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Research Article

Article Quality Indicator: Proposing a New Indicator for Measuring Article Quality in Scopus and Web of Science

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ABSTRACT

For different aims in science policy, careful analysis of the academic articles and their quality and quantity based on acceptable criteria seems indispensable. This study endeavored to introduce and use an indicator which can combine essential factors that may exert influence on the quality of articles in Scopus and Web of Science databases. Such factors as journal rank, citations without self-citations, citing journals quality, cited journals quality, citing to top articles and authors' *h*-index which might affect quality of articles were extracted from literature. To identify the weight of each factor, the Analytical Hierarchy Process (AHP) was employed and the experts' points of view on scientometrics were elicited as well. Then, the weights of each of these factors were set in the Article Quality Indicator (AQI) formula. The weight of each factor is as follows: Citations without Self Citations (0.235), Journal Rank (0.201), Citing to Top Articles (0.194), Citing Journals Rank (0.148), Cited Journals Rank (0.132) and Authors *h*-Index (0.086). To examine the indicator, the articles in the field of *Medical Ethics* were selected and the factors for 48 articles were extracted. Results revealed that with using the proposed indicator, the highest value of the AQI was 3.25 and the lowest was 0.01. Interestingly, regarding these properties as well as taking all the facets into account along with calculating their weights based on experts' views; the successful testing of the formula resulted in a reliable indicator. And, the indicator can be used as complementary to other one-dimensional indicators or as a replacement of them. This way, it can be proposed to be capitalized on for policy making in academia and research. Regarding the calculation of this indicator for articles through databases, due to its characteristic features and comprehensiveness, this indicator can be an appropriate option to make research policies based on a variety of components.

Keywords: Article quality, Article evaluation, Indicator, Science policy, Citation databases.

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INTRODUCTION

Parallel with the growth in the number of academic products such as academic articles, conference papers, books, reports, databases and presentations (viz., oral and written), evaluating their quality is a difficult task. Evaluation of scientific products quality seems to be a crucial issue not only for researchers, but also in a higher level, for postsecondary education, research managers and research funding agencies,[1] science policy and for scholarly understanding of how the science system operates.[2] Moreover, in postsecondary education, most of the crucial decisions such as employment, promotion of current staff members or granting scientific awards are based on the evaluation of researcher's academic products.[3]

In fact, articles are one of the major academic products. Normally, published academic articles need to be analyzed carefully by experts in the field and they should be given scores for their quality and quantity.[4] This score is according to the indicators.

Researchers have presented different indicators for measuring the quality of academic papers. For instance, the journal impact factor shows the frequency with which the journal's articles are cited in the scientific literature. It is computed by dividing the number of citations in year 3 to any items published in the journal in years 1 and 2 to the number of articles published

in that journal in years 1 and 2.[5] Impact factor has obtained acceptance as a quantitative indicator;[6] however, many researchers have criticized the methods used to compute the impact factor.[7] Experiential evaluations of on the capacity of the impact factor in measuring journal quality accurately are rare.[8-9] Other limitations for this indicator include impact factor depending on the research field, journals' impact factors are not statistically representative of individual journal articles and typically, are based on a relatively small number of highly cited papers.[4]

The citations of a publication demonstrate peer recognition and are one of the most important quality indicators. This measure is precise, robust and clear. However, it depends on many factors; the first is the number of published articles in journals. Clearly, more citations will accrue when more papers are published per year, but it could be discussed that this range of productivity is not the same as quality or impact. The second is that different research fields have very different citation practices; for example, dentistry sciences have a much greater citation than social sciences or humanities.[10] The other factor is the average number of authors for a paper. Papers can have many authors effectively increasing the total number of citations. This is the major problem which makes it very difficult to compare journals across different research fields.[11]

Along these lines, Priem *et al*. contend that accumulation of citations could be observed one/two years after publishing or even longer. Therefore, it is limited to assess the real-time quality of the scientific papers. In addition, the citation count cannot be employed for measuring quality of other documents (i.e., slides, reports, databases).[12]

Obviously, another indicator is h-Index, which is the most rigorous quality indicator of scientific research that measures the impact of a particular scientist rather than a journal.[13] Like most pure citations, this indicator may be influenced by self-citations and the number of co-authors.[14,15]

In its original setting, the *h*-index puts young researchers or latecomers at a disadvantage given both output of publication and apperceived citation rates will be relatively low.[16]

In addition to the aforementioned factors, another factor such as quality of cited and citing articles can affect the evaluation of article quality. In Scopus and WoS, such indicators as Scimago Journal Rank (SJR) and Eigenfactor are that have measured journal quality based on weighted citations according to citing journals.

SJR is a bibliometric indicator that measures the prestige or influence of a scientific journal. This indicator has been used a citation window of three years which is broad enough to include most citations and sufficiently dynamic to measure the evolution of scientific journals. It limits self-citation of journal to a maximum of 33% of its issued references so that excessive self-citation will not involve reinforce the value of a journal on its own.[17]

Eigenfactor score (ES) and Article Influence Score (AIS) are freely available and both rank journals through a similar algorithm as Google's Page Rank does, which shows the prestige of citation sources in addition. They have different time windows based on 5 years of citations. ES does not have a divisor and is impressed with total citations not the citable documents of a journal.[18] This indicator essentially measures the relative frequency of occurrence of each journal in the network of citations and applies this as a calculation of prestige.[17]

In addition, articles cited in a paper as references, are taken into consideration by reviewers of the paper (before acceptance) because the validity of the cited references to some extent reflects the validity of the article's intellectual basis. Therefore, due to limitations listed above for presented indicators, this study endeavored to introduce and use an indicator which can combine essential factors affecting the quality of articles. In addition, this indicator needs to be able to identify the impact ratio of each factor.

MATERIALS AND METHODS

Methodology

This stepwise research was conducted in three phases. As to the first phase, to extract efficient factors in evaluating articles, search was done in such databases as Scopus, Web of Science, Emerald, Science Direct and with such keywords as Article quality indicator/index. Article evaluation research quality. After vetting the content of the searched articles, quantitative indices were extracted. These indices were journal rank, citations without self-citations, citing journals quality, cited journals quality, citing to top articles and authors' *h*-index. Also, to complete the extracted indices, such indices which are used in scientific databases for evaluating scientific factors, were employed. To measure each of the scientific components, the relevant indicators need to be as constant and measurable as possible. This way, in this study, the evaluation of the cited and citing articles' quality is to be considered. However, due to the consideration of the indicators provided to evaluate the relevant components of cited and citing articles, including citation, validity of authors and validity of the journal, it was established that the validity of the journals which published cited and citing articles has the desired characteristics, including lack of change over time (And its annual calculation) as well as measurability.

Due to the reasons provided in the Introduction, each of these factors has its own drawbacks. Therefore, they are considered

complementary to each other in identifying the validity of articles.

Given all these indices are not the same in identifying the validity of an article, the second phase was conducted via AHP to identify the weight of the indicators

Regarding the advantages of the Analytical hierarchy process (AHP) method, expert opinion was used in this study to determine the weight of the factors:

One of the important advantages of the AHP method is making the group decision possible; it integrates the decisions of all the group members in a way that the optimal decision includes all members' opinions.[19] Using AHP, we can make all the components of a problem related and obtain their complete interactions.[20] The AHP has found ready acceptance by busy managers and decision-makers. It paves the way for organizing the decision-maker's thoughts and can help in organizing the problem in a manner that is simple to follow and analyze. It is almost universal adoption as a new paradigm for decision-making coupled with its ease of implementation and understanding can form its success. Additionally, it has proved to be a methodology capable of producing results that agree with perceptions and expectations.

Saaty describes the seven pillars of the AHP as follows

- Ratio scales, proportionality and normalized ratio scales;
- Reciprocal paired comparisons;
- The sensitivity of the principal right eigenvector;
- Clustering and using pivots to extend the scale;
- Synthesis to create a one-dimensional ratio scale for representing the overall outcome;
- Rank preservation and reversal;
- Integrating group judgments;

The use of ratio scales for comparisons helps in unifying the multidimensionality of the problem in a unified dimension from the perspective of the final outcome.[21]

So according to mentioned method (AHP), a questionnaire was developed based on this method which was designed in the form of paired comparisons between the factors two by two, in which experts' opinions were received and scored from 1 to 9 based on the importance of each factor versus another factor. Number 1 represents the significant weight of the two elements and number 9 represents the very high importance of an element compared with the other element. Given that in this method, it was necessary to receive the opinions of experts and specialists in a particular field, which is the field of scientometrics in this research, the number of participants was identified according to the qualitative research methods, in which the number of participants is usually less than 50 and is mainly suitable to be between 15 and 20. This questionnaire was sent to 20 experts in the field of scientometrics.

Based on the responses to the paired comparisons in AHP questionnaire, the geometric means of the factors and then the weights of them were calculated in Excel. In the group of pair comparisons, it is necessary to compute the compatibility rate for group comparison. If the compatibility rate is less than 0.1, the decision will be acceptable. Therefore, according to the compatibility rate, which was calculated about 0.01, the results of this method were acceptable in this study:

$$\lambda_{max} = 6.08252$$

$$I.I = \frac{\lambda_{max} - n}{n} = 0.01375 \text{ compatibility index}$$

$$I.R = \frac{I.I}{R.I.I} = \frac{0.01375}{1.24} = 0.011089 \text{ compatibility rate}$$

Then, the weights for each of the discussed factors in the article quality indicator (AQI) formula were embedded.

Establishing AQI formula is like this: all the factors in their weights in the first step are multiplied by the factors in the second step. Integer numerator of the fraction consists of these values for an article; in addition, to identify the desirability level of an article this value needs to be compared with the average value of all articles in the related field. Thus, the integer numerator is the average of the factors for all the articles that the article belongs to their field. The third phase is done through evaluative analysis and for the purpose of testing the achieved index. The purpose of evaluative research is the methodology, which helps the researcher to see if research goals have been addressed or not. In other words, this method identifies whether a software, index, program and formula pave the way for reaching the intended results. So, in this, study all articles in the field of medical ethics were extracted from the WoS (Web of Science) and considering the research articles of this collection including original and review articles, letters to editors, editorials and finally, 20,361 articles were selected. Given that the values of the factors in the desired year are considered for use, it was necessary to select a year as an example. The most recent year at the time of conducting the research, which had the conditions for data extraction (Citations two years after the publication of articles), was 2015 which encompassed 1,471 articles. At the first stage, the factors presented in the indicator were extracted for all 1,471 articles (Denominator) and at the second stage, out of each 16 journals of this field, in the Journal Citation Report database, the presented factors were extracted for three articles as a sample (A total of 48 articles), namely numerator. The calculated values were embedded in the indicator obtained from this

study and the results were calculated using the descriptive method and were then presented. Finally, in order to determine the correctness of its application, Confirmatory factor analysis (CFA) has been used on the sample data to determine the Spearman's correlation between the two.

RESULTS

Seventeen experts in the field of scientometrics presented their opinions through the questionnaires which had been sent to them. Table 1 provides the geometric means of the experts' opinions in the form of paired comparisons between the factors affecting the quality of an article.

Then, the weight of each factor was calculated based on the above-mentioned means and they were presented in Table 2 in their relative order of significance.

As it is evident, citations without self-citations have the highest weight in terms of significance and authors' *h*-index has the lowest weight.

In order to define an indicator to determine the article quality, the weights obtained through the above method were multiplied by 10 and rounded to one decimal place. They will then be multiplied by the values of each factor of an article. Because the quality of an article and its weakness or strength is needed to be measured based on a specific criterion, thus, getting inspired by some standard indicators in international databases such as FWCI and Cite Score Percentile in the Scopus and Eigen factor and Article Influence Score in the WoS, the mean values of each indicators in the relevant subject area can be considered as a criterion.

Proposed Indicator

According to what was mentioned above, the proposed article quality indicator is presented in this study based on the discussed factors, as follows

$$AQI = \frac{\begin{array}{c}(2\times JR)+(2.4\times(C-SC)+(1.5\times CgJR)+\\(1.6\times CdJR)+(1.9\times CTA)+(0.9\times(AHI)\end{array}}{\begin{array}{c}(2\times FJR)+(2.4\times(FC-FSC)+(1.5\times FCgJR)+\\(1.3\times FCdJR)+(1.9\times FCTA)+(0.9\times FAHI)\end{array}}$$

Based on what database the data of the desired article are extracted from, the numerator components in the above indicator are as follows

- JR= Journals Rank: Equivalent to the IF of journal which published the article in WoS and the SJR of journal which published the article in Scopus;
- C-SC= Citations without Self Citations: Number of article citations minus the self-citations in the corresponding citation database (Citations and self-citations are considered two years after the publication of articles.);
- CgJR= Citing Journals Rank: The mean IF of all journals containing articles citing desired article in WoS and the mean SJR of all journals containing articles citing desired article in Scopus;
- CdJR= Cited Journals Rank: The mean IF of all journals containing sources used in desired article in WoS and the mean SJR of all journals containing sources used in desired article in Scopus;
- CTA= Cited Top Articles: The number of articles cited by the desired article, referred to as "Hot Papers" or "Highly Cited Papers" by WoS, to all sources used in the article and in Scopus, the number of articles cited by the desired article, which fall in percentiles between 90 and 99, to all sources used in the article;
- AHI= Authors' *h*-Index: The mean *h*-index of all the authors of desired article in the corresponding citation database

Based on what database the data of the desired article are extracted from, the denominator components in the above indicator are as follows

- FJR= Field Journals Rank: Equivalent to the mean IF of all available journals in the desired subject area in WoS and the mean SJR of all the journals in the desired subject area in Scopus
- FC-FSC= Field Citations without Field Self Citations: The mean number of citations from all articles in the desired subject area minus the mean number of authors' self-citations from all articles in that subject area in the corresponding citation database (Citations and self-citations are considered two years after the publication of articles.);
- FCgJR= Field Citing Journals Rank: The mean IF of all journals containing articles citing any articles in the desired subject area in WoS and the mean SJR of all journals containing articles citing any article in the desired subject area in Scopus;
- FCdJR= Field Cited Journals Rank: The mean IF of all journals containing sources used in any articles in the desired subject area in WoS and the mean SJR of all journals containing sources used in any article in the desired subject area in Scopus.
- FCTA= Field Cited Top Articles: The number of articles cited by the articles in the desired subject area, referred to as "Hot Papers" or "Highly Cited Papers" by WoS, to all sources used in all articles in that area and in Scopus,

Table 1: Geometric means of article quality factors significance in the form of paired comparisons.

	Journal Rank	Citations without Self Citations	Cited Journals Rank	Citing to Top Articles	Authors *h*-Index	Citing Journals Rank
Journal Rank	1	0.653854	1.588628	1.153646	2.035862	1.806828
Citations without Self Citations	1.529394	1	1.842494	1.205909	2.34388	1.409944
Cited Journals Rank	0.629474	0.542743	1	0.557653	2.04466	0.913058
Citing to Top Articles	0.866817	0.82925	1.793229	1	2.199963	1.238454
Authors *h*-Index	0.491192	0.426643	0.489079	0.454553	1	0.596825
Citing Journals Rank	0.658174	0.709248	1.09522	0.807459	1.675533	1

Table 2: The weights of factors for article quality evaluation.

Rank	Factors	Weight
1	Citations without Self Citations	0.235945
2	Journal Rank	0.201893
3	Citing to Top Articles	0.194389
4	Citing Journals Rank	0.148275
5	Cited Journals Rank	0.132716
6	Authors *h*-Index	0.086783

the number of articles cited by the articles in the desired subject area, which fall in percentiles between 90 and 99, to all sources used in all articles in that area;

- FAHI= Field Authors' *h*-Index: The mean *h*-index of all the authors of the articles in the desired subject area in the corresponding citation database

Example Data

As noted in the method section, in order to test the proposed indicator, all articles in the field of medical ethics were taken into consideration and at Stage 1, the values of six factors effective in measuring the article quality were fully calculated for 1,471 research papers of this field conducted in 2015 and at Stage 2, they were calculated for 48 sample papers. Seeing as authors' *h*-index is not presented in a structured form in the database being used (WoS), it was not possible to calculate this indicator. Moreover, the ratio of the Top Cited Articles to all desired articles can only be calculated using the desired database, thus, in this study, this factor could not be calculated either. Four factors were calculated. At the first stage, the factors were extracted and calculated for all 1,471 articles like this:

FJR = 1.4

FC = 1.95

FSC = 0.42

FC-FSC = 1.53

CgJ (Citing Journals) = 2681

$$\sum_{i=1}^{2681} CgJR = 8291.96$$

FCgJR = 3.09

CdJ (Citing Journals) = 31200

$$\sum_{i=1}^{31200} CdJR = 159923.49$$

FCdJR = 5.12

As the above values were substituted in the indicator, the denominator was 17.763.

At the second stage, the statistics obtained for the four factors were extracted for 48 articles and the calculated values along with the final value of the indicator were presented in Table 3.

Given the value of the indicator for the article, present in the numerator, is divided by the value of the indicator for all articles in the relevant subject area, the criteria for measuring the quality of an article is 1 through this method. If the value of the indicator is less than 1, the article will have a weaker quality than its usual level in the relevant subject area. The value of the indicator equal to 1 represents a medium quality corresponding to the medium level of the relevant subject area. However, if this indicator is higher than 1 for an article, it can be indicative of high quality of the article relative to the medium level of the corresponding subject area, based on the indicator presented in this study. Based on the results presented in Table 3 and using the proposed indicator of this study, the highest value of the AQI is 3.25 and the lowest is 0.01.

Although, according to the information provided, AHP method is appropriate to determine the weight and importance of each of the factors discussed in this paper, in order to determine the correctness of its application, confirmatory factor analysis (CFA) method was used on the sample data to determine the correlation between the two. Therefore, the weight of each factor is provided in Table 4 using this method (Goodness of Fit Index (GFI) = 0.96). In addition, the results

Table 3: The value of the indicators for articles in the field of medical ethics and the final AQI according to AHP and CFA.

No.	Journal	JR	C-SC	CdJR	CgJR	AQI_AHP	AQI_CFA
1	AMERICAN JOURNAL OF BIOETHICS	6.43	0	0	3.88	1.01	0.41
2	AMERICAN JOURNAL OF BIOETHICS	6.43	2	2.27	21.81	2.78	2.15
3	AMERICAN JOURNAL OF BIOETHICS	6.43	1	1.07	1.23	1.04	0.49
4	BMC Medical Ethics	1.62	3	1.87	6.9	1.25	1.06
5	BMC Medical Ethics	1.62	1	1.95	1.67	0.60	0.55
6	BMC Medical Ethics	1.62	10	0.85	2.33	1.78	1.21
7	BIOETHICS	1.56	0	1.56	0.78	0.37	0.34
8	BIOETHICS	1.56	0	0	1.21	0.26	0.12
9	BIOETHICS	1.56	12	2.95	4.68	2.39	1.87
10	JOURNAL OF MEDICAL ETHICS	1.53	0	0	0.51	0.21	0.07
11	JOURNAL OF MEDICAL ETHICS	1.53	11	2.91	2.65	2.10	1.64
12	JOURNAL OF MEDICAL ETHICS	1.53	0	0	0	0.17	0.04
13	Accountability in Research-Policies and Quality Assurance	1.51	6	1.72	7.6	1.68	1.35
14	Accountability in Research-Policies and Quality Assurance	1.51	1	0.42	5.97	0.78	0.59
15	Accountability in Research-Policies and Quality Assurance	1.51	18	1.9	6.64	3.25	2.36
16	Journal of Empirical Research on Human Research Ethics	1.35	5	2.97	5.93	1.51	1.34
17	Journal of Empirical Research on Human Research Ethics	1.35	3	3.21	15.8	1.99	1.86
18	Journal of Empirical Research on Human Research Ethics	1.35	0	0	9.93	0.88	0.7
19	HASTINGS CENTER REPORT	1.35	1	0.98	10.93	1.17	1.01
20	HASTINGS CENTER REPORT	1.35	1	2.99	0	0.54	0.59
21	HASTINGS CENTER REPORT	1.35	1	1.22	8.78	1.03	0.9
22	Public Health Ethics	1.26	1	2.5	2.48	0.67	0.68
23	Public Health Ethics	1.26	4	2.01	0.33	0.88	0.72
24	Public Health Ethics	1.26	1	0	2.33	0.45	0.27
25	JOURNAL OF LAW MEDICINE And ETHICS	1.22	5	5.19	3.28	1.49	1.51
26	JOURNAL OF LAW MEDICINE and ETHICS	1.22	0	0	1.03	0.21	0.1
27	JOURNAL OF LAW MEDICINE and ETHICS	1.22	0	0	3.3	0.38	0.25
28	Neuroethics	0.98	3	1.78	4.4	0.99	0.86
29	Neuroethics	0.98	0	0.98	6.27	0.65	0.6
30	Neuroethics	0.98	0	0	0.78	0.17	0.08
31	Medical Law Review	0.93	6	2	4.62	1.42	1.18
32	Medical Law Review	0.93	0	0	4.09	0.40	0.3
33	Medical Law Review	0.93	0	0	0.03	0.11	0.02
34	Developing World Bioethics	0.9	0	0	5.34	0.49	0.38
35	Developing World Bioethics	0.9	3	3.82	15.87	1.99	1.95
36	Developing World Bioethics	0.9	0	0	0.22	0.12	0.04
37	Journal of Bioethical Inquiry	0.82	1	0.93	7.76	0.87	0.77
38	Journal of Bioethical Inquiry	0.82	1	0.76	0.65	0.34	0.27
39	Journal of Bioethical Inquiry	0.82	0	0	6.94	0.60	0.49
40	Ethik in der Medizin	0.62	0	0	0.14	0.08	0.02
41	Ethik in der Medizin	0.62	0	0	0.23	0.09	0.03
42	Ethik in der Medizin	0.62	0	0	0	0.07	0.01
43	GENETIC COUNSELING	0.24	0	0	3.37	0.27	0.23
44	GENETIC COUNSELING	0.24	0	0	1.66	0.15	0.12
45	GENETIC COUNSELING	0.24	0	0	0	0.03	0.01
46	Acta Bioethica	0.1	0	0	0.5	0.05	0.04
47	Acta Bioethica	0.1	0	0	0	0.01	0
48	Acta Bioethica	0.1	0	0	0	0.01	0

Table 4: Estimates obtained from Confirmatory factor analysis (CFA).

Variables	Estimate
JR	0.15
C-SC	0.55
CgJR	0.99
CdJR	0.42

Table 5: Association between article quality factors and AQI based on Spearman's correlation coefficient.

	JR	C_SC	CgJR	CdJR	AQI
JR	1.000				
C_SC	0.451	1.000			
CgJR	0.439	0.854	1.000		
CdJR	0.333	0.471	0.449	1.000	
AQI	0.633	0.846	0.788	0.781	1.000

of application of these weights to determine the indicator used, are reported in Table 3, column of AQI_CFA.

The results revealed that the AQI obtained from CFA and AQI obtained from AHP weights were strongly associated, Spearman's correlation coefficient was 0.98 and significant (P <0.001).

Moreover, the result of correlation of each of the factors with final AQI (According to AHP weights) was provided in Table 5. The results show that there is a correlation between all the factors and final AQI (All correlation coefficient were significant (P<0.05), because the proposed AQI is created according to the research objective and the effect of total amount of factors.

DISCUSSION

This study was conducted to provide an article quality measurement indicator to balance other indicators in this field and to solve their problems. From among deficiencies existing in the previous indicators, we can refer to their focus on a particular aspect of the quality of an article and not all of its aspects in a comprehensive manner. As mentioned in detail in the initial sections of this study, there are drawbacks for each of these indicators. The impact factor is highly dependent on the area of research and top cited articles.[4] From among the limitations of the citation indicator, we can refer to the difference in receiving citations in different subject areas and the average number of authors, which can increase the number of received citations.[10-11]

The *h*-index is also affected by self-citations and the number of authors.[14-15] In addition, this indicator is not appropriate for novice researchers seeing as their citation and publication outputs are relatively low.[16]

In view of that, we first identified all factors affecting the quality of articles. Given that it is possible that the role of each factor will be different, based on experts' opinions, we calculated the impact degree of them and presented the proposed indicator accordingly. In order to effectively demonstrate the results of employing this indicator to identify its strengths and weaknesses, we selected a sample in the field of medical ethics and calculated the factors present in this indicator and then the final value of the indicator for articles in this field as well as in the compilation of articles in the entire field based on the proposed indicator. Accordingly, with respect to the indicator's strengths, we can refer to the following:

- As can be seen in some articles, despite the weakness of an article in a particular factor based on the proposed indicator, that article can earn points for other factors affecting its quality; thus, establishing a basis for a fair assessment. This point can be seen especially in cases where no citations have been received yet.
- Seeing as the weight of factors is calculated and presented based on experts' opinions and considering the emphasis of other texts of the literature on the citation factor, which indicates the impact of an article on the relevant subject area and even in other scientific areas due to its quality,[10,11] we are witnessing the higher weight of this factor as compared with that of other factors, whose impact can be seen in top cited articles of the studied area. For instance, an article with 18 citations, which has the highest number of citations in the collection of 48 articles studied, has scored 43.2 points in this factor. Despite the fact that the Impact Factor (IF) of the journal publishing this article is 1.51, this article earned a higher AQI among other articles, even among articles of a journal with the Impact Factor (IF) of 6.434.
- Because values corresponding to the factors are divided by the mean value of these factors in the relevant subject area, the normalization, which is made, paves the way for comparing a particular article in an area with articles of other areas as the impact of the difference between the areas in their research and citation performance has been adjusted.
- The emphasis on a particular factor for scientific evaluations in scientific associations gives rise to the researchers' mentality to focus on enhancing that factor (Such as the impact factor of a journal publishing the article) and neglecting other factors. If all the factors are taken into consideration when evaluating papers, it can be expected that the researchers will try to boost different qualitative facets of an article and they will not focus on a single factor.
- Now, the major emphasis in databases is on citations to identify the quality of an article. Given that all the factors

presented in this indicator can be calculated in databases and are easy to extract through the database, scientific associations can be provided with comprehensive and complete information in an integrate form with consideration of all the factors to evaluate the quality of articles.

- In case of providing the calculation of this indicator for articles through databases, due to its presented features and comprehensiveness, this indicator can be an appropriate option to establish research policies based on a variety of components such as the article and the author, which can play an effective role in some cases like giving research grants, determining the top researcher, determining the top article and so on.
- Finally, it seems unavoidable to point out that the field of medical ethics is considered an example, but it is also possible to calculate and implement this indicator in other areas.

Regarding the weaknesses of this indicator, the following can be mentioned

- Given that six factors are involved in the calculation of this indicator, it may be difficult to calculate it. Nevertheless, given the fact that this indicator takes the effects of all these factors into account, it is worth calculating it.
- One of the items that contribute to the accurate calculation of the coefficients of the factors is experts whose opinions can be received. The number of experts was limited in the field of scientometrics compared to that in some other scientific fields, even though the said number was in accordance with the standard of qualitative studies.

Limitations

For the purpose of calculating this indicator, there are some limitations, which are among limitations caused by the manual calculation of indicators. However, if these values can automatically be calculated in Scopus and Web of Science databases, these limitations will be reduced. The limitations are as follows

- The impossibility of manually calculating all indicators; for example, *h*-index and CTA.
- The impossibility of substituting the field of medical ethics (Which was chosen for manual calculation due to its appropriate number of documents) by a broader area with a greater diversity in the six factors.

CONCLUSION

Regarding the importance of articles in research evaluations in different areas, which target the quality of articles, there is a need for valid evaluation tools to facilitate this matter. These tools need to have features such as comprehensiveness, ease of calculation, access to basic information and understandability so that a fair and just assessment can be made on articles based on them. Databases such as Scopus and Web of Science have already presented indicators and factors based on their information, each of which possesses part of these features. However, given that they have considerable deficiencies in the most important feature, namely comprehensiveness, it was necessary to introduce a highly comprehensive indicator taking into consideration all the features. Having the aforementioned features and other features such as computability by databases, taking all factors into account along with calculating their weights based on experts' opinions, the successful testing of the formula corresponding to the indicator and so on the presented indicator can be evaluated as complementary to other mono-dimensional indicators or instead of them and can be employed in scientific-research policies.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVIATIONS

AQIN: Article Quality Indicator; **AHP:** Analytical Hierarchy Process; **JR:** Journals Rank; **C-SC:** Citations without Self Citations; **FJR:** Field Journals Rank; **FC-FSC:** Field Citations without Field Self Citations; Field Citing Journals Rank (FCgJR); FCdJR: Field Cited Journals Rank; **FCTA:** Field Cited Top Articles; **FAHI:** Field Authors' *h*-Index; **ES:** Eigenfactor score; **AIS:** Article Influence Score; **SJR:** Scimago Journal Rank.

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SUMMARY

- Designing an indicator to evaluate the quality of articles for citation databases.
- Provide an article quality measurement indicator to balance other indicators.
- The appropriate indicator to make research policies based on a variety of components such as the article, author/s, journal, citations and references.
- The weight of factors is calculated and presented based on experts' opinions and is tested on a data set.

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