
Medical Publication and Scientometrics – a Writing and Preparation of Research Results in Fifth Steps for Publication in Scientific Journals

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Background: Scientific research is the only real way and method for the proliferation of true knowledge in all spheres of science, but also in academic institutions. Medical, and in a broader sense biomedical scientific research, is a process of systematic research of current and important health problems related to defined aspects of physical, mental or social well-being of the population of local, regional or global character. **Objective:** As the fact that today is conducted a number of scientific researches in the field of medicine, it is necessary to define the steps by which it is carried out to make it universal and to have scientific value. This paper describes the research methods, study design, the way in which one should be written, and why it is important to publicize the same. The aim of this article is to present the current tools available in scientometry for the evaluation of scientific validity of published articles and explain the purpose. **Methods:** Special emphasis is placed on scientometrics as the science that evaluates scientific papers and their citation in the selected sample of journals. **Results and Discussion:** The most important satisfaction for any scientist should be the realization that the result of research in a certain way in the future will affect at least one person to be healthier, which should be fundamental to the realization of research in practice—at universities or specialized scientific laboratories and institutes. Scientometrics analyzes scientific articles and their citation in a selected sample of scientific journals. Bibliometrics denotes quantitative research of communication processes by applying appropriate mathematical and statistical methods to books and other communication media. Bibliometric methods are used for quantitative analysis of written materials. Citation provides guidelines for scientific work, because it stimulates scientists to deal with the most current areas of research, and organizes scientific article at the world level, or shapes and directs it. Citation is influenced by: article quality, understanding of the article, language in which the article is written, loyalty to a group of researchers, article type, etc. In this article we pointed that h-Index presents one of a set of valuable measures to determine scientific excellence (bibliometrics recognize also m-value as useful). Some of the indicators used in the evaluation of scientific work are: Impact factor (IF); Citation of the article; Journal citations; 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 during the same period. Factor of influence depends on: the quality of the journal, the language on which it was printed, the area it covers, the journal distribution system. Although the h-Index is a better measure than a citation impact factor (IF), it is still based on the opinions of other authors. **Conclusion:** Since research in medicine can affect the improvement of clinical and public health practices, it is necessary to conduct them. Only quality research with exact results offers the scientific community new information about the examined problem, and the researcher personal satisfaction, the possibility of communicating and conducting scientific dialogue with other members of the academic community, and opening opportunities to receive critical review of those who have insight into the research.

Keywords: research, method, publication, scientometrics.

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1. BACKGROUND

True knowledge is gained through scientific research. The highest level of knowledge is the ability to investigate scientific problems (1). The ability to study a scientific problem is the highest level of knowledge. Medical scientific research is a process of systematic studies of individual, particular aspects of the physical, mental and so-

cial well-being. Those articles which include clinical and public health research in the group include research on a population level. Research process can be extremely exciting to researchers because not only the results are those that are important but the research itself, involvement in the problem, exploration of the unknown and discovering answers to the previous set, unanswered questions (2, 3).

Researchers in biomedical research examine biological, socioeconomic and environmental factors in which we live and work, which affect health and contribute to illness, disability or death. Since research in medicine can affect the improvement of clinical and public health practices, it is necessary to conduct them. In order to be considered a significant scientific work, it is important that they be conducted according to certain rules and guided by the steps presented in my work. Only quality research with exact results offers the scientific community new information about the examined problem, and the researcher personal satisfaction, the possibility of communicating and conducting scientific dialogue with other members of the academic community, and opening opportunities to receive critical review of those who have insight into the research (4, 5).

In order that research project is valuable and recognized by the academic community and other researchers, it is important to contain the same elements as the previous written works (1). It is immaterial whether the research is conducted by a student or a teacher, all the steps are defined, and in a nutshell they are: identifying the issues that will be explored, data collection, analysis of the collected evidences and reaching a conclusion. For this purpose authors need to follow appropriate Guidelines and Declarations written by adequate and important scientific institutions, associations, academies, instruction for authors in scientific journals, or participated at scientific seminars, symposia, conferences, congresses, etc like described in references at the list of references at the end of this text (7-23). The papers written by author(s) need to answers why scientific researches should be carried out and what kind of satisfaction they provide to the researcher. Author searched the most influential on-line databases and analyzed deposited papers within the topic scientometrics and used descriptive method of reviewing important facts about experiences with scientometrics in the scientific and academic practice following rules how to prepare papers by IMRAD or BOMRAD Form described in Instructions for authors in every journal or deposited on websites of the journals which are indexed in on-line scientific journals and listed in recognizable scientometric or bibliometric lists valuated by indexes like h-Index, Google Scholar, etc. (1, 25-29). Also, authors of the papers need strictly follow rules of COPE and Publication ethics recommendations deposited in instructions for authors stored on the journals websites (30-45).

2. PURPOSE AND PROCESS OF MEDICAL RESEARCH

Researchers in medical research examining the biological, socio-economic and environmental factors that influence health and contribute to the development of disease, disability or death. Research at the population level has defined its goals and the most important are:

- Identifying and classifying new clinical identity
- Detect risk factors for disease
- Development and testing of new protocols for the prevention or treatment of disease.

The idea that researchers will get rich or become famous after writing scientific article must be immediately discarded. It usually takes a few months or even years until the initial idea of the study comes to the end of work and set of conclusions. Even after publishing, only a small number of articles leading to the current changes in health status or clinical practice. However, the researcher can still enjoy the fruits of their labor through:

- The acquisition of new skills
- Satisfying its own curiosity
- The ability to publish their own work.

However, the most satisfaction for any scientist, especially the young should be the knowledge that the result in a particular way in the future will affect at least one person to be healthier. This should be the fundamental reason why the research is conducted.

Author Kathryn H. Jacobsen in her book "Introduction to health research methods: a practical guide" (6) states that any research process consists of 5 steps. The first step is identifying the problem that we want to explore, and the second is to choose the research manner. Once the goals are set, the other three steps involve study design and data collection, data analysis and writing conclusions.

Scientific researchers in the field of medicine interact through published articles or presentations presented at professional meetings (e.g., conferences). That research which is not published or displayed in another way, cannot affect the practices that can make people healthier. For this reason, scientists are encouraged, especially young ones that after complete the project publish scientific work in a professional journal.

3. IDENTIFYING THE PROBLEM—FIRST STEP

The first step includes actions such as (5):

- Selection of topic
- Literature retrieval
- Focusing on the question posed in the survey.

This step is probably the most challenging part of the research project. In this step, the creativity is not only allowed, but is obligatory. Selection of research topics usually reflects personal affinity of the researchers for the problem. One of the most commonly used method in the selection of research topics is brainstorming which aim is to create a nice long list of possible research topics. After the researcher searched the databases with summaries of previously published papers, journals and books, consult with colleagues, it gained insight into the possibilities for research and expand the list of possible topics for research (6).

When are identified possible research topics, it is important to formulate them so that each includes three important elements: exposure, disease or outcome and the population. When these three items are defined, they should be combined to form a research question that must be answered, for example: Is physical activity associated with increased risk of bone fractures in adults with diabetes? In fact, physical activity is exposure to potentially provoking factor, bone fractures is a disease or condition, and adults

with diabetes represent a population among which to perform the research.

3.1. LITERATURE RETRIEVAL

Once the field of research is chosen, the researcher needs to explore the existing literature that could be used for the research (1). Usually first are explored basic information on the internet. Organizations that deal with public health such as the World Health Organization and the U.S. Center for Disease Control and Prevention have basic information on various diseases and risk factors for their occurrence. It might also helpful finding statistical data for a particular problem, and once the exposure, disease or outcome and population is identified.

Abstract (summary) presents a brief description of an article, chapter or book, and the length is one paragraph. Abstracts in medical science give a glimpse into the design of the study, the population covered and the key words that are related to the research. Many databases contain such summaries, and we will mention just a few: PubMed, PubMed Central, Scopus, Embase, ISI Web of Science, Hinari, ISC, MEDLINE, Bibliomed, etc.

If the researcher cannot get from the database insight into the whole article, it remains the possibility to directly contact the author and ask for a copy of the same. After receiving the article, the researcher should re-read the summary, review charts and tables because usually the most important results are presented graphically and read the whole article to get a real insight into the problem.

3.2. FOCUSING ON THE QUESTION SET IN RESEARCH

Having selected research topics, researcher should focus on the specific question to which research should provide the answer. What will be the guiding question in the study also depends on the type of study that will be conducted. By the manner in which data will be collected, we can distinguish three types of studies:

- The primary study: collecting and analyzing new data
- Secondary studies: an analysis of existing data
- Tertiary Study: A review and synthesis of existing literature.

4. CHOICE OF STUDY DESIGN—SECOND STEP

Commonly used study designs are:

- A meta-analysis
- Correlation (ecological) studies
- Case studies and case series studies
- A cross-sectional study
- Cohort Study
- Experimental
- Controlled studies (case control)
- Qualitative study.

The study design must be appropriate to the goals that have been previously set. For example, if the objective is to evaluate whether an intervention is effective, the most appropriate study would be experimental. If on the other hand we want to understand certain populations, the best would be to apply some of the observational studies such as cohort or cross-sectional study.

Each of the listed types of studies is focused on a specific population. Thus for instance, case studies and controlled studies are focused on individuals with a specific disease, while cohort studies are more concerned with an individual's exposure to the risk factor.

Researchers who have fairly easy access to the population of interest, such as a group of individuals with a specific disease or exposure to a risk factor, usually elected by the study design that is appropriate for the participants in the study.

4.1. META-ANALYSIS

Usually the goal of scientific research is to explore a new identity and give insight into its characteristics. However, the goal of meta-analysis is synthesis of already known facts obtained in previous studies and offers a new interpretation of the results. Meta-analysis of the research in the field of medicine requires:

- Extensive literature search
 - Extracting key information from relevant articles
- The clear and concise presentation of information.

Meta-analyses can often be helpful step in the preparation of a primary or secondary research. It offers the researcher possibility to become an expert in literature searches. Often the conclusions of meta-analysis are more than an interpretation of the study, which involves because they offered a synthesis of knowledge from a large number of articles.

However, it is important to note that in academic circles meta-analysis are considered as less valuable scientific works. Also, there are journals that do not publish a meta-analysis and therefore their popularity is lower.

4.2. CASE STUDY AND STUDY OF SERIES OF CASES

Case study describes one patient. The study describes a series of cases two or more patients who have the same condition or disease, or who are subjected to the same procedure. Such research is possible only when there is adequate access to the source of the observed cases. This type of study is carried out if we want to:

- Identify new syndromes
- The hypothesis for future research

Describe the characteristics and similarities among patients with the same signs and/or symptoms of disease.

5. CROSS-SECTIONAL STUDIES

The aim of cross-sectional studies is to measure the exposure of the population or part of a particular risk factor or disease at a given point in time. This type of study is used to:

- Describe community
- Evaluate health programs
- Assess needs of the population.

5.1. CONTROLLED STUDY

Controlled studies (case-control studies) comparing exposure to a particular risk factor in patients who are also those in which there is no disease. Its goal is to identify risk factors for certain diseases. Participants in this study were selected according to whether they are sick or not. Therefore, those who have the disease belong to the group

of cases, and those with no illnesses in the control group. Controlled studies are among the best to determine the risk factors for certain diseases.

5.2. COHORT STUDY

A cohort is a group of similar people who are monitored during a certain time. All cohort studies involving at least two measurements as follows:

During the initial research confirming the existence of the primary exposure and disease in all study participants

Over the next assessment while measuring the incidence of new disease in relation to the initial survey.

6. STUDY DESIGN AND DATA COLLECTION – THIRD STEP

The third step involves creating a detailed plan to carry out the study. There are different protocols for primary, secondary and tertiary type of study. However, in any of them we should think about the following:

- Data collection methods
- Selection of the sample population
- Creating questionnaires
- Research and interviews
- Additional assessments
- Approval of the ethics committee
- Resources to conduct research

Financial resources and budget

Time limits.

One of the most important steps in creating a study is to select a suitable sample from the population that will be processed. We distinguish four distinct entities to consider before data collection. The broadest term is the target group to which may apply the results of the research. Within that group we separate well-defined subset of individuals from the target group. The sample population includes individuals who were asked to participate in the study and the study population group consists of those who have actually consented to participate.

The questionnaire is a tool by which researchers systematically collect information from participants in the study. For any topic in the field of health care, one can make the questionnaire. Best questionnaires are those who are skillfully made for a specific purpose.

Most primary studies collected data from research participants through the interview. Interview is suitable for data collection because they can complement also other findings. Additional assessment incorporates: anthropometric measurements, vital signs, clinical examinations, tests, physiological functions, laboratory analysis, medical imaging, diagnostic procedures, etc.

All researchers have an ethical obligation to reduce to a minimum the risk that could have participants in the study. Ethics Committee must protect research participants, researchers and institutions in which the process is carried out. It is unacceptable to conduct research for which protocols the ethics committee had not given consent (1).

DATA ANALYSIS – 4. STEP

The fourth step in the research is the processing of the

data collected. Most studies require only a descriptive analysis and some comparative statistical analysis. Data are usually recorded in some of the software used for databases processing such as Microsoft Access. After the data has been entered, they can be imported into one of the standard software for statistical analysis.

Descriptive analysis is used to describe the basic characteristics of the study population and other data sources.

Comparative analyzes comparing groups of participants on the basis of age or gender, exposure or existence of disease, etc. A comparative analysis involving statistical tests that classify participants into two categories and compares the characteristics of those categories.

7. WRITING AND PUBLICATION OF RESULTS – FIFTH STEP

The last step in the research is to write the report and conclusions of the research and the presentation or publication. Usually the results of the work are published in the form of an article. Earlier we mentioned that every professional article must have its own summary or “distillate” which outlined what was done in the course of the research, in what way, what are the results and the author’s interpretation of them (4). The format of scientific articles can vary greatly from journal to journal. Nevertheless, many of them follow the IMRAD scheme, recommended by the International Committee of Medical Journal Editors (ICMJE) or BOMRAD form, recommended by author of this article. Professor Izet Masic MD, PhD in his professional article, “How to Search, Write, Publish and Prepare the Scientific Papers in the Biomedical Journals” states that the summary must be clear and precise. To help remember the necessary features, it is useful to use the English acronym for “Keep It Simple and succinct” – KISS (3).

After the summary, are followed the usual parts of a professional article. Above mentioned author in the same article provides gives acronym IMRaD Introduction, Methods, Results and Discussion and Conclusion (3). The introduction should provide information that will help the reader to understand the methods and results of the research. The introductory section should contain a definition of the problem and the formulation of the problem being investigated. In experimental and clinical research is necessary to specify the objective(s) of research and hypotheses (assumptions) which are included in the study. The description of the methods used in the study must first emphasize the study design that will be used. It is necessary to describe the main features of the study, describe the sample tested, the standard values for the tests, etc. In this chapter, it is necessary to explicitly specify the parameters that are monitored and controlled during the study. This part should end with the description of the statistical methods used. Section where we present the results of research begins with a description of the test population and clearly identifies the size of the tested sample and the demographic characteristics. The results obtained by statistical analysis should be presented in tables and charts whenever possible. When displaying the results it

is necessary to mark the interval of deviation, and their levels of statistical significance. In a comparative study the interval of deviation must relate to the differences between the groups. Discussion is the most important part of the article, and it begins by summarizing the key findings obtained during the study. Promote the most important results and comparison with those obtained in previously conducted studies. If they are significantly different, it is necessary to give a possible explanation for these differences. Finally we should give a confirmation of the set objectives (goals) and confirm or reject the hypothesis. In conclusion is presented the most important facts that were obtained during the research.

Citing references can be done in two ways:

- In the text of which is given as a brief description of the source of information
- At the end of the document where is provided detailed bibliography information for each source.

References are often cited in the nomenclature according to Vancouver or alternatively by style called ICMJE (International Committee of Medical Journal Editors). The literature review should use only those references that are directly related to the topic of the study. At the end the article should be prepared for its publication, and there are numerous reasons why researchers should publish their work. Some of them are:

- The possibility of conducting scientific dialogue
- Receiving critical review
- Showing respect for the participants and partners
- Facilitate future research
- Personal satisfaction.

8. SCIENTOMETRICS

Scientometrics is part of scientology (the science of science) that analyzes scientific papers and their citation in the scientific journal selected sample (5). Name bibliometrics in the seventies was introduced to denote a quantitative study of the communication process using mathematical and statistical methods to books and other media of communication. Almost simultaneously, in the countries of the former Eastern Bloc was introduced scientometrics name derived from the Russian language. More specifically, in 1969 was introduced the name scientometrics relating to scientific field that deals with the study of science as an information process by applying quantitative (statistical) method, and later Tibor Braun (who in 1977 established international journal *Scientometrics*), introduces the name *Scientometrics* (1, 3).

Citation provides guidance to scientific work because it encourages scientists to deal with the most current research areas. So actually "terror of scientometrics indicators" organizing scientific work at the global level, it shapes and directs it (7). On the citation impact: quality of work, an understanding of the language in which the work was written, the loyalty of a group of researchers, type of work, the benefit in terms of "I quote you, and you love me", "benefit" in terms of "I will not quote it because he/she is my competitor" etc. Most of the scientific articles

are cited by inertia, because every scientist has a collection of articles cited whenever he/she writes about a certain topic. Others are papers that cite the man himself stood citations, whereas others because it requires a reviewer or editor, to small and self-help. Only a small portion, perhaps only every fifth or tenth article, is cited because it was supposed to. They are those whose work directly benefits the author of the information or whether there touches on problems and solutions presented.

All persons designated as authors of the work must meet the following conditions: that significantly contributed to the planning and preparation of the article or the analysis and interpretation of results and participated in writing and correcting the article and that they agree with the final version of the text. Persons who are involved in data collection or superior to researchers, but are not actively involved in the development work cannot be the authors. The editor has the right to ask the author to explain the contribution of each of them. The contribution of one author is 1, and if the article was written by several authors their contribution is 1/n. In doing so, the contribution of each of the following is half of the size of the previous one. Sequence is determined by the author's agreement.

Some of the indicators used in the evaluation of scientific research are:

- Impact factor
- Article citations
- Journal citations
- The number and order of the 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 during the same period. Factor of influence depends on: the quality of the journal, the language on which it was printed, the area it covers, the journal distribution system.

9. BIBLIOMETRIC STANFORD LIST OF MOST CITED AUTHORS IN SCOPUS DATABASE

On December 4th 2021 in Sarajevo held Symposium titled "Scientometry, Citation, Plagiarism and Predatory in Science Publishing". Symposium were based on interpretations of bibliometric Stanford list published in October of the 2020 in the journal *PLOS Biology*, which brings up the question about the credibility of the data in the media and that the Stanford list may have been misinterpreted. Participants of the Symposium concluded that "the data must be analyzed more seriously and possibly argued for their accuracy and credibility." (17).

The original title of the paper with the Stanford list is: "Updated science-wide author databases of standardized citation indicators", published by Elsevier (Amsterdam, the Netherlands), by John P. A. Ioannidis, Kevin W. Boyack and Jeroen Baas, professors at the University of Stanford in California (USA) (17). The authors of the study state that the influence of world scientist citations is often misinterpreted, and in order to achieve maximum objectivity, they created a publicly available database with more than 190,000 leading scientists of the world. Using the princi-

ples of artificial intelligence that deal with algorithm design, the authors correlated several parameters that, in their opinion, are important for the objective evaluation of each scientist. They especially emphasized the importance of distinguishing between the concepts of the number of citations and their impact. The available database contains standardized information on citations, h-index, hm-index, citations of articles in different positions of authors/co-authors in the analyzed article and a summary indicator of the impact of citations. Scientists are classified into 22 scientific fields and 176 scientific branches. For all scientists who have published at least 5 articles, percentages specific to the scientific field are given. Collective data for each author/co-author were analyzed and updated from the beginning of the career until the end of 2020. The selection is based on the first 190,000 according to the c-score (with and without self-citations) or on the percentage range of 2% of the most cited. The methodology used during preparation of the list of scientists with the greatest impact on citations was published in the scientific journal PLOS Biology in 2020 (17). Recently Stanford University published the world's top 2% most influential scientists from all fields in 2021 and during their whole career. Eleven scientists from Bosnia were on the list of the most influential scientists in 2021, and seven on the list of most influential during his career. Scientists are classified into 22 scientific fields and 176 sub-fields (18) (Figure 1).

Speaking about the Stanford list, circulating in the scientific community, academician Izet Masic, one of the most influential researcher in the field of scientometrics, during "SWEP 2021" Symposium of Academy of Medical Sciences of Bosnia and Herzegovina, and Editor-in-Chief of few indexed scientific journals, in December of 2021 held in Sarajevo, stated and proposed: "we have agreed that it is necessary to suggest that scientometric analysis with the method used by authors from Stanford University in the USA should take into account two very important variables: (17) each author's contribution, when there are co-authors of the article, so the number of citations from the total number of authors should be divided by each co-author individually, and not for each co-author to receive a citation as if they were the first; and (17) it is necessary to take into account the evaluation of the quality of the content published in the research results in the paper published and stored in the index databases. Only then would the Stanford list be more complete and of better quality. In that case, perhaps half of the authors from that list would be dropped out, especially if the numbers of citations as the first author or as a co-author were singled out". Apparently, the list is misleading mostly because many publications have been excluded and the number of citations for

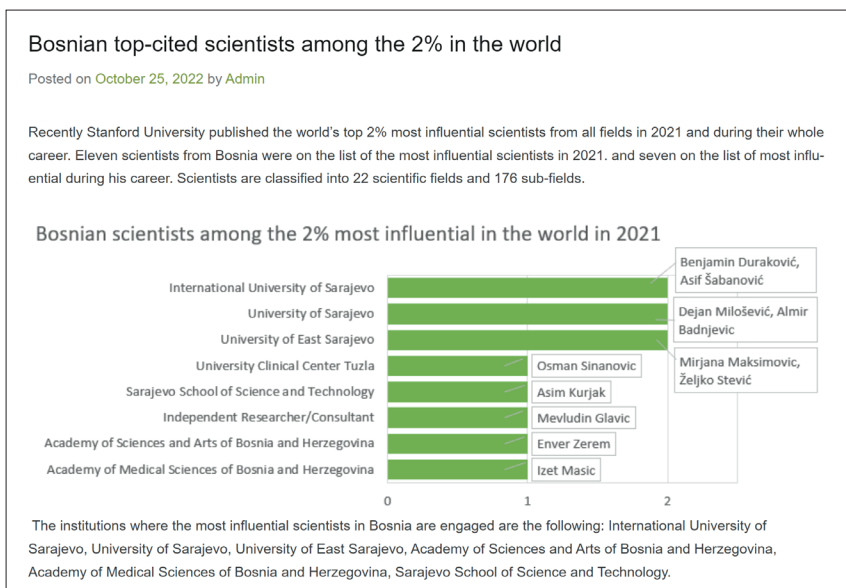


Figure 1. The list of most cited scientists from Bosnia and Herzegovina at Stanford bibliometric list (within 2%) in 2021

each author was not divided by the number of authors per article. Only after these corrections it would be realistic, but then half of the authors would drop out of the existing list (17). The authors who created the Stanford scientometric list of the most cited authors from articles stored in the SCOPUS bibliographic database methodologically took into account whether someone was the first, last or only author, and the like, and did so in great detail. Unfortunately, they did not take into account the number of authors per article. Then, they looked at the number of citations according to SCOPUS, and half of our citations are missing there (there are almost twice as many on ResearchGate) (17).

Also, criteria for assessment of scientific status of somebody who built-up scientific or academic career, besides the mentioned indexes in this text, must take into account also authorship of textbook(s), books, monographs etc.; the proof of organized congresses or scientific conferences or chaired of scientific sessions at conferences, etc.; editing of scientific indexed journals recognized internationally, membership in scientific associations at international or national levels, some special awards at international level, etc. These criteria should be important for quality assessment of scientific biosketch of scientists. Current academies and academicians can propose it with consultation of scientific bodies and experts at universities in one country, selected regions or worldwide.

10. CONCLUSION

Given that research in medicine can contribute to the improvement of clinical and public health practice, they should be implemented. In order to be considered as significant scientific work, it is important to be carried out according to established rules and guided steps that were presented in my article. On the question of why one scientist should carry out a research, we can provide more answers. The most important is that, well done research

with the exact results of the scientific community provides new information about the investigated problem and the researcher personal satisfaction, ability to communicate and conduct scientific dialogue with other members of the academic community and to create opportunities to receive critical review of those who have access to the research.

The fact is that scientometrics and online databases have a great influence on the development of the quality of the articles by measuring scientific contents of published articles using IF, Scopus h-Index, Google Scholar Index, etc., which today ask every academic or scientific institution, when making the election in some of the academic or scientific title.

In this article we pointed that h-Index presents one of a set of valuable measures to determine scientific excellence (bibliometrics recognize also m-value as useful). Although the h-Index is a better measure than a citation impact factor (IF), it is still based on the opinions of other authors. In the cases when somebody wants to compare or assess the academic or scientific quality of applicants for funding, promotions to some academic title, or prizes, other factors must be considered. Other parameters must be included as age, career stage, a field of a scientist, awards, chaired of the projects, etc.

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