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Comparative analysis between impact factor and h-index for psychiatry journals

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Abstract

Objective: Journal Impact Factor (IF) is well known for being the document measure of scientific journal impact, despite several recognised limitations. Our study tried to propose a new rating system (journal h-index) applied to a sample of psychiatry journals and compared to IF.

Method: In order to strictly compare their IF and h-index using the same data, we wanted to work on all the citations obtained in 2006 by the articles published in 2004-2005 in the 50 journals of our Web of Science sample of psychiatry. We studied the statistical correlation between the IF 2006 and h-index 2006.

Results: The rankings of the 50 psychiatry journals were different when we took into account respectively the descending order of IF 2006 and h-index 2006 which revealed 16 steps and therefore 16 groups of journals. We noted that two journals were up 21 places (record) in h-index 2006 ranking and one journal lost 17 places. Nevertheless we obtained a high correlation coefficient well illustrated by the group of the seven first journals whose the two rankings were very close. We noted that our sample had only two journals really specialised in the publication of reviews.

Conclusions: The rating of journals starting from the h-index may represent an interesting and complementary alternative to the well-known rating based on the IF. The h-index rating proposes a categorization of journals making it possible to create classes of journals with the same h-index. This type of ranking by classes is often appreciated and used by experts and scientific committees of evaluation.

Key Words

Journal Impact Factor, Hirsch index, journal ranking, psychiatry journals

Résumé

Objectif : Le Facteur d'Impact (FI) est bien connu pour être le principal indice bibliométrique permettant d'évaluer les journaux scientifique, malgré certaines limites maintenant reconnues. Notre étude propose un nouvel indice bibliométrique basé sur le h-index et testé sur un échantillon de journaux de psychiatrie, comparativement au FI.

Méthode : Afin de comparer rigoureusement le FI et le h-index en utilisant strictement les mêmes données, nous avons travaillé sur l'ensemble des citations reçues en 2006 par les articles publiés en 2004-2005 par les 50 journaux issus d'un échantillon de la section « Psychiatry » du Web of Science. Nous avons étudié la corrélation entre le FI 2006 et le h-index 2006.

Résultats : Les classements des 50 journaux de psychiatrie étaient différents lorsque nous prenions en compte respectivement l'ordre décroissant du FI 2006 et l'ordre décroissant du h-index 2006, ce dernier révélant 16 paliers et donc 16 groupes de journaux. Nous avons mis en évidence que deux journaux ont gagné 21 places (le record) dans le classement h-index 2006 et qu'un journal a perdu 17 places. Néanmoins nous avons obtenu un coefficient de corrélation élevé, ce qu'illustre bien le groupe des sept premiers journaux dont les deux classements sont très proches. Nous avons noté que dans notre échantillon seuls deux journaux étaient réellement spécialisés dans la publication de revues de synthèse.

Conclusion : L'évaluation des journaux basée sur le h-index peut représenter une alternative intéressante et complémentaire au classement fondé sur le FI bien connu. Le classement basé sur le h-index propose une catégorisation des journaux par classes de journaux présentant le même h-index. Ce type de classement par classes est souvent apprécié et utilisé par les experts et les comités scientifiques d'évaluation.

Mots clés : Facteur d'Impact, h-index, classement des journaux, journaux de psychiatrie

The Thomson Scientific journal Impact Factor (IF) of Garfield is well known for being the document measure of journal impact (Garfield, 1955). IF is often used to rank scientific journals, despite several recognised limitations well summarized by Curtis and Hunter (2006), Delavalle et al. (2007), Dong et al. (2005), Hecht et al. (1998). First, IF only looks two years retrospectively. Secondly, review articles are summaries of the field and are much more frequently cited. Third, the denominator of the equation relates to the number of citable items, including original manuscripts, letters, case reports, and literature reviews published; the journal that publishes very few citable items annually will have an advantage despite infrequent citation. Fourth, some journals encourage self-citation. Fifth, different specialties may indeed have different standards for the number of articles cited per manuscript. The ISI recognizes the shortcomings of their methodology and have agreed that it is but one measure of a journal's quality.

Hirsch recently suggested a new research performance indicator that is designed for application at the micro level (Hirsch, 2005). The Hirsch-Index, or h-index, quantifies as a single-number criterion the scientific output of a single researcher. The h-index is a very simple new measure incorporating both quantity and visibility of publications (Bornmann et al., 2007): "A scientist has index h if h of his or her N_p papers have at least h citations each and the other ($N_p - h$) papers have fewer than $\leq h$ citations each" (Hirsch, 2005). For example h-index of 20 means that the scientist has published 20 papers that each had at least 20 citations.

Braun et al. (2006) proposed that the h-index could be usefully applied to the citation analysis of journals, as well. The h-index for evaluating the scientific impact of journals as a robust alternative indicator can be an advantageous complement to journal IF. The journal h-index is calculated as follows: "Retrieving all source items of a given journal from a given year and sorting them by the number of times cited, it is easy to find the highest rank number which is still lower than the corresponding 'Times Cited' value. This is exactly the h-index of the journals for the given year".

In order to progress in the IF/h-index comparison analysis, this study compares IF and h-index using exactly and strictly the same parameters (identical two publication years (2004-2005) and identical one-year citation window (2006)). Hence, we propose here to compare IF 2006 and what we call h-index 2006 for one sample of 50 psychiatry journals taken from the Journal Citation Reports (JCR) 2006. Moreover the field of psychiatry (using both social and scientific methods) would be interesting to compare to one more classical medical field such as pharmacology (that publishes many literature reviews) recently studied (Bador et al., 2010).

Methods

Constitution of the sample

We ranked the 94 journals of the "Psychiatry" section of the JCR 2006 drawn from the Web of Science in descending order of IF and we took the first 50 journals to constitute our sample.

In order to strictly compare their IF and h-index using the same data, we wanted to work on all the citations obtained in 2006 by the articles published in 2004-2005 in the 50 journals of our sample of Psychiatry. So we had to calculate a Hirsch-type index for journals that agrees with the Braun et al.'s (2006) definition of the h-index of a journal for a given year. Our given year being 2006, we wanted to compare IF 2006 and what we logically called h-index 2006.

Calculation of h-index 2006

The IF was easily extracted from the JCR 2006 whereas h-index 2006 was calculated manually for each of the 50 journals of our sample in the following way:

- 1) Search for articles of 2004
- 2) We displayed the references citing each article obtained ("Times Cited" link)

- 3) Using the window obtained and the “Refine Results” function, we extracted the number of articles of 2006 (Citations 2006) from the “Publication Years” menu
- 4) The same procedure for the articles of 2005

Thus, for each of the 50 journals, we compiled a table similar to the one shown in table 1 for the journal “Journal of Psychiatry and Neuroscience”. We then identified the h-index 2006 corresponding to the number h of articles published in 2004-2005 and cited at least h times during 2006.

Please insert Table 1: Calculation of the h-index 2006

Also, for all the articles of 2004-2005 published in the 50 journals, we identified the number of “Reviews” using the “Refine Results” function and the “Document Types” menu. We thus calculated the percentage of Reviews compared with the total number of articles published in 2004-2005.

Correlation between the h-index 2006 and the impact factor 2006

We studied the statistical correlation between the IF 2006 and h-index 2006. For this, we calculated Pearson’s correlation coefficient.

Results

Table 2 presents the data obtained (IF 2006, h-index 2006, IF ranking, h-index ranking, IF/h-index ranking difference, number of articles published in 2004-2005, percentage of articles that are reviews) for the 50 psychiatry journals ranked in descending order of h-index 2006 and compared to the ranking based on IF 2006. Except the group of the seven first journals for which the two rankings are very close, table 2 shows significant differences between the two rankings, for example :

- The journal “Psychopharmacology” ranked 24th with IF 2006 (IF 2006 = 3.625), was ranked 7th with h-index 2006 (h-index 2006 = 15), equal to the journals “British Journal of Psychiatry” (whose IF ranking, 7th, did not change, IF 2006 = 5.436) and “Schizophrenia Research” (itself ranked 14th in the IF 2006 ranking, IF 2006 = 4.264).
- The two journals ranked 11th with h-index 2006 (h-index 2006 = 13) were ranked respectively 9th (IF 2006 = 4.767) and 23rd (IF 2006 = 3.630) with IF 2006.
- Among the seven journals ranked 14th with h-index 2006 (h-index 2006 = 11), the best IF 2006 ranking was 15th and the worst was 35th. However two journals had exactly the same IF 2006 (IF 2006 = 3.857) and the same h-index 2006 (h-index 2006 = 11), and therefore the same rankings!

Please insert Table 2: h-index 2006 ranked list of the 50 first Psychiatry journals

Table 2 also shows the saving or loss of places in the two rankings. So we can see that for example the journals “Progress in Neuro-Psychopharmacology and Biological Psychiatry” and “Psychiatry Research” are up 21 places (which is the record) in h-index 2006 ranking, the journal “International Journal of Neuropsychopharmacology” loses 17 places in h-index 2006 ranking.

As a complement, to illustrate the data in table 2 in graph form, we present figure 1 which shows the ranking of the sample in descending order IF 2006.

Please insert Figure 1: Comparison of IF 2006 and h-index 2006 for Psychiatry journals (IF 2006 ranking)

Figure 1 shows an overall decrease in h-index 2006, revealing 16 steps (each step having an identical h-index 2006, as also shown in table 2) and therefore 16 groups of psychiatry journals whose h-index

varies from 27 to 5. The h-index 2006 is always, and without exception, much higher than the IF 2006 (up to 4 times higher for the journals “Psychopharmacology” and “Progress in Neuro-Psychopharmacology and Biological Psychiatry”).

Overall, our sample of Psychiatry journals publishes quite few articles in the form of reviews. Only two journals (4%) are really specialised in the publication of this type of article: “Mental Retardation and Developmental Disabilities Research Reviews” and “Progress in Neuro-psychopharmacology and Biological Psychiatry”, respectively published 100% and 94% of reviews.

For the Psychiatry journals, we obtained a high Pearson’s correlation coefficient of 0.88. In figure 2, we show the scatter plot and the associated linear regression line.

Please insert Figure 2: Correlation of IF 2006 and h-index 2006 for Psychiatry journals

Discussion

The interest and originality of our study were to compare rankings based on IF 2006 and h-index 2006, using strictly the same data based on the usual definition of IF (identical two publication years 2004-2005 and identical one-year citation window 2006) for one sample of journals of the health field such as Psychiatry. The study by Schubert et al. (2007) is based on strictly the same parameters as well, but particularly on one publication year and on a three-year citation window beginning with the publication year for both the journal impact measure and the h-index.

The results given in table 2 show that, for the Psychiatry journals, the two rankings are quite different. The IF allows a ranking using a customary descending order starting from the values of the JCR given to the nearest thousandth. However, the h-index offers a decreasing ranking starting from values that are integers. Therefore, the h-index ranking is much less fine and precise and reveals 16 steps (figure 1) each corresponding to a group of journals with the same h-index. Also, the amplitude of the 50 h-index values (amplitude = 22) is higher than that for the 50 IF values (amplitude = 12). Furthermore, we must note that for a given journal of our sample the h-index is always higher than the IF (up to 4 times higher).

The “Psychiatry” section has very few journals specializing in the publication of reviews, which makes this type of data not very important for comparing the IF and h-index. So for our sample the rankings based on the IF and the h-index are not very sensitive to the percentage of reviews published. This is not what we observed with the “Pharmacology and Pharmacy” section which has the characteristic of having a very big percentage of journals specializing in the publication of reviews. These journals are those that very often present the best IF, which is logical since their review articles are more often cited than the original articles. However, ranking based on the h-index is not very sensitive to the percentage of reviews published (Bador et al., 2010).

If we study the relative ranking (in table 2) of our 50 psychiatry journals in the 2 types of ranking analysed here, we can see that 6 journals have identical rank: “Archives of General Psychiatry” 1st, “Neuropsychopharmacology” 5th, “British Journal of Psychiatry” 7th, “European Neuropsychopharmacology” 21st, “Psychiatry Research-Neuroimaging” 33rd, “Human Psychopharmacology-Clinical and Experimental” 42nd. Among the 44 other journals, 23 journals won between one and five places, 17 journals won between 10 and 21 places. Two journals having the same h-index 2006 ranking have the same IF 2006 (IF 2006 = 3.857) which is very rare in a given section of the JCR, they have of course an identical IF 2006 ranking. For a given journal, the possibly high difference between the two rankings may be explained by the fact that the high IF (ant then the good IF ranking) is the result from one or several outstandingly highly cited articles for which the journal h-index is not sensitive.

The second part of this comparative study of the IF and h-index concerned the analysis of their Pearson's correlation coefficient. Thus, we noted a high Pearson's correlation coefficient (0.88) for the Psychiatry sample. This is well illustrated by the group of the seven first journals whose the two rankings are very close as seen in table 2. This was not what we observed with the Pharmacology and Pharmacy section which obtained a low Pearson's correlation coefficient (0.59) (Bador et al., 2010).

More generally, and as shown in our study of one very small sample, the rating of journals starting from the h-index may represent an interesting and complementary alternative to the well-known rating based on the IF. In fact, the h-index rating proposes a categorization of journals (several journals capable of having the same h-index) making it possible to create classes of journals with the same h-index: e.g. class 5, class 6, class 7...class 19, class 25. It is evident that, to have a meaning, this ranking must be made as for IF, within a collection of comparable journals of the same well-identified scientific discipline. In order to put this new type of ranking into perspective, we could certainly propose to display beside the value of each class the maximum value found for the journal obtaining the best h-index for the discipline studied, using the following model:

journal X \rightarrow h-index=6/25

journal Y \rightarrow h-index=19/25

meaning that journal X is characterized by an h-index of 6 and journal Y by an h-index of 19, with the note that the journals rated first of the discipline studied have an h-index of 25.

This type of ranking by classes of journal is often appreciated and used by experts and scientific committees of evaluation as shown by Vanclay in the study proposing a ranking of forestry journals based on an evaluation of the journals by experts and also on their h-index (Rousseau, 2006).

The use of ranking by classes of journal based on the h-index is interesting in disciplines in which the amplitude of h-index is high in order to have the maximum number of classes to compare. This is the case of scientific, technical and medical fields where authors cite a lot of articles. Nevertheless in other types of disciplines such as social sciences, arts and humanities in which scientific collaboration and citations of articles by authors are less developed, the method of journal h-index may be less significant and more difficult to use.

As shown by Braun et al. (2006), for a given journal the h-index presents different and useful characteristics compared with the IF. Firstly, h-index is insensitive to an accidental excess of uncited papers and also to one or several outstandingly highly cited papers; secondly, it combines the effects of "quantity" (number of publications) and "quality" (citation rate) in a rather specific balanced way that should reduce the apparent "overrating" of some review journals.

The h-index could be very interesting and a complementary tool of IF if it would not be calculated for a "life-time contribution" as suggested by Hirsch (2005) for individual scientists, but for a definite period as we did in this study with the same parameters as IF 2006 (articles published in 2004-2005 and cited in 2006). In our study, IF and h-index were exactly and strictly comparable and thus complementary in the rating of journals of the same discipline.

Nevertheless we must point out a limitation in the use of the journal h-index. The journal h-index cannot be higher than the number of articles published, so it disadvantages journals that may have a high IF but with a smaller journal h-index as a result. Braun et al. (2006), who worked on 2001 as source year (one publication year), had to eliminate the first and second journals of the 2001 IF list. Since these journals published 24 and 23 papers, respectively, in 2001, they had no chance to compete with the chart toppers (obviously the h-index cannot be larger than the number of papers it is based on). So if we take a two publication year period as in our study, all journals will have published enough articles (probably at least fifty) and this will avoid having to possibly eliminate some journals having very high IF because they published a very low number of articles.

As suggested by Rousseau (2006), one might also consider calculating a relative h-index by dividing it by the yearly number of articles of the journal, which could be another research lead for the assessment of the different ranking methods of scientific journals.

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Table 1: Calculation of the h-index 2006

Journal of Psychiatry and Neuroscience			
Articles 2004*	Citations 2006	Articles 2005*	Citations 2006
1	1	1	0
2	13	2	0
3	0	3	2
4	13	4	1
5	1	5	0
6	4	6	1
7	3	7	0
8	3	8	2
9	0	9	0
10	3	10	1
11	0	11	1
12	7	12	0
13	1	13	0
14	0	14	0
15	15	15	0
16	17	16	1
17	5	17	0
18	2	18	1
19	5	19	4
20	15	20	0
21	8	21	0
22	1	22	0
23	11	23	0
24	15	24	4
25	0	25	2
26	19	26	5
27	1	27	0
28	2	28	1
29	7	29	1
30	1	30	3
31	3	31	1
32	1	32	1
33	0	33	6
34	0	34	3
35	1	35	1
36	2	36	5
37	0	37	5
38	5	38	1
39	12	39	12
		40	0
		41	0
		42	1
		43	0
		44	5
		45	3
		46	0
		47	2
		48	1
		49	0
		50	1
		51	5
		52	1
		53	0
		54	1
		55	2
		56	3
9 papers cited at least 10 times		1 paper cited at least 10 times	
Total: 10 papers 2004-2005 cited at least 10 times			
9 papers cited at least 11 times		1 paper cited at least 11 times	
Total: 10 papers 2004-2005 cited at least 11 times			
h-index = 10			

*Order of the articles given by the Web of Science

Table 2: h-index 2006 ranked list of the 50 first Psychiatry journals

h-index 2006 ranking	Abbreviated Journal Title	IF 2006	h-index 2006	IF ranking	h-index ranking	IF/h-index ranking difference	NB articles 2004-2005	% Reviews
1	ARCH GEN PSYCHIAT	13.936	27	1	1	0	233	3
2	AM J PSYCHIAT	8.250	25	3	2	+1	592	49
3	BIOL PSYCHIAT	7,154	22	4	3	+1	635	5
4	MOL PSYCHIATR	11.804	21	2	4	-2	204	49
5	NEUROPSYCHOPHARMACOL	5.889	16	5	5	0	468	6
	J CLIN PSYCHIAT	5.533	16	6	5	+1	552	19
7	BRIT J PSYCHIAT	5.436	15	7	7	0	326	25
	SCHIZOPHR RES	4.264	15	14	7	+7	503	3
	PSYCHOPHARMACOLOGY	3.625	15	24	7	+17	801	5
10	AM J MED GENET B	4.463	14	11	10	+1	298	1
11	J AM ACAD CHILD PSY	4.767	13	9	11	-2	287	41
	J NEUROL NEUROSUR PS	3.630	13	23	11	+12	700	3
13	J AFFECT DISORDERS	3.138	12	28	13	+15	456	4
14	CNS DRUGS	4.210	11	15	14	+1	157	50
	ADDICTION	4.088	11	17	14	+3	319	11
	ACTA PSYCHIAT SCAND	3.857	11	18	14	+4	258	13
	PSYCHOSOM MED	3.857	11	18	14	+4	287	6
	PSYCHOL MED	3.816	11	20	14	+6	299	5
	BIPOLAR DISORD	3.494	11	25	14	+11	156	23
	PROG NEURO-PSYCHOPH	2.584	11	35	14	+21	320	94
21	J CLIN PSYCHOPHARM	4.561	10	10	21	-11	171	4
	J PSYCHIATR NEUROSCI	4.100	10	16	21	-5	70	26
	EUR NEUROPSYCHOPHARM	3.794	10	21	21	0	160	6
	DRUG ALCOHOL DEPEN	3.213	10	27	21	+6	300	8
25	INT J NEUROPSYCHOPH	5.184	9	8	25	-17	114	10
	SCHIZOPHRENIA BULL	4.352	9	12	25	-13	122	11
	PSYCHOTHER PSYCHOSOM	4.333	9	13	25	-12	93	4
	J PSYCHIATR RES	3.700	9	22	25	-3	140	2
	DEMENT GERIATR COGN	2.511	9	38	25	+13	223	3
	PSYCHIAT SERV	2.430	9	41	25	+16	316	0
	J INT NEUROPSYCH SOC	2.367	9	43	25	+18	188	7
	PSYCHIAT RES	2.310	9	46	25	+21	303	1
33	J PSYCHOPHARMACOL	3.255	8	26	33	-7	149	14
	INT CLIN PSYCHOPHARM	3.080	8	29	33	-4	113	5
	EUR ARCH PSY CLIN N	3.042	8	30	33	-3	120	5
	AM J GERIAT PSYCHIAT	2.894	8	31	33	-2	198	5
	PSYCHIAT RES-NEUROIM	2.755	8	33	33	0	151	2
	MENT RETARD DEV D R	2.671	8	34	33	+1	82	100
	DEPRESS ANXIETY	2.549	8	36	33	+3	113	5
	J PSYCHOSOM RES	2.322	8	45	33	+12	273	0
	EPILEPSY BEHAV	2.026	8	50	33	+17	345	14
42	GEN HOSP PSYCHIAT	2.500	7	39	42	-3	118	0
	J CHILD ADOL PSYCHOP	2.486	7	40	42	-2	148	8
	HUM PSYCHOPHARM CLIN	2.386	7	42	42	0	127	19
	NEUROPSYCHOBIOLOGY	2.367	7	43	42	+1	158	2
	COMPR PSYCHIAT	2.181	7	47	42	+5	138	2
	CNS SPECTRUMS	2.051	7	49	42	+7	175	53
48	PHARMACOPSYCHIATRY	2.849	6	32	48	-16	119	7
	CAN J PSYCHIAT	2.531	6	37	48	-11	192	23
50	WORLD J BIOL PSYCHIA	2.094	5	48	50	-2	53	30

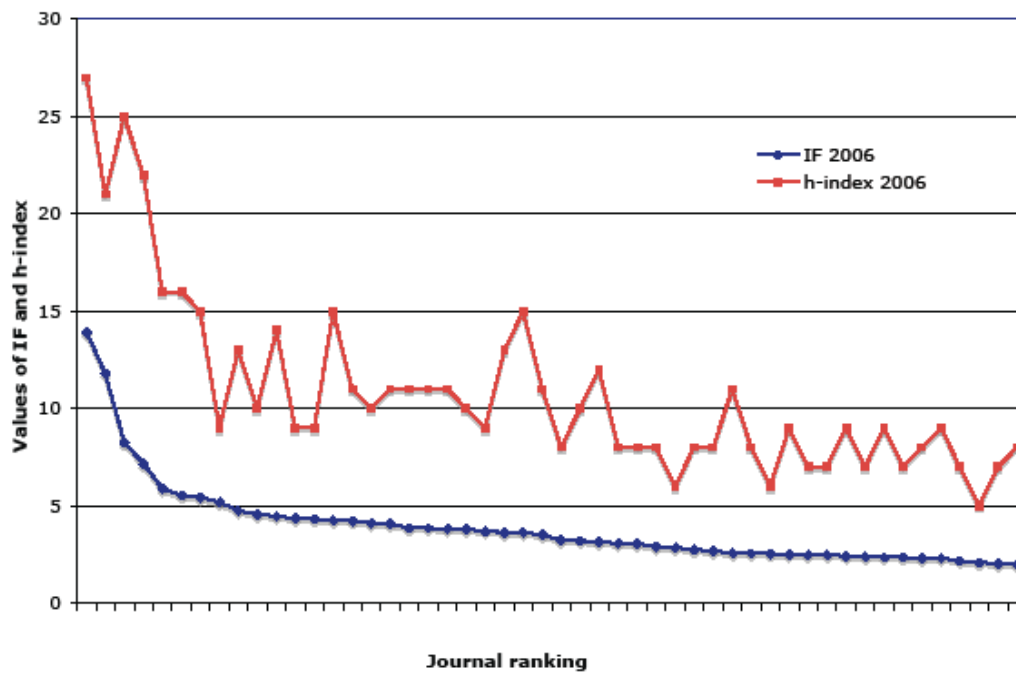


Figure 1: Comparison of IF 2006 and h-index 2006 for Psychiatry journals (IF 2006 ranking)

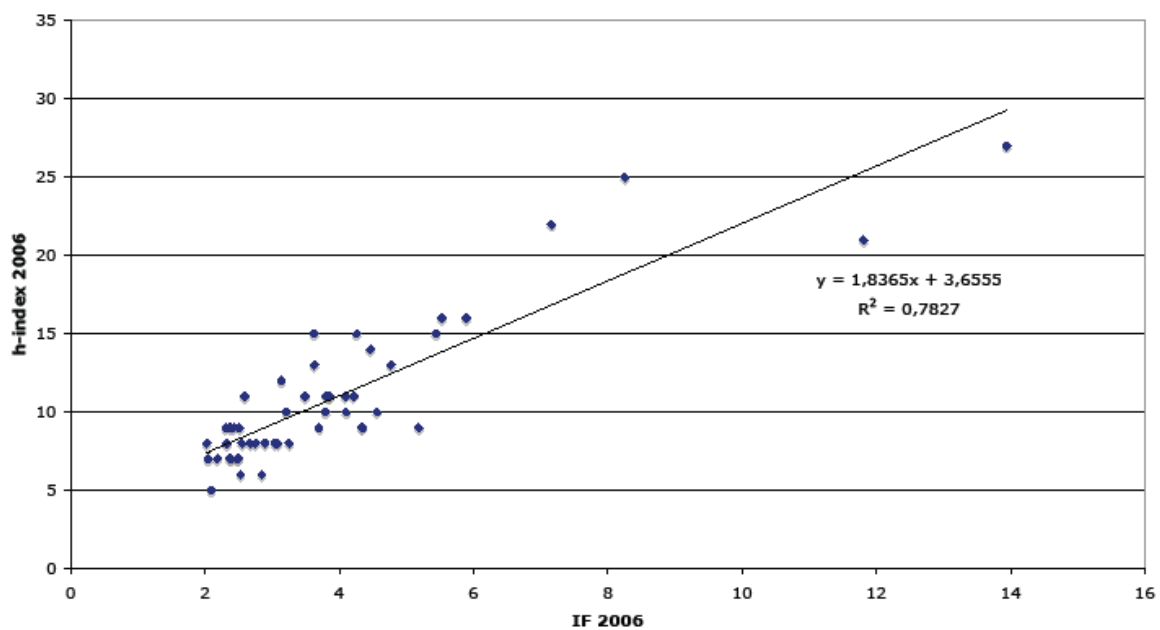


Figure 2: Pearson's correlation of IF 2006 and h-index 2006 for Psychiatry journals