reports compiled from the Journal of Family Practice and the Journal of Family and Community Medicine where the cross-sectional design was used in 88% and 76.4% of the published articles, respectively [10,11].

In the present study, we found that parametric data analysis methods were used in 206 papers (65%). Most of the statistical methods used were basic statistics, contingency table analyses, epidemiological statistics, t-test, correlation and regression totaling 77% of the statistically tests. Similar frequency of statistical methods (66%) was found in the six selected Polish medical journals in the years 1988-1992 [12]. Studies from Pakistan had also reported that descriptive statistics is the most frequent method of analysis (67.6%) among the research articles [4]. Also similar findings from China had been reported where the most commonly used statistical methods were *t* tests and contingency tables [10,13]. In the present study, apart from the use of a few advanced statistical methods such as multiple regression analysis and survival analysis, we did not find any remarkable improvement in the proportion of statistical tests. A study from China had demonstrated the improvement in the use of statistical methods within a decade. A study on evaluation of all original articles published in 5 leading journals in 1985 (n=640) and in 1995 (n=954) revealed that the percentages of original articles reporting clinical trials, prospective studies, or basic science research increased from 18% to 31%, the proportion of papers using statistical tests increased from 40% to 60%, more sophisticated statistical methods were used, and of those articles using statistics, the proportion using appropriate methods increased from 22% to 46% [13].

Our findings indicated that a reader with knowledge on descriptive statistics, analysis of contingency tables, epidemiological methods (Odds Ratio, Relative Risks, Sensitivity, Specificity and Student *t* – tests) would then have complete statistical access to 77% of the articles published in the MHSRJ. It has also been reported that a reader who was conversant with descriptive statistics (percentages, means, and standard deviations) had statistical access to 58 per cent of the 760 research and review articles in Volumes 298 to 301 of *The New England Journal of Medicine*. Understanding t-tests increased this access to 67 per cent. The addition of contingency tables gave statistical access to 73 per cent of the articles. Familiarity with each additional statistical method gradually increased the percentage of accessible articles [14]. However, a recent study on the articles published in The New England Journal of Medicine showed that there was a continued trend toward increased use of newer and more complex methods [15].

We also observed that laboratory-based design was the second commonest design (33%) in the MHSRJ. This was not common for a Journal aiming at general readers. It might be due to the publication policy of the MHSRJ as the Journal is published by the Department of Medical Research where many basic research including laboratory-based studies are in progress and the results obtained from such studies are usually published in the Journal.

Statistics is an essential component of health research from design initiation to paper writing. Since, researchers, scientists and even policy makers often depend on the correct conclusions obtained from the published papers conducting the correct statistical analysis is of paramount importance. In a study on articles published in the journal TRANSFUSION, it was found that 22% of the articles reported conclusions not supported by the data [16]. A study also highlighted the inappropriate use of statistics in published articles in China Medical Journals as a serious problem [13].

In this study, we found many serious deficiencies in the statistical analysis of research articles;

omission of *P* values and confidence intervals, failure to describe sample size calculation and sampling procedures, and under use of assumptions. Absence of sample size estimation and failure in defining the sample unit were also common features. The findings were in line with a study on Chinese research articles where the most common errors were presentation of *P* values without specifying the test used, use of multiple *t* tests instead of analysis of variance, and use of unpaired *t* tests when paired tests were required [13].

4. CONCLUSION

This study was the first attempt to review the type of research designs and statistical methods used in medical journals in Myanmar. The current analysis showed that most of the published articles in MHSRJ continued to use a cross-sectional design while survival studies and randomized clinical trials still required more attention as compared to journals of advanced countries. Clinical studies often showed methodological weaknesses. Compared with the clinical researches in the developed countries, clinical research in Myanmar still has ample rooms for improvement not only in study design but also in statistical analyses. Furthermore, the Journal editors and reviewers should carefully review the incorporated design and statistics in the articles considered for publication in the Journal. In the future years, the Journal should try to adhere to specific International Guidelines such as Randomized Trials CONSORT for Randomized Trials, STROBE for Observational Studies, ARRIVE for Animal Research Reporting of In-Vitro Experiments, etc. as much as possible to upgrade the level of the MHSRJ.

DISCLAIMER

The products used for this research were commonly and predominantly products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

It is not applicable.

ETHICAL APPROVAL

As per international standard or university standard ethical approval has been collected and preserved by the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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