Evaluation on Application of Medical Statistics Knowledge for Medical Undergraduates Thesis

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Abstract. Objective: To evaluate the application of medical statistical knowledge among undergraduates of preventive medicine, and to provide suggestions for improving the quality of graduation thesis. **Methods:** A self-designed questionnaire was used to evaluate 1054 papers of undergraduates from 2003 to 2017. **Results:** In 1054 papers from 2003 to 2017, the improper use of statistical descriptive indicators and the incorrect use of one or more statistical inferences in statistical inferences were 6.64% and 4.57% respectively. Simple and complex statistical methods were used differently. The main types of medical statistical methods used in this paper were simple ($\chi^2 = 17.32$, P < 0.01). There are 6 articles using the R×C χ^2 test instead of the χ^2 trend test, accounting for 0.86%, and 38 rank sum test were misused by χ^2 test, accounting for 5.44%. There were 81 cases of variance analysis misused as t test, accounting for 43.32%. Of 24.09% (53/220) were statistical irregularities or incorrect use of statistics. There were 568 statistical Tables in 1017 articles using unstandardized, accounting for 55.85% (568/1017). **Conclusion:** There is still a shortage of undergraduate students in preventive medicine who have mastered and applied medical statistics. There are errors in statistical analysis methods and statistical charts or statistical Tables. The teaching and practical application of medical statistics should be strengthened in a targeted manner.

Introduction

Graduation thesis as an important part of the undergraduate practical teaching link [1] is an important basis for measuring the teaching level, degree qualification and student graduation, as well as the test of the basic knowledge and comprehensive knowledge of students during their school years [2,3]. On the surface, the quality of college graduates seems to reflect only the comprehensive level and ability of students. From a deeper level of analysis, the quality of graduation thesis is a comprehensive reflection of many factors such as school quality, school style, teacher' teaching level, students' comprehensive quality and ability [4]. The quality evaluation of the dissertation is based on the training objectives and the academic level requirements of each degree level, and the corresponding indicators are used as the evaluation basis to judge the pros and cons of the dissertation [5]. In the process of completing the paper, the design of the paper, the collection, collation, analysis and the expression of the results are all inseparable from statistical knowledge. The correct use of statistical knowledge is directly related to the reliability of the results of the paper, and also to the merits and demerits of the paper [6]. In medical colleges, medical statistics and epidemiology are basic courses for undergraduates majoring in prevention. Thesis can directly reflect the learning effect of students on teaching courses. Therefore, by analyzing the application of TCM statistical knowledge in students' papers, we can understand the problems existing in the teaching of medical statistics and epidemiology from the side, so as to guide the teaching of medical statistics and epidemiology. To this end, this study evaluates the graduation theses of Undergraduates in the Department of Preventive Medicine, Medical College of Qinghai University from 2003 to 2017. The present report is as follows.

Research object and method

Research object

1054 graduation theses of undergraduates majoring in preventive medicine from 2003 to 2017 in the Department of Public Health, Medical College of Qinghai University were analyzed and evaluated one by one.

Evaluation tool

Through literature consulting and consulting experts, the thesis of 15 session's undergraduate graduates from 2003 to 2017 was evaluated by self-made evaluation Table. The evaluation covers the use and misuse of statistical descriptions (centralized and discrete trend indicators) and statistical inferences. The usage and misuse of simple statistical methods (t-test, chi-square test, variance analysis, rank sum test, correlation analysis of two variables, simple linear regression) and complex statistical methods as well as meta-analysis. Statistical maps, the use of Tables and non-standard conditions, and finally a comprehensive evaluation of the use of medical statistical knowledge. Before the investigation, the quality evaluators will be uniformly trained, and the data will be entered in strict accordance with the unified standards.

Statistical method

SPSS 20.0 was used for data analysis. The counting data were tested by chi-square tests, and the α level was 0.05.

Results and Analysis

1. Use and misuse of statistical descriptions and inferences

Of the 1054 papers, 889 were statistically described using statistical indicators, accounting for 84.35%. 898 articles were statistically inferred, accounting for 85.20%. In 59 statistical descriptive papers, one or more statistical description indicators were used improperly, and the misuse rate accounted for 6.64% (59/889). In 41 of 898 papers using statistical inference, one or more statistical inference conclusions were incorrect or the calculation was incorrect. The misuse rate was 4.57% (41/898).

2. Use of statistical methods

Overall, 899 papers are still based on simple statistical methods, accounting for 85.29%, while 102 papers are based on complex statistical methods, accounting for 9.68%. There were differences between the two statistical methods ($\chi^2 = 17.32$, P < 0.01). Over the years, the use rate of simple statistical methods is higher than that of complex statistical methods. Previous students have a low rate of use of complex statistical methods, but in the past three years, the use of complex statistical methods has shown an upward trend, and the use of complex statistical methods by students in 2017 is up to 30.88%. See Table 1.

3. Misuse of common statistical methods

Chi-square test was used in 698 papers, accounting for 66.22%. 187 (17.74%) papers used t-test. 203 (19.26%) were used in the variance analysis. There are 6 articles using the R×C χ^2 test instead of the χ^2 trend test, accounting for 0.86%, and 38 rank sum test were misused by χ^2 test, accounting for 5.44%. There were 81 cases of variance analysis misused as t test, accounting for 43.32%.

4. Use of statistical charts and statistical Tables

There are 220 articles used the chart, accounting for 20.87%, and 1017articles used statistical Tables, accounting for 96.49%. The usage rate of statistical Tables was high, and the difference was statistically significant ($\chi^2 = 1242.80$, P<0.01). Over the years, the use of statistical maps by students in 2003-2017 has been on the rise. The utilization rate of statistical maps has increased from 5.06%

in 2003 to 44.12% in 2017. See Table 2.

Table 1 The use of simple, complex statistical methods by students in 2003-2017

Years	Simple statistical method		complex statistical method		Total number of articles
	Number of articles	Proportion (%)	Number of articles	Proportion(%)	
2003	53	67.08	2	2.53	79
2004	53	58.89	3	3.33	90
2005	54	72.00	0	0.00	75
2006	82	95.35	6	6.98	86
2007	43	74.14	1	1.72	58
2008	47	70.15	1	1.49	67
2009	48	92.31	3	5.77	52
2010	60	89.55	4	5.97	67
2011	45	88.24	5	9.80	51
2012	41	100.00	4	9.76	41
2013	48	100.00	5	10.42	48
2014	75	100.00	7	9.33	75
2015	102	94.44	29	26.85	108
2016	83	93.26	11	12.36	89
2017	66	97.06	21	30.88	68
Total	899	85.29	102	9.68	1054

Table 2 Use of statistical charts and Tables by students in 2003-2017

Years	Use chart		Use Table		Total number of articles
	Number	Rate (%)	Number	Rate (%)	
2003	4	5.06	54	68.35	79
2004	2	2.22	85	94.44	90
2005	4	5.33	72	96.00	75
2006	12	13.95	85	98.84	86
2007	8	13.79	58	100.00	58
2008	11	16.42	66	100.00	67
2009	7	13.46	52	100.00	52
2010	3	4.48	67	100.00	67
2011	10	19.61	50	98.04	51
2012	6	14.63	41	100.00	41
2013	17	35.42	48	100.00	48
2014	18	24.00	75	100.00	75
2015	39	36.11	107	99.07	108
2016	49	55.06	89	100.00	89
2017	30	44.12	68	100.00	68
Total	220	20.87	1017	96.49	1054

5. Misuse of statistical charts and Tables

Of the 220 papers, 53 were unregulated or misused when using statistical charts, accounting for 24.09% (53/220). Among them, there are 12 papers with missing labels or titles, accounting for 22.64% (12/53) of irregular or incorrect use of statistical charts; in 25 papers, the vertical or horizontal axes of statistical charts are not standardized, accounting for statistical charts. 47.07% (25/53) of non-standard or misuse; there are 15 papers that use a bar graph instead of a circle or a percent bar chart, accounting for 28.30% (15/53) of the irregular or incorrect use of the chart; In the three papers, the bar graph is conflated with the histogram, accounting for 5.66% (3/53) of the irregular or incorrect use of the chart. See Table 3.

Table 3 Non-standard or incorrect use of statistical charts

Misuse types	Yes	No	Error rate(%)
Lack of labels or titles in statistical charts	12	41	22.64
The expression of vertical or horizontal axes of statistical charts is not standardized.	25	28	47.07
Substitute a histogram for a circle or percentage bar chart	15	38	28.30
Confusion between histogram and histogram	3	50	5.66
Total	55	157	25.94

In the 1017 papers, the statistical Tables of 568 papers were used irregularly, accounting for 55.85% (568/1017). Among the 4 papers, the statistical Table lacks labels or titles, accounting for 0.70% (4/568) of irregular or insufficient statistical Tables; There are 3 papers that split a composite Table into several simple Tables, accounting for 0.53% (3/568) of irregular or insufficient statistical Tables; There are 124 papers that compose several simple Tables with different properties into a composite Table, accounting for 21.83% (124/568) of irregular or insufficient statistical Tables; In the Table of 177 papers, the same column of data is not aligned or the decimal number is inconsistent, accounting for 31.16% (177/568) of the statistical Table is not standardized or insufficient; The vertical and horizontal headings of the Tables with 44 papers are reversed, accounting for 7.75% (44/568) of irregular or insufficient statistical Tables; There are 169 papers in which the symbols are cumbersome or irregular, accounting for 29.75% (169/568) of the irregular or inadequate statistical Tables. See Table 4.

Table 4 Non-standard or inadequate statistics

Misuse types	Yes	No	Error rate(%)
Lack of labels or titles in statistical Tables	4	564	0.70
Split a composite Table into several simple Tables	3	565	0.53
Force several simple Tables of different properties to be compounded into a composite Table	124	444	21.83
Unaligned or inconsistent decimal digits in the same column of data in the Table	177	391	31.16
The vertical and horizontal headings of the Table are reversed	44	524	7.75
Representation of symbols in Tables is cumbersome or nonstandard	169	399	29.75
Total	521	2887	15.29

Discussion

Via this research, it is found that one or more statistical description indicators in the papers of undergraduate graduates have one or more statistical inferences, and one or more statistical inferences are incorrect or the miscalculation rate is relatively low. Explain that the students have a good grasp of the conditions of use of the indicators when describing the data. However, the simple statistical method is still used for data analysis, and the use rate of complex statistical methods is lower. In recent years, the use of complex statistical methods has shown an upward trend. In addition to completing the thesis, students will complete the graduation internship in one semester. In addition, it is necessary to cope with the pressure of employment. It is difficult for students to read a lot of literature conduct experimental operations or conduct on-site investigations [7], so students will choose simple statistical methods to analyze data. In the analysis of inappropriate use of statistical methods, it was found that students did not grasp enough conditions for the use of chi-square test and rank sum test, and the rate of inappropriate use was 5.44%. The variance analysis that should be used in the comparison of multiple sample mean is simplified artificially and divided into two sample mean by t test, which results in the decline of test efficiency. The incorrect statistical analysis method may be related to students' inadequate grasp of medical statistical knowledge or limited ability to use it. Although the our university has offered courses of graduation

thesis writing, there are still many students who have not mastered the basic skills of making charts when they formally do graduation thesis, which leads to the misuse or non-standardization of statistical charts and Tables.

To sum up, the statistical application ability of medical students is trained. To change this situation, it is necessary to strengthen students' training in the application of statistical knowledge in peacetime [8]. We should be improved from the following aspects: First, through timely adjustment of the completion time of graduation thesis, the completion time of graduation thesis teaching tends to be reasonable [9], and the support of experimental conditions should also be increased [10]. Second, teachers should strengthen students' knowledge of medical statistics, appropriately increase teaching cases, and integrate the teaching of graduation thesis into all aspects of daily teaching [11]. At the same time, pay more attention to practical teaching in the teaching process, improve students' ability to analyze and solve problems [12], and enhance students' ability to use medical statistical knowledge. Third, reduce the number of instructors to teach, increase the number of instructors, and appropriately select teachers with practical ability or scientific research ability to serve as instructors [13]. Fourth, carry out appropriate special training, strengthen students' training in the basic skills of making statistical charts and statistical Tables, and urge students to seriously complete graduation thesis writing.

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