ORIGINAL REPORT

Knowledge of Medical Students of Tehran University of Medical Sciences Regarding Plagiarism

Mohammad Hadi Gharedaghi[1,2], Keramat Nourijelyani[2], Mohammad Salehi Sadaghiani[1,2], Yashar Yousefzadeh-Fard[1,2], Azadeh Gharedaghi[1], Pouya Javadian[3], Afsaneh Morteza[4], Yasir Andrabi[1,2], and Saharnaz Nedjat[2,5]

[1] *Department of Pharmacology, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran*

[2] *Department of Epidemiology and Biostatistics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran*

[3] *Maternal-Fetal-Neonatal Health Research Center, Tehran University of Medical Sciences, Tehran, Iran*

[4] *Endocrinology and Metabolism Research Center, Tehran University of Medical Sciences, Tehran, Iran*

[5] *Knowledge Utilization Research Center, Tehran University of Medical Sciences, Tehran, Iran*

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Abstract- The core concept of plagiarism is defined as the use of other people's ideas or words without proper acknowledgement. Herein, we used a questionnaire to assess the knowledge of students of Tehran University of Medical Sciences (TUMS) regarding plagiarism and copyright infringement. The questionnaire comprised 8 questions. The first six questions of the questionnaire were translations of exercises of a book about academic writing and were concerning plagiarism in preparing articles. Questions number 7 and 8 (which were concerning plagiarism in preparing Microsoft PowerPoint slideshows and copyright infringement, respectively) were developed by the authors of the present study. The validity of the questionnaire was approved by five experts in the field of epidemiology and biostatistics. A pilot study consisting of a test and retest was carried to assess the reliability of the questionnaire. The sampling method was stratified random sampling, and the questionnaire was handed out to 74 interns of TUMS during July and August 2011. 14.9% of the students correctly answered the first six questions. 44.6% of the students were adequately familiar with proper referencing in Microsoft PowerPoint slideshows. 16.2% of the students understood what constitutes copyright infringement. The number of correctly answered questions by the students was directly proportionate to the number of their published articles. Knowledge of students of TUMS regarding plagiarism and copyright infringement is quite poor. Courses with specific focus on plagiarism and copyright infringement might help in this regard.

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Keywords: Copyright infringement; Medical students; Microsoft Power Point slideshow; Plagiarism

Introduction

Plagiarism refers to the unacknowledged use of other people's ideas or words, and comprises the use of published or unpublished data in the original language or as a translation without crediting the author(s) (1). The first use of the term plagiarism probably dates back to the first century when it was employed by Marcus Valerius Martialis to describe the theft of the intellectual assets of others without proper attribution (2). Even the most renowned scientists of all history like Newton and Pythagoras have been accused of indulging in plagiarism after their work had been re-examined by other scientists (3,4).

The issue of plagiarism is of great concern these days. Despite the negative view of the scientific community towards plagiarism, statistics show that a considerable proportion of researchers commit plagiarism (5). Among researchers, students are the least experienced, and therefore, they are more likely to commit plagiarism unintentionally. For this reason, this population has been studied in many articles in terms of knowledge of plagiarism and attitudes toward it (6-9).

The total number of published articles by Iranian researchers, number of citations to Iranian articles and Iran's rank in terms of number of published ISI citations

Corresponding Author: Keramat Nourijelyani
Department of Epidemiology and Biostatistics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran, P.O. Box: 13145-784
Tel: +98 21 88989124, Fax: +98 21 88989125, E-mail: nourik@tums.ac.ir

between the years 2007 and 2011 were 72179, 294735 and 29th, respectively (10). Tehran University of Medical Sciences (TUMS) has held the first rank in research for 9 consecutive years among all the medical universities of Iran. Despite this fact, scientific writing is not part of the curriculum for medical students of TUMS. Herein, we assessed the extent of knowledge of senior medical students regarding plagiarism. Our intention of conducting such a research is to determine the status quo in terms of the level of understanding of medical students of TUMS about this matter, and possibly draw the attention of faculty members to the fact that educational programs need to be carried out to minimize plagiarism in this susceptible population.

Materials and Methods

As previously described, a questionnaire was used in this study to evaluate the knowledge of students regarding plagiarism. At the beginning of the questionnaire, we asked the participants about their gender, age, academic year and semester and whether or not they had previously published an article. Those who had previously published an article were asked about the number of their publications. We also inquired about whether or not they had attended scientific writing classes before. Medical students of TUMS can also voluntarily participate in MPH classes as an MD-MPH student. MD-MPH students attend many classes which are intended to familiarize students with different research methodologies and increase their research skills. Based on this fact, we thought that these classes might give an insight of the issue of plagiarism to MD-MPH students, and probably increase their capability to correctly detect examples of plagiarism. Consequently, we also asked if the participants of our study had attended the MPH classes. We provided a brief explanation of plagiarism at the beginning of the questionnaire. The questionnaire comprised 8 scenarios, and each scenario explained the method by which a student prepares an article or a PowerPoint slideshow. We asked the participants to read each scenario and decide whether or not the student's act is acceptable (Appendix 1).

The first six questions of the questionnaire were translations of exercises of a book named "Academic writing for graduate students: essential tasks and skills" authored by Swales and Feak and published in 1994 (11). These questions were intended to assess the knowledge of students regarding plagiarism in preparing articles. In order to estimate the proportion of students who are familiar with plagiarism in preparing Microsoft PowerPoint slideshows, question 7 was added to the questionnaire. Question 8 assessed the participants' knowledge regarding copyright infringement.

Five experts in the field of epidemiology and biostatistics read the questionnaire and approved its face and content validity (12,13). To assess the reliability of the questionnaire, a pilot study was carried out at three teaching hospitals affiliated to TUMS (Imam Khomeini Hospital, Shariati Hospital and Sina Hospital), and 19 students were asked to complete the questionnaire twice (the test and retest were performed with a 2 week interval in July 2011). Participants of the pilot study were interns (year 6 and 7 medical students), and stratified random sampling was used as the sampling method. Stratification was based on the proportion of male interns to female interns and the total number of interns in the three teaching hospitals. The strata were as follows: six male and four female interns from Imam Khomeini Hospital, three male and three female interns from Shariati Hospital, two male and one female intern from Sina Hospital). Cohen's kappa was calculated for each question based on the results of the test and retest (Table 1). The data obtained during the pilot study was not combined with the data of the main study.

Table 1. Cohen's kappa and number of correct answers to the questions by interns of Tehran University of Medical Sciences. Nineteen and 74 interns participated in the pilot study and the main study, respectively.

Question	Cohen's kappa	Number of correct answers (%)		
		Pilot study		Main study
		Test	Retest	
1	0.87	5 (26.3%)	6 (31.6%)	22 (29.7%)
2	0.78	11 (57.8%)	11 (57.8%)	38 (51.3%)
3	0.79	12 (63.2%)	10 (52.6%)	50 (67.6%)
4	0.79	10 (52.6%)	12 (63.2%)	38 (51.3%)
5	1	17 (89.5%)	17 (89.5%)	69 (93.2%)
6	1	19 (100%)	19 (100%)	67 (90.5%)
7	0.9	9 (47.4%)	10 (52.6%)	33 (44.6%)
8	0.77	2 (10.5%)	3 (15.8%)	12 (16.2%)

Appendix 1.

The questionnaire which was used for the study (Scenarios number 3 and 5 were considered acceptable by the authors. All the other scenarios were considered as an unacceptable act).

The purpose of the questionnaire before you is to assess your knowledge about the issue of plagiarism. You might have heard of the term plagiarism before. In brief, this term refers to the unacknowledged use of other people's words, ideas or findings. Nowadays, a lot of attention is being given to the issue of plagiarism, especially in the context of research publication. Please fill the required information below (your gender, age, academic year and semester, number of published articles, attendance in scientific writing classes and attendance in MPH classes), and decide whether each of the presented scenarios below is or is not an example of plagiarism.

Gender: …… Age: ……. Academic year and semester: …….

Do you have any published articles? If yes, how many?

Have you ever attended a scientific writing class?

Have you attended MPH classes as an MD-MPH student?

Scenario 1. A student takes phrases of 10 to 15 words from different sources and puts them together. He/she also adds a few sentences of his own and makes a complete and coherent paragraph. All sources appear in a list of references at the end of the article.

Is the student's act an example of plagiarism? Yes ☐ No ☐

Scenario 2. A student copies a paragraph from a textbook or web page. He/she makes small changes in the paragraph (replaces a few verbs and adjectives). The source appears in a list of references at the end of the article.

Is the student's act an example of plagiarism? Yes ☐ No ☐

Scenario 3. A student paraphrases a paragraph. He/she substantially changes the language, structure and arrangement of the sentences. Some of the details are also changed. The source appears in a list of references at the end of the article.

Is the student's act an example of plagiarism? Yes ☐ No ☐

Scenario 4. A student copies a paragraph from another source. He/she omits one or two sentences and puts one or two sentences in a different order. The source appears in a list of references at the end of the article.

Is the student's act an example of plagiarism? Yes ☐ No ☐

Scenario 5. A student quotes a paragraph by using quotation marks (" ") and/or placing it in italic font. He/she mentions the source in the text and includes the citation in a list of references at the end of the article.

Is the student's act an example of plagiarism? Yes ☐ No ☐

Scenario 6. A student copies a paragraph from a textbook or web page.

Is the student's act an example of plagiarism? Yes ☐ No ☐

Scenario 7. A student finds a picture in Google and uses it in preparing a Microsoft PowerPoint slideshow. The picture had been published in a journal a year ago.

Is the student's act an example of plagiarism? Yes ☐ No ☐

Scenario 8. A student puts a graph from another source in his/her article. The graph belonged to an article which had been published 3 years ago. He/she refers to the source of the graph within the text and in the reference list at the end of the article.

Is the student's act acceptable? Yes ☐ No ☐

Initially, we also included a question after each scenario which asked the participants to state whether or not they had previously acted in the same way as the student in the scenario. However, the participants of the pilot study argued that this matter is very personal, and it should not be asked in the questionnaire. For this reason, during the main study, we omitted this question and only asked the participants to state whether the student's act in each scenario is acceptable or not.

The main study was carried out in July and August 2011. The participants were all interns (year six and seven medical students) at the time of the study. The total number of interns of TUMS at the time at which this study was carried out was about 200 (approximately 110 male and 90 female). We specifically chose this group since medical students are all mandated to hand in the proposal for their thesis before beginning internship. They must finish their thesis before graduation. Those who do not present their thesis as articles in ISI, Medline, Scopus or EMBASE cited journals lose 2 marks (10% of the whole marks). Considering the forgoing we believe that interns should be well aware of what constitutes plagiarism.

The questionnaires were anonymous, and we assured

the participants that the data they provided would only be used for research purposes and remain confidential. In addition, the study design was approved by the ethics review committee of TUMS. The required sample size was calculated based on Cochran's formula and the results of the pilot study (14). We conducted the main study in all the teaching hospitals of TUMS, and used stratified random sampling as the sampling method. The size of each stratum was based on the ratio of male to female interns and the number of interns present at each teaching hospital. Questionnaires were handed out during lunch time, when many interns where present in the fraternity home. Before handing out the questionnaire, we asked the interns whether they had previously completed the questionnaire during the pilot study. The questionnaire was not handed out to those who had participated in the pilot study.

We used SPSS version 13 to carry out the analyses in the study. Chi-square analysis, Mann-Whitney U test, Spearman's rank correlation test, linear regression and binary logistic regression were the analyses used in our study. P-values less than 0.05 were considered statistically significant.

Results

Table 2 summarizes general characteristics of the participants of the study. In total 74 students (41 male and 33 female) participated in the study. The response rate was 100%. Their age ranged from 24 to 33 and the mean age was 25.52±0.18. Twenty seven of them had attended scientific writing classes, while forty seven had not. Forty five students did not have any published articles. Twenty two of them were MD-MPH students.

As previously described, questions 1 through 6, question number 7 and question number 8 evaluated the ability of participants to correctly recognize plagiarism in preparing articles, plagiarism in preparing slideshows and copyright infringement, respectively. Eleven students (14.9%) correctly answered all of the first six questions. Thirty three students (44.6%) gave a correct answer to question number 7. Twelve students (16.2%) correctly recognized the copyright infringement explained in scenario 8. Surprisingly, only one student out of 74 (1.4%) correctly answered all 8 questions (Table 1).

Regarding the number of correct answers to the first six questions, there was no statistically significant difference between the students who had attended scientific writing classes and those who had not (4.11±0.27 *vs.* 3.68±0.16, respectively; P=0.24). Additionally, no statistical difference was evident when we compared the number of students who answered question number 7 correctly between the two groups (P=0.64; odds ratio=1.25). A similar result was obtained regarding question number 8 (P=0.68; odds ratio=1.29).

MD-MPH students had a mean score of 4.22±0.30 in questions 1 to 6, while MD students scored 3.67±0.16. However, the difference was not statistically significant (P=0.13). Thirteen out of 22 MD-MPH students gave a correct answer to question number 7, while 20 out of 52 MD students correctly answered this question. Again, the difference did not yield a significant P (P=0.10; odds ratio=2.31). We carried out the same analysis for question number 8 and obtained similar results (P=0.69; odds ratio=0.75).

Table 2. General characteristics of participants. Data are presented as number (%) or mean ± SEM

Variables		Number (%) or mean ± SEM
Gender	Female	33 (45%)
	Male	41 (55%)
Age		25.52 ± 0.18
Year and semester	Year 6 semester 13	22 (30%)
	Year 7 semester 14	24 (33%)
	Year 7 semester 15	28 (37%)
Published articles	0	45 (61%)
	1 – 3	22 (30%)
	4 – 9	6 (8%)
	9 <	1 (1%)
Participants who had attended scientific writing classes		27 (36%)
Participants who had attended MPH classes		22 (30%)

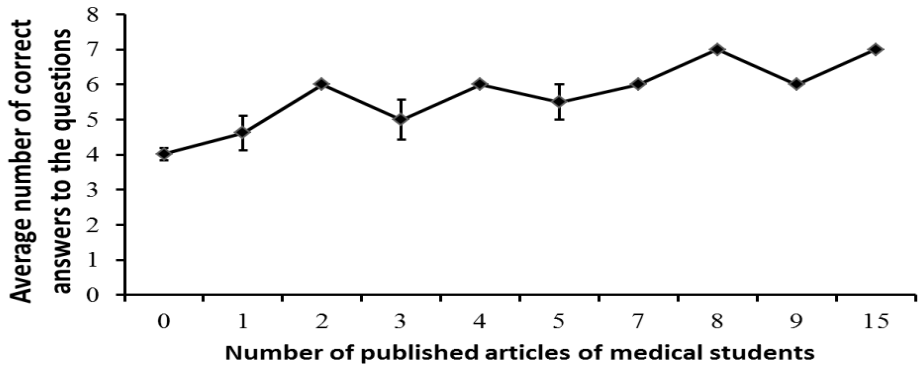

Figure 1. Relation between the number of published articles by the students and the number of correct answers to the questions of the questionnaire. Data are represented as mean ± SEM.

Figure 1 depicts the relation between the number of published articles of the students and the number of correctly answered questions by the students. Regarding questions 1 to 6, the number of correctly answered questions by the students was directly correlated with the number of articles he/she had published (Spearman's rank correlation coefficient = 0.26; *P*=0.023). We used a binary logistic regression to analyze the relation between the number of published articles by the students and correctly answering questions number 7 and 8. The analysis revealed that, the larger the number of published articles by a student, the higher the probability of correctly answering question number 7 (*P*=0.017; odds ratio=1.52). However, such a relation was not true for question number 8 (*P*=0.22; odds ratio=1.14).

To assess the contribution of different factors in the number of correct answers for all eight questions, we performed a linear regression analysis. Gender, age, academic semester, number of published articles, attending scientific writing classes and attending MPH classes were entered as independent variables. Variance inflation factor, the Durbin-Watson statistic and normal P-P plot of regression standardized residuals were checked to rule out multicollinearity, autocorrelation and non-normality of the residuals. The analysis revealed that the only variable which significantly correlated with the number of correctly answered questions was the number of published articles (*P*=0.008; Figure 1).

Discussion

Authors might unintentionally commit plagiarism. For instance, many authors might not realize that when they use 7 or more consecutive words from another article the phrase must come in quotation marks (15). In addition, an author might unintentionally plagiarize by presenting an idea which he/she himself thinks of it as an original and novel finding, although he/she had heard or read about it in the past. In other words, he/she has forgotten the source of that knowledge. This is referred to as "cryptomnesia"(16). It would be convenient to use the references that have been listed by another author for his/her article, to provide references for our own articles without reading the original articles. However, if the author had mistaken, that is the original article does not mention what has been cited or conveys the opposite, we would be committing some kind of plagiarism known as "second generation referencing". If we list a large amount of references for a single statement in our article while some of those references are actually unrelated to that statement, we would be committing another form of plagiarism termed "blanket referencing"(17). Issues like those mentioned above indicate that although, at first glance, the concept of plagiarism seems to be very simple, researchers need to be familiar with the diverse technical aspects of it.

Previous studies in universities of Pakistan, Croatia and the United Kingdom demonstrated that a minority of students were aware of the correct way of referencing materials from articles and the web (6,7,9). In addition to being aware of what counts as plagiarism, researchers need to understand what is considered moral and acceptable referencing in literature. A study carried out among pharmacy students of the University of Sydney revealed that 31% of undergraduates and 41% of postgraduates believed that citing verbatim phrases from other articles using quotation marks, indentation and referencing is unacceptable, while the opposite is true (8).

The first six questions of the questionnaire were translations of exercises of a book named "Academic writing for graduate students: essential tasks and skills"

authored by Swales and Feak and published in 1994 (11). Dennis used this questionnaire and found that a large number of computer science students in the University of Nottingham were not completely aware of all the aspects of plagiarism (18). Our study revealed that the knowledge of medical students of TUMS regarding plagiarism is quite poor. Only 14.9% of the students seemed to be well acquainted with moral and acceptable referencing.

Scientific writing classes for students are held by the Students' Scientific Research Center at TUMS. Since these classes are not part of the curriculum for medical students, some students voluntarily attend these classes. The purpose of these classes is to promote the writing skills of students and help them publish articles. However, it seems that these classes have not been effective in terms of increasing the students' knowledge of plagiarism. On the other hand, although some of the MPH classes focus on scientific research and critical appraisal of medical articles, our study revealed that MD-MPH students do not score more than MD students.

In the present study, it was found that students who had a higher number of published articles gave more correct answers to the questions. This might be due to the fact that students of TUMS become familiar with the concept of plagiarism while writing manuscripts and gaining feedback from their peers, supervisors or even reviewers of their articles. This indicates that students might unintentionally commit plagiarism while preparing their first few articles and this plagiarism might go unnoticed. Ergo, we believe that students must be educated regarding this issue. Since plagiarism appears to be overlooked in some scientific writing classes, certain courses need to be held which specifically focus on plagiarism.

Currently, Iran is not a full member of the World Trade Organization. Therefore, copyright laws are not popular among Iranians (19). This is why many of the students in our study (even those who had a large number of published articles) gave an incorrect answer to question number 8. Many Iranian articles are published by journals belonging to countries which are bound to copyright laws. Consequently, we believe that scientific writing courses should also familiarize Iranian researchers with copyright laws.

The present study showed that senior medical students of TUMS are not adequately familiar with plagiarism and copyright infringement. According to the Academic Ranking of World Universities (ARWA) TUMS has the highest rank among Iranian universities (20). Therefore, students of other universities of Iran might also lack a satisfactory level of knowledge regarding plagiarism. Moreover, studies on students of other universities in Middle Eastern countries have reported similar results (6).

In our study, about 10% of the students were not aware that copying a paragraph from a textbook or a web page is unacceptable. This might indicate that a proportion of students are not aware of plagiarism at all. Unfortunately, in spite of increasing worldwide concerns regarding plagiarism, Iranian universities have done little to confront this issue. In our opinion, integrating scientific writing courses that specifically focus on plagiarism and copyright infringement in the curriculum of medical schools might help to minimize unintentional plagiarism among students.

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