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REVIEW

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Plagiarism in Scientific Research and Publications and How to Prevent It

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ABSTRACT

Quality is assessed on the basis of adequate evidence, while best results of the research are accomplished through scientific knowledge. Information contained in a scientific work must always be based on scientific evidence. Guidelines for genuine scientific research should be designed based on real results. Dynamic research and use correct methods of scientific work must originate from everyday practice and the fundamentals of the research. The original work should have the proper data sources with clearly defined research goals, methods of operation which are acceptable for questions included in the study. When selecting the methods it is necessary to obtain the consent of the patients/respondents to provide data for execution of the project or so called informed consent. Only by the own efforts can be reached true results, from which can be drawn conclusions and which finally can give a valid scholarly commentary. Text may be copied from other sources, either in whole or in part and marked as a result of the other studies. For high-quality scientific work necessary are expertise and relevant scientific literature, mostly taken from publications that are stored in biomedical databases. These are scientific, professional and review articles, case reports of disease in physician practices, but the knowledge can also be acquired on scientific and expert lectures by renowned scientists. Form of text publications must meet standards on writing a paper. If the article has already been published in a scientific journal, the same article cannot be published in any other journal with a few minor adjustments, or without specifying the parts of the first article which is used in another article. Copyright infringement occurs when the author of a new article, with or without mentioning the author, uses a substantial portion of previously published articles, including past contributions in the first article. With the permission of the publisher and the author, another journal can re-publish the article already published. In that case, that is not plagiarism, because the journal states that the article was re-published with the permission of the journal in which the article is primarily released. The original can be only one, and the copy is a copy, and plagiarism is stolen copy. The aim of combating plagiarism is to improve the quality, to achieve satisfactory results and to compare the results of their own research, rather than copying the data from the results of other people's research. Copy leads to incorrect results. Nowadays the problem of plagiarism has become huge, or widespread and present in almost all spheres of human activity, particularly in science.

Scientific institutions and universities should have a center for surveillance, security, promotion and development of quality research. Establishment of rules and respect the rules of good practice are the obligations of each research institutions, universities and every individual researchers, regardless of which area of science is being investigated. There are misunderstandings and doubts about the criteria and standards for when and how to declare someone a plagiarist. European and World Association of Science Editors (EASE and WAME), and COPE - Committee on Publishing Ethics working on the precise definition of that institution or that the scientific committee may sanction when someone is proven plagiarism and familiarize the authors with the types of sanctions. The practice is to inform the editors about discovered plagiarism and articles are withdrawn from the database, while the authors are put on the so-called black list. So far this is the only way of preventing plagiarism, because there are no other sanctions. **Key words: scientific research, ethics, citing, plagiarism.**

1. SCIENTIFIC RESEARCH AND PHASES OF SCIENTIFIC RESEARCH

Jacques Yves Cousteau said: "What is a scientist after all? Scientist is a curious man looking through a keyhole of nature, trying to understand what is happening" (1).

Whether it comes to young enthusiasts eager to contribute to the scientific community or, in turn, experienced scientific researchers who want to establish their name in the pillars of science for the general good of the research, from the idea to the final realization there is a certain sequence of steps to be followed (2). Scientific research in medicine is the process of implementation of systemic study within well-defined aspects which can contribute to universal mental, physical and social well-being of individuals and communities, as defined in the Constitution of the World Health Organization (WHO). There are several types of medical scientific research: laboratory, clinical research and public health. Scientific research contributes to the community and individuals in the community. The benefit to the community is reflected in the collection of evidence that will enhance clinical and socio-medical policies and practices, identifying health problems and methods of health promotion, prevention of disease and disability, the expansion of scientific literature that is the basis for all future scientific research, policy and practice. The well-being of the individual is acquiring new knowledge, and the development of new, improved skills, which will result in the individual academic growth (3, 4, 5).

1.1. Scientific research

In order that research project be valuable and recognized by the academic community and other researchers, it is essential that contains the same elements as other articles. It does not matter to which level of academic status belong the author of the study, it is essential that the steps are the same for all studies. The author Kathryn H. Jacobsen in her book "Introduction to Research Methods in Health: A Practical Guide" (1) states that the research process consists of five steps: problem identification, selection of the research manner, the choice of study design and data collection, data analysis and writing the conclusion (5, 9).

Studies on the population level have clearly defined goals, while the most important of these are (5-10):

- Identifying and classifying new clinical identity;
- Detection of risk factors for disease;
- The development and testing of new protocols for the prevention or treatment of disease (1, 8).

The process of scientific research from ideas, hypothesizing, through evidence, analysis of results, to the conclusion and publication of research results in an indexed journal can take months, even years. Unfortunately, the funds allocated for research is often provided by the researchers themselves, and it is a major limiting factor that some research can even begin or end.

1.2. Stages of scientific research

Scientific research has several stages (11-20):

- Determining research topics;
- The choice of scientific methods of research;
- Study design and data collection;
- Data processing, analysis and interpretation;
- Writing and publishing a scientific article;

1.3. Rules for proper research

In order that study had its purpose and effects, but also justify the intent and invested funds, it must meet certain postulates:

- Every scientific research from idea to written scientific article should go through certain phases: the review of the relevant literature on the topic of research, defining the objectives and hypotheses of research, sample selection for the study, implementation of research based on scientific methodological principles, statistical analysis, comparing the obtained own results with results of other authors published in scientific publications, conclusions and specific recommendations for any specific application in practice. Study design and project outline research are usually conducted by experienced researchers as mentors and by own work;
- Researchers and authors of scientific papers must follow the rules of the Ethics Code of Good Scientific Practice (GSP), primarily to follow the principles of honesty and integrity;
- Researchers rely on published data, and must be trained to selectively process the information, then, must be able to distinguish between original ideas and, finally, to have knowledge in order that their research results are compared with previously published in the scientific literature.

In order to achieve and realize the above mentioned:Authors are required to follow ethical principles and stick

to moral and legal regulations acceptable by the scientific community;

- Authors must properly cite relevant publications and cite facts and conclusions, or published or unpublished ideas and words of other researchers and authors. The reader should be clearly informed of the facts from the original texts of other authors, or of recycled articles from other sources (numerical marking, following Vancouver, the Harvard, APA, PubMed and other rules of citation of articles and other sources, for example: 2,9,14,15, etc.);
- Authors should properly cite references in their original form (the author(s), article title, abbreviated journal title, year of publication, volume editions, number, initial and final page of the published article, or the other sources in accordance to the order prescribed);
- Authors should use the knowledge acquired in the lectures, conferences or other sources of scientific and technical literature, provided that each source must include full bibliographic information;
- Authors must each citation in the text indicated in the bibliography at the end of the text and put it in quotation marks copied the contents of which have more than six consecutive words;
- Authors must obtain permission from other authors or publishers of scientific reproduction of protected materials (texts, images, charts, graphs, etc.) copyright;
- If the author re-used text or attachment as another author's own observations, then published in the article, in quotation marks, should be accompanied by a quote of recycled text, published in the primary source;
- Authors and coauthors must sign a declaration of originality and authorship which provides descriptions of contribution by each of them separately in an article that is going to be published;
- Every author of the publication must respect the rules of writing an article in which he/she wants to publish the article, considering that most journals have their own rules, but in line with the principles ICMJE, COPE, etc.

1.4. Scientific publishing

Publications are the products of scientific work. Once published, scientific work becomes a source of reference, post publishing review and critique. To contribute to the largest evidence-based medicine (EBM), the paper should be credible, while honesty of each author becomes a pillar of trust in science. Researchers become responsible for what they publish and influence the future of the publication, science and education in general.

2. SCIENTOMETRICS

Scientometrics is part of Scientology (the science of science) that analyzes scientific papers and their citations in scientific journals selected sample (1, 8).

The term scientometrics first appeared in the literature in 1969. The original definition of scientometrics is that it is a scientific discipline or field of science that deals with the study of science as an information process by applying quantitative (statistical) methods, and later Tibor Braun (who is the 1977 formed an international magazine Scientometrics) introduced the world to name Scientometrics (8). Some of the indicators used in the evaluation of scientific research (1, 8):

- Impact Factor;
- Citing articles;
- Citing journal;
- The number and order of authors, etc.

Impact factor is the number of citations of articles published in the journal during the previous two years, divided by the total number of articles published in the journal for the same time period. Impact factor depends on: the quality of the journal, the language in which it was printed, the territory covered by the distribution system (8).

2.1. Impact factor (IF)

Given the growing number of scientific publications, there is a need among the readership to assess quality and reliable source of information. IF is the most commonly used evaluation aid. IF does not indicate quality, but high impact factor indicates the possibility of high quality (1, 4, 6, 8).

In order to assessed IF and citation in general, it uses a large number of databases, such as Thomson Reuters' Web of Science (WoS), Scopus, etc. Thomson Reuters Journal Citation Reports are involved and the scientific citation index (Science Citation Index, SCI) and Social Scientific Citation Index (SSCI) (1).

In the use of IF there are some pitfalls to be avoided (1):

a) The time window for the impact factor

The two-year period is not long enough to assess the quality over quoting, as in many disciplines, yet these publications did not reach the top. Five-year estimate of IF gives better results.

b) Self citation and active manipulation of the impact factor

Citing is considered as "currency" of modern science, which is why its analysis of the editors, authors and readers become indispensable. Many authors, intentionally and inappropriately, citing their previous articles to raise their rating in the research community.

c) Coverage and preference of English language in the SCI database

SCI database covers less than one-quarter reviews of contemporary journals and shows preference to journals in the English language. As a result this reveals a serious discrepancy between the citation in English and in other languages.

d) Impact factor is an arithmetic measure of the journal and cannot predict the quality of the article

In 2009 an article had 5,624 citations, which shifted IF this journal from 3 to 49.93 while all other articles in this journal had three or less citations. Because of this uneven distribution it is impossible to estimate the IF on the basis of a single article or author (1, 5).

e) Impact factor is incomplete in assessment focused on journals

Incompleteness depends among other things on, the discipline, the language and location of scientists-researchers.

f) Subject areas and categories of scientific articles

Articles within the fast growing discipline is more quoted than traditional scientific fields, such as mathematics and theoretician. These varieties give a distorted picture of the rating of certain journals. Also, some subject areas are additionally cited with works from other areas. Examples of medical, clinical studies that rely on the results of basic science, resulting in 3-5 times larger number of citations of articles of basic medicine in relation to the clinical part. The consequence is that the basic medical journals have higher IF of the journal Clinical Medicine, which does not give a realistic picture of any original research note. On the other hand, review articles are cited more often than the original parts, so many journals and IF it's rating rose by publishing an increasing number of review articles.

g) Withdrawn articles

Invalid works, such articles withdrawn continue to be cited in other articles. It leads to the bias in the calculation of IF.

2.2. H-index and its application

H-index is based on the number of cited articles of an author published in a journal or other publications in relation to the number of citations of these articles in other publications. Citing provides insight into the scientific work because it encourages scientists to deal with the most current topics (1, 8).

With regard to the respective issues when calculating the IF, the scientific community has proposed many solutions. Hirsch in 2005 suggests that every scientist has its own H-index. It is probably the simplest index, oriented on scientist and defined as the number of articles by the number of citations \geq h. in order To raise his/hers H-index, the author must be cited additional 2h+1 times. For example, to increase its H-index from 4 to 5 must be quoted another nine times. Its only drawback is that this factor is unfavorable for young researchers who have not had enough opportunities to publish a large number of works in the short time they had available for research. Schreiber suggests that in calculating the H-index should not be used self citation because it is unethical and is subject to manipulation, and introduces the concept of "the honest h index, hh) (1). Yet, despite its many shortcomings, the Impact Factor is currently most often used metric tool for assessing the journal, which should be a message to researchers to continue their search for a reliable and applicable scientometrics method (1, 22).

All persons who present themselves as the authors of the article must meet the following requirements: to have contributed significantly to the planning and preparation of the article, or analysis and interpretation of results and participated in writing and correcting the article, as well as to agree with the final version of the text. People engaged in collecting data or superior researchers, however, have not been active participants in the development of scientific work and cannot be authors. The editor has the right to ask the author to explain the individual contribution of each of them. The contribution of one author is 1, and if in the preparation of the article participated many authors, their contribution is 1/n. This means that the contribution of each subsequent is half the size of the contributions of previous author in order. The order is determined by agreement between the authors (8, 9).

3. CITING

Citing is the way in which the author explains to the readers that certain textual content contained in particular paper is taken from another source. It also gives the reader insight they needed to find the original source, including:

Information concerning the author;

- Title of the article;
- Page numbers from which the material was taken;
- Time when some content was "downloaded" from some official sites where the content is stored and presented for public use (Open access).
- a) WHY cite?

Recognition of authorship by quoting is the only proper way to use the work of others and not to commit plagiarism. There are many reasons that source should be cited:

- Citing helps greatly to the one who wants to know more about the author's ideas and where these ideas came;
- Not all the sources are as good and true. Journals with a high above mentioned indices are relevant to quote;
- Citing shows how much work has gone into research;
- Citing helps the reader to distinguish between the author's and ideas of others.

Very important issues to be considered when quoting content of other authors from scientific publications are:

b) WHEN to cite;

- When to use quotation marks;
- When to paraphrase;
- When to use an idea already expressed by someone?

c) There are different styles of citation:

- CHICAGO;
- MLA (MODERN LANGUAGE ASSOCIATION);
- ACS (AMERICAN CHEMICAL SOCIETY);
- IEEE (INSTITUTE OF ELECTRICAL AND ELEC-TRONICS ENGINEERS);
- NLM (NATIONAL LIBRARY OD MEDICINE);
- VANCOUVER (BIOLOGICAL SCIENCES);
- APA (AMERICAN PSYCHOLOGICAL ASSOCIA-TION).

4. PLAGIARISM

4.1. Definitions of plagiarism

Plagiarism (Latin *plagere*=kidnap, *plagiatum*= "stealing people"), means the act of appropriation or copying someone else's written, artistic or other creative work as your own, either in part or in whole, without specifying the source or authorship of the original. Unlike forgery in which is questioned the authenticity of the work, plagiarism is the illegal and unethical copying of another's work, which is up as its own. Plagiarism is literary term for stealing, copying others' works. In recent years, it is interpreted as a violation of copyright. Generally speaking, plagiarism is when someone uses someone else's ideas, statements, linguistic style and does not recognize the intellectual authors. Plagiarism may be intentional or unintentional (1, 4, 6, 12).

Types of plagiarism (12):

- Direct form–Fully or partially copy the text, computer files, audio or video recordings without mentioning the primary source;
- Mosaic form–Borrowing ideas and opinions from the original source, a few words and phrases without citing the source;
- Self-plagiarism–Reuse own work without specifying the primary (own) sources.
- In some ancient cultures of the Far East, certain forms of plagiarism were common.
- According to data from WAME World Association of Medical Editors, precise definition of plagiarism is when are copied six consecutive words (6,21) in a continuous set of 30 used characters.

Generally speaking, plagiarism is when someone uses someone else's ideas, statements, linguistic style and does not recognize the intellectual pioneers. Plagiarism main goal is to deceive the reader. An interesting comment was made by Samuel Johnson, which one of the manuscripts received for publication characterized as follows: "Your work is good and original. Unfortunately, the parts that are good are not original, and the parts that are original are not good" (1).

It is "the tendency of literary theft and misappropriation of others spiritual property as a whole" or generally "attributed someone else's work as your own" (1).

4.2. Common causes of plagiarism

- Following trends of academic promotion and research funding, which entails the use of extensive text on the principle of "publish at all costs" or "Perish mantra";
- Personal ambitions of poorly educated individuals;
- Financial pressure.

4.3. Types of plagiarism

Plagiarism is not always black and white issue. The boundary between plagiarism and research is sometimes unclear. Identifying different forms of plagiarism is a very important step towards its prevention.

Here are listed ten (10) most common types of plagiarism as follows:

- CLONE-Submitting someone else's work, which is just transcribed, as his/hers own;
- CTRL-C-Contains most of the text from a single source, without alterations;
- FIND-REPLACE-Changing key words and phrases, but retaining a substantial part of the content of the primary sources;
- REMIX-Paraphrasing multiple sources which are so arranged that complement each other;
- RECYCLE-The use of their own work (if the article is already published somewhere and not cited);
- HYBRID-Combine perfectly cited sources with the copied without citation;
- MASH UP-Blending the copied material which is taken from multiple sources;
- ERROR 404–Includes quoting non-existent or inaccurate source;
- AGGREGATOR–Include proper citation of sources, but contains almost nothing of their own work;
- RE-TWEET-Includes proper citation, but with too much text used from the original.

4.4. Plagiarizing others' research results

Unlike forgery in which is questioned the authenticity of the article, plagiarism when it comes to illegal and unethical taking of another's work, which is presented as its own.

Many people define plagiarism as copying someone else's work, or borrowing other people's ideas. But terms such as copying and lending may mask the seriousness of the offense.

According to **Merriam–Webster dictionary** plagiarism represents (1): a) The theft and use of other people's ideas or words as yours; b) Use of sources without attribution; c) Literary theft and d) presenting some ideas as own and as it is new, while this idea already exists in other source. In other words, plagiarism is an act of fraud, involving the theft of someone else's work and presenting as own.

4.5. Is the theft of ideas and words really possible?

Statutory legislation in the academic community in the United States and other developed countries strictly protects the expression of their own ideas, which are considered intellectual property and are protected by copyrights. Almost all forms of expression are protected by Copyright as long as they are preserved in any medium (such as a book or a computer file).

- 4.6. That is why under plagiarism is considered (1, 6):
- Presenting someone else's work as own;
- Copying words or ideas of another person without specifying the original authorship;
- Not using quotation marks;
- Giving incorrect information about the source that is cited;
- Changing words but copying the sentence structure of the source without specifying the source or authorship of the original;
- Copying so many words or ideas which eventually make most of the work, regardless of whether the source is acknowledged or not.

4.7. How to avoid plagiarism?

It is very easy to find information on a topic that needs to be explored, but it is not always easy to add that information to own work and do not create a plagiarism. There are ways to avoid plagiarism, and should just be followed simple steps when writing a paper.

There are several ways to avoid plagiarism (1, 6):

- Paraphrasing When information is found that is great for research, it is read and written with own words.
- Quote Very efficient way to avoid plagiarism. It is literally the wording of certain authors and they sentences are always placed in quotes.
- Quotation or citation in the text marked with the number at the end of the citations while under this number is stated the reference from which the quote was taken.
- Citing own material If the author of the material used it in an earlier paper, he/she shall quote he/she self, because if this is not done, he/she plagiarized him/herself
- References must be listed at the end of the article and includes sources where authors found the information in the given article.
- Always follow the rules to properly cite references, acknowledging ideas taken at conference and formal/ informal conversations;
- Reference must include full bibliographic information;
- Any source that is specified in the text must be listed in the references;
- Quotation marks should be used if are copied more than six consecutive words;

The author must obtain permission from other authors/publishers to reproduce the tabular, graphic or picture attachments or used text under copyright (6, 12)

Unfortunately, digitizing made copy-paste plagiarism and inappropriate reuse resources from Web sites, online journals and other electronic media. Within academic institutions, plagiarism, which is made by students, professors or researchers is considered academic dishonesty or academic fraud. Researchers and professors are usually punished for plagiarism by sanctions, suspension or even loss of credibility. It was easier to detect plagiarism, during the 1980s. In the last century, began to develop software for the detection of academic ("Turnitin" and "Safe Assign" software) and scientific plagiarism ("Cross Check" and "eTBlast" software) (1,7). International Committee of Medical Journal Editors (ICMJE) has given a detailed explanation of what is not a duplicate publication. In the U.S. in 1989, ORI proposed sanctions for plagiarism (4, 6, 8).

Retractions in academic publishing have reached celestial heights-even increased tenfold in the last three decades, and the biggest reason for this is plagiarism and duplications (self plagiarism). The National Science Foundation (NSF) in March 2013 stated to explore more than 100 cases of suspected plagiarism in a year. Unfortunately, this problem is not limited to NSF, but also to other academic institutions as well as other spheres of interest, which is often revealed to the public only when scandals break out. In Germany, two prominent members of the Cabinet of the Prime Minister had to withdraw from office amid allegations of alleged plagiarism in dissertations. Similar scandals rocked Canada, the Philippines, Romania and Russia. Most high-publicity scandals are illuminated in the past three years, thanks to a significant extent bringing around readership of plagiarism as well as facilitated and increased access to instruments for the detection of plagiarism. This knowledge is worrisome because it indicates that plagiarism and duplication are not problems of recent date, but are now only more easily visible (20).

The software to detect plagiarism is well tested, widely available, economically affordable and easy to use. Although it relies on human analysis, this instrument can significantly speed up the process of validation of submission originality. Publications that require the use of instruments for the detection of plagiarism as part of the review and guideline authors have significantly reduced the number of rejected or withdrawn papers. On the other hand, a large number of organizations ignore this problem. In a survey conducted by Thenticate in October 2012, one of three scientific editors said they continue to face a plagiarized work, and according to the same survey, more than half of the scientific researchers do not check their work, but leaves the editors to detect plagiarism or duplication (even those unintended) (20).

To researchers is recommended that before they even send somewhere their work, to use the software in order to identify plagiarism or self-plagiarism, which perhaps they themselves are not aware of, in order to preserve public confidence, clean professional record and the further possibility of publishing and finance works. The scientific community, with special emphasis on publishers, must be clear and consistent in finding plagiarism, deterring it, with clear sanctions for those who violate these provisions (12).

5. MEASURES TO PREVENT PLAGIARISM

Historically, the first attempts to address scientific misconduct and dishonesty were initiated in the U.S. 1992 with the establishment of the Office of Research Integrity (ORI). The main tasks of this organization are to promote scientific integrity, the development of guidelines for scientific research and investigation of allegations of misconduct, especially in biomedicine. Based on the American model, many national bodies for ethics in science are founded on a global level.

Another major step forward was the establishment of a Committee on Publication Ethics based in the UK (COPE, 1997). COPE has introduced the scientific principles of fairness and developed a set of diagrams which recorded occurrence of plagiarism. If plagiarism is treated after publication, editors should inform the reader about the misconduct. Also, plagiarism can be detected electronically (e.g. Cross Check) (21, 22).

At the international level, databases with cases of plagiarism should start publishing the names of all blacklisted–plagiarist.

Scientific and academic institutions should have a unit for monitoring, research and quality development. In accordance with the principles of the GSP and Good Laboratory Practice (GLP) institutions should take responsibility for the integrity of research reporting (23-26).

6. CONCLUSION

Modern medicine from a doctor requires continuous training, follow up of new medical discoveries and implementation of new knowledge into practice. A doctor in the PHC or in hospitals encounters with patients of different disease profiles, which are manifested in a different form, different intensity, with different response to therapy and different prognosis, so that every patient is a new experience. However, this experience and knowledge is often not sufficient for the best outcome for the patient and doctors are often forced to use additional reading and research on the problem of his/hers patient. Therefore, use of medical journals and articles that are in databases widely available to everyone who knows them properly. For this reason, it is particularly important that any research conducted revealed that published an article to be written according to the rules described above, to be conducted as meta-analyzes that will shorten "wondering" of readers trough the huge number of articles related to the problem and thus conclusions from made research combined with their knowledge and experience and to provide to the patient better service (on these principles is based Evidence Based Medicine EBM) (10, 14).

On the other hand, thanks to the databases available on the Internet and medical journals, many researchers get ideas for their own research, and are used to compare the results of different studies, taking into account not to make plagiarism and proper citation is of utmost importance.

Finally, as more the author has been cited, his credibility is increased, indicating that the quality of its scientific research work. In literature and on various websites and blogs today is revealed a growing number of cases of plagiarism and other unethical behavior of the researchers. Described are several cases of plagiarism in the countries of the Balkan region. In the countries of former Yugoslavia, the number of plagiarism in books, articles, monographs, scientific papers and it is rapidly increasing. One important reason is that the newly introduced concept of the Bologna education requires academic staff to quickly and in large quantity publish scientific and professional articles for advancement in academic career, it has become counterproductive and degrades the quality of the published articles content. Plagiarism is now easier to detect thanks to databases and software packages specifically designed for this purpose.

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