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## Original articles

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### Relationship between the duration of peer-review, publication decision, and agreement among reviewers in three Chilean journals

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#### Abstract

**Aim:** To investigate the relationship between time taken for peer review, publication decision, and level of agreement among reviewers.

**Methods:** The average time for eight stages of the peer review process was estimated for 369 peer review processes of three international Chilean journals published in Spanish in the fields of the humanities, engineering and university teaching. According to the combination of recommendations made by reviewers, each process was classified as having total, partial or low agreement. Data for each stage were grouped according to level of agreement and decision type.

**Results:** Total peer review time was greater for articles that were accepted. For all three of the journals examined, publication period was the longest stage, and time taken to select referees was longest for the humanities journal. Partial agreement between reviewers was related to longer publication times in the university teaching journal, while there was no relationship between reviewer agreement and publication time in the engineering journal.

**Conclusions:** Duration of the peer review process was related to decision type. Relationship between level of agreement between reviewers and the duration of the various stages of the publication process was found to vary between disciplines.

#### Keywords

Peer review, publication decision, reviewer agreement, time

#### Introduction

Peer review of research articles is a means of controlling and coordinating the generation and dissemination of scientific knowledge. The significance of peer review for promotion, tenure-track and funding, among other key elements in academic and scientific life, is unquestionable. Acceptance and rejection rates,<sup>1,2,3</sup> and the level of agreement among reviewers<sup>4,5,6</sup> are two of the most studied variables of the peer review process.

ICMJE and other editorial organizations highlight the importance of ensuring timely peer review.<sup>7,8</sup> Given the importance of disseminating new information and the high pressure to publish, several researchers of the peer review process<sup>9,10</sup> argue that time is a key element in understanding

how scientific knowledge is produced, validated and disseminated. Time taken to complete the peer review process is difficult to measure due to a lack of data showing the different stages of the process, the time taken to select reviewers, or the exact time required for revision.

Over the last few decades, several studies of the duration of the peer review process have been conducted, primarily among English language journals in the medical sciences.<sup>11–15</sup> Although some of these studies have linked duration of the peer review process with publication outcome,<sup>1,3,13</sup> no data are available regarding the association between duration of peer review and agreement between the reviewers. The research reported here aimed to relate duration of peer review with type of decision (rejection, acceptance, withdrawal) and level of agreement among reviewers.

#### Methods

Data included total number of submissions (2008–2012) to three international Spanish-language journals edited in Chile: *Onomázein*, *Formación Universitaria* and *Información Tecnológica*. A total of 369 peer review processes were documented: 78 (21.14%) from *Onomázein*, 79 (21.41%) from *Formación Universitaria* and 212 (57.45%) from *Información Tecnológica*. Each process included two reports containing the reviewers' recommendations (total of 738 reports).

*Onomázein* ([www.onomazein.net](http://www.onomazein.net)), published twice a year, specializes in the humanities (linguistics and similar areas of study). It has an average of 12 articles per issue and is edited by Pontifical Catholic University of Chile using a double-blind review process. All publication costs are assumed by the publisher. *Formación Universitaria* ([www.citrevistas.cl/a1-formacion.htm](http://www.citrevistas.cl/a1-formacion.htm)) specializes in topics related to teaching at the university level while *Información Tecnológica* ([www.citrevistas.cl/a1.htm](http://www.citrevistas.cl/a1.htm)) publishes articles in engineering and related disciplines. Both are published bi-monthly (six issues per year). *Formación Universitaria* contains five articles per issue and *Información Tecnológica* between 12 and 16; both employ a single-blind review process. All publication costs for these two journals are covered by the authors. The editors of these two journals initiate selection of reviewers immediately upon manuscript receipt. Once payment of publication fees have been verified, the editors send the manuscript to the reviewers (this process

can take around 3 days). In practice, reviewer selection date coincides with the official start of the review process.

Input data for this study were: (a) manuscript reception date, (b) dates of dispatch to the first and second reviewer, (c) dates of reviewer responses, (d) recommendations of the reviewers, (e) final decision by the editor, (f) date of article withdrawal by the authors, (g) decision notification date, and (h) publication date of accepted articles. Final editorial decision and number of withdrawn articles (regardless of reviewers' recommendations) were taken into consideration in calculating acceptance and rejection rates.

During our study period (2008–2012) *Onomázein* offered reviewers four options to qualify a manuscript: accept without modification; accept with minor revision; accept with major revision; and reject. *Información Tecnológica* and *Formación Universitaria* offered three options: accept with minor revision; accept with major revision; and reject. Because of these differences in recommendation options, a qualitative measure that classifies levels of agreement between reviewers was included: total (reviewers agree exactly in their recommendations); low (recommendations were diametrically opposed); and partial (all other cases). Operational definitions of the time periods involved in the peer review process are shown in Table 1.

**Table 1. Operational definitions of time periods involved in peer review process.**

	Time period	Definition
Editor	1) Reviewer selection	Time elapsed from reception of the article to dispatch of the same to the last of the reviewers
Editor	2) Notification	Time elapsed from the response of the last reviewer to the communication of the results to the author
Editor	3) Publication	Time elapsed from notification to publication (for accepted articles)
Editor	4) Editorial time subtotal	For accepted papers: time periods 1+2+3 For rejected papers: time periods 1+2
Reviewer	5) Total review time	The maximum time elapsed from the reception of the article by the first reviewer to the response of the last one
Editor + Reviewer	6) Response to author time	Time elapsed from the reception of the article to the notification of the author: time periods 1+2+5
Reviewer	7) Average review time	Average duration of the reviews by first and second reviewers
E + R + Author	8) Total time	Time periods 4+5

Continuous data were presented as mean  $\pm$  standard deviation. As data were not normally distributed (Kolmogorov–Smirnov Test,  $\alpha=5\%$ ), the Kruskal–Wallis Test was used to determine possible significant differences in time between total, partial and low agreement between reviewers

for each journal. Multiple comparison test (kruskalmc) with Bonferroni adjustment was used to identify which values were significantly different (available in R software v.3.2.2).

## Results

### *Duration of peer review according to decision type*

Duration of the different stages of the peer review process and indicators of cumulated time according to publication decision category are shown in Table 2. Reviewer selection time for *Onomázein* was 147 days on average, regardless of decision type. Reviewer selection times were shorter for *Formación Universitaria* and *Información Tecnológica*.

Notification time varied between the three journals, from a minimum of 4 days to a maximum of 31 days. Although *Onomázein* had the shortest time to notify the author of a rejected manuscript (4 days), it had the highest value for withdrawn manuscripts (31 days). *Información Tecnológica* had the longest time for communicating acceptance (28 days).

### *Duration of peer review according to level of agreement between reviewers*

The longest peer review times for *Onomázein* corresponded to examples with low reviewer agreement, whereas shorter and intermediate times belonged to processes for which reviewers' judgements coincided exactly or partially (Table 3).

For *Formación Universitaria*, the longest times for the majority of stages (6 out of 8) corresponded to those processes in which agreement was partial, whereas duration was intermediate for stages in which there was total agreement, and shortest for those with low agreement.

In half of the cases, *Información Tecnológica* followed the same pattern as *Onomázein*: low agreement was related to the longest periods. For editorial time subtotal, processes for which there was low agreement exhibited a significant difference ( $p<0.001$ ) from those processes with total and partial agreement.

## Discussion

In our study, the editorial time subtotal, which corresponds to the total time that the editor had the manuscript in her/his possession showed that firstly, accepted articles took the most time, as publication stage was included in the total. Secondly, the difference in editorial time subtotal between accepted and rejected/withdrawn articles was quite clear for *Formación Universitaria* and *Información Tecnológica*, unlike *Onomázein*, for which the difference between accepted and rejected articles was 37 days.

Data for total review time showed that *Formación Universitaria* and *Información Tecnológica* have rapid evaluations (around 1 month), with little difference in total review time according to decision type. In the case of *Onomázein*, however, there was a 21-day difference between articles that are ultimately rejected and those that are accepted (87 vs. 66 days). This is true also for average review time (item 7 in Table 2), with *Formación Universitaria* at around 20 days, *Información Tecnológica* at around 30 days and *Onomázein*, up to almost 2 months.

As Azar<sup>12</sup> points out, for an author, the time taken to send a response is the most important stage as the future of

**Table 2. Average duration (days) of the different stages of the peer review process and indicators of cumulated time according to decision type.**

Decision type (N)	Onomázein (N=78)						Formación Universitaria (N=79)						Información Tecnológica (N=212)					
	A=54		R=10		W=14		A=68		R=6		W=5		A=184		R=23		W=5	
	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$
1. Reviewer selection	103	116	215	116	123	106	0	0	0	0	0	0	0	0	0	0	0	0
2. Notification	7	31	4	12	31	64	9	8	14	9	12	12	28	12	11	13	9	12
3. Publication	146	97	0	0	0	0	125	62	0	0	0	0	270	174	0	0	0	0
4. Editorial time subtotal (1+2+3)	256	170	219	120	154	133	134	63	14	9	12	12	298	174	11	0	9	0
5. Total review time	66	43	87	83	76	53	28	14	25	13	26	13	36	15	36	19	35	9
6. Response to author time (1+2+5)	176	142	306	145	230	123	37	15	39	12	38	5	64	14	47	15	44	16
7. Average review time	46	25	50	44	58	38	23	11	16	9	20	7	29	14	31	16	30	8
8. Total time (4+5)	322	190	306	151	230	138	162	62	39	0	38	25	334	174	47	19	44	9

N, number of cases for each journal and subgroup; A, accepted; R, rejected; W, withdrawn;  $\bar{x}$ =average;  $\sigma$ =standard deviation. White cell, shortest time within each journal; light grey cell, intermediate time within each journal; dark grey cell, longest time within each journal.

the manuscript strongly depends on it. *Onomázein* took considerable time, ranging from 176 days for accepted articles to 306 days for those rejected. In contrast, and concordant with lower review times, *Formación Universitaria* and *Información Tecnológica* had much shorter response times (44–64 days), with *Formación Universitaria* being the fastest (within 40 days)

Total processing time for *Onomázein* was 12 days less than that for *Información Tecnológica*, the slowest journal, with a total processing time for accepted articles of 322 days (11 months). However, in contrast with the other two journals there was little difference in time to publication or rejection in *Onomázein*, the authors of rejected articles waiting 16 days less than those of accepted manuscripts to be informed of a final decision. In other words, the editor takes about the same length of time to publish one article as he or she does to reject another. Processing accepted articles faster than those that are rejected or withdrawn is quite a challenge, because the editor is unable to reach any publication decision without sight of the results.

These data highlight the amount of time that an editor needs to keep a journal running. Of the three journals *Formación Universitaria* had the shortest times for overall publication and for all of the stages – authors wait about 5 months to see their work published, while they can expect to receive a rejection notice in a month.

Total time for the peer review process is an important indicator of a journal's capacity to process articles. The values reported for the slowest journal in this study (*Información Tecnológica* = 334 days) were lower than the average total time (365 days) reported by Björk and Solomon.<sup>11</sup> In two of the journals analysed here a low level of agreement among reviewers was related to a longer total time.

As the publication stage (valid only for accepted articles) took up the longest time in the whole process, our first conclusion is that, from submission to publication, accepted articles always take more time than rejected ones. According to Björk and Solomon,<sup>11</sup> the publication stage takes up around half of the total processing time, ie, time between initial submission to first decision is approximately the same as time from first decision to publication. In our study, one of the journals had similar times (45.3% for *Onomázein*, ie 146 of a total of 322 days; SD = 8.9), but for the other two

journals, publication stage took longer (77.1% for *Formación Universitaria*, ie 125 of a total of 162 days, SD = 5.7; and 89.2% for *Información Tecnológica*, ie 298 of a total of 334 days, SD=5.6). This relatively longer time needed for the publication stage is due to the often fixed number of articles published per issue and the increasing number of manuscripts processed by each journal. A longer publication stage could be related to a low level of agreement among reviewers.

Regarding response to author time, *Onomázein* showed a pattern similar to that reported by Bjork and Solomon<sup>11</sup> (192 days), although only for accepted (176 days) or in-process articles with total reviewer agreement (191 days). Data for the other two journals were very close to those reported by Bornmann and Daniel<sup>15</sup> but lower than those reported by Gupta<sup>1</sup>. In one journal, response to author time was related to reviewer agreement, and in the other two the slowest response time appeared in processes in which reviewers agreed partially. As mentioned above,<sup>13</sup> response to the author is a key element in improving the peer review process.

Average review time reflects the reviewer's dedication to the peer review process. Data showed that *Información Tecnológica* and *Formación Universitaria* reviewers were fairly quick, with mean values close to 1 month, as reported by Kljaković-Gaspić et al.<sup>14</sup> In *Onomázein* this value was doubled, yet still 1 month less than the average review time reported by Lyman.<sup>12</sup> It is interesting to note that no significant differences regarding the decision type or the level of agreement among reviewers were found during this stage.

Due to the complexity of peer review, further evidence might be necessary to strengthen the conclusions of this study, eg the inclusion of comparable data from journals published in other languages. Our results, however, provide some insight into the process through which scientific knowledge is constructed and disseminated, and can be useful to editors interested in analysing and improving their editorial practices.

Agreement among reviewers affects the duration of most stages of the publication process. When agreement among reviewers is partial or low, the editor needs more time to make a decision, which slows the overall process. In our study, this relationship is prominent in the humanities and higher education teaching journals, but not in the engineering journal.

**Table 3. Average time (in days) of the various stages of peer review process and indicators of cumulated time with respect to the level of agreement.**

Level of agreement (N)	Onomázein (N=78)						Formación Universitaria (N=79)						Información Tecnológica (N=212)					
	T=29		P=43		L=6		T=38		P=40		L=1		T=129		P=77		L=6	
	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$	$\bar{x}$	$\sigma$
1. Reviewer selection	130	119	104	116	197	133	0	2	0	0	0	0	0	0	0	0	0	0
2. Notification	2	7	15	47	28	45	10	7	10	9	25	0	25	11	27	13	18	5
3. Publication	143	99	138	92	236	125	95	53	121	69	64	0	215	190	264	158	284	62
4. Editorial time subtotal (1+2+3)	275	134	257	158	461	253	105	53	131	70	89	0	240	189	291	158	302**	68
5. Total review time	59	56	76	47	80	47	27	12	29	16	10	0	36	15	36	15	40	21
6. Response to author time (1+2+5)	191	150	195	139	305	156	37	13	39	16	35	0	61	14	63	16	58	13
7. Average review time	40*	31	52	27	68	40	21	9	23	13	8	0	30	13	29	14	27	14
8. Total time (4+5)	334	154	333	175	541	262	132	53	160	68	99	0	276	188	327	159	342	63

N, number of cases for each journal and subgroup; T, total agreement; P, partial agreement; L, low Agreement;  $\bar{x}$  = average,  $\sigma$  = standard deviation, White cell, shortest time within each journal, Light grey cell, intermediate time within each journal, Dark grey cell, longest time within each journal. \*Significant difference with alpha = 0.05 \*\*Significant difference with alpha = 0.01

Based on the observation of other variables that were not considered in other studies, ie reviewer selection time and notification time, other conclusions can be reached. The reviewer selection time was quite long for the humanities journal and very short for those in the other two fields, which could be explained by the high degree of specialization and lack of time of potential reviewers, but also by the different business models of the journals.

Editors could profit from these data to improve their practices in specific ways. An efficient journal should focus on improving two of the time indicators of the overall process: response to author time and total time. If a journal has a long response to author time, the editor could improve reviewer selection time by creating and maintaining a database of potential reviewers or by asking authors to recommend them, cautioning competing interests. In contrast, if a journal has long overall processing times, a publication backlog will result, caused mainly by the duration of the publication stage, which takes up most time in the majority of journals. Editors of such journals could improve efficiency by having a flexible number of articles per issue or by increasing the number of issues per year.

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### Competing interests

Two of the authors (JOV & CG) are the editors of the journals included in this study.

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