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1 **Weighing the Impact (Factor) of Publishing in Veterinary Journals**

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4
5 Where you publish is important. Even as online publishing has shifted our focus from bound
6 print issues to article PDFs, the prestige and importance of a journal—the package in which your
7 article is wrapped—can have a big influence on the perceived value of your work and on your
8 ability to reach certain audiences.

9 Today, the value of a journal is determined largely by its impact factor, a widely used
10 metric of journal quality and prestige. An impact factor is a ratio of the number of citations a
11 journal receives in a given year to articles published during the previous 2 years, relative to the
12 total number of articles published over the same period.^{1,2} For example:

13
14 2013 impact factor =
$$\frac{\text{number of citations received in 2012 to articles published in 2011 and 2010}}{\text{number of articles published in the journal in 2011 and 2010}}$$

15
16
17 Over the past 2 decades, the impact factor has evolved from a tool intended to aid librarians in
18 purchasing journals for their collections, to the primary benchmark for discipline-based rankings
19 and a proxy for the scientific quality of individual articles, authors, graduate programs, and
20 universities.^{3,4} The linked valuation between impact factor and individual research articles has
21 led us down a slippery slope to where this single number can make the difference in getting
22 tenure, promotion, a job, or a grant. In China, authors receive cash rewards to publish in high
23 impact factor journals;⁵ in Greece, faculty hiring is based in part on a “total impact factor”, the
24 sum of the impact factor of all the journals in which a person has published; in Brazil, the

25 allocation of research resources and fellowships is linked to journal ranking and impact factor.⁶
26 This competitive race to attain “maximum impact” has altered the behavior of both authors and
27 editors, with publishing decisions often based solely on impact factor. Sadly, the drive for impact
28 comes at the expense of specialty journals and journals representing small research communities,
29 including veterinary medicine and regional and local journals, making it more difficult for them
30 to grow and improve.³

31

32 **A look at the numbers**

33

34 A journal’s impact factor is published annually by Thomson Reuters in *Journal Citation Reports*.
35 In 2013, impact factors ranged from 0.000–162.500 for the 8,474 science journals in the
36 Thomson-Reuter Web of Science database. The distribution of impact factors is highly skewed:
37 the median value was approximately 1.4 and only 2 journals (*CA: A Cancer Journal for*
38 *Clinicians* and the *New England Journal of Medicine*) had an impact factor >50. Nearly 24% of
39 journals had an impact factor of ≤ 1.0 while only about 7% had an impact factor ≥ 5 . For the 129
40 journals in the Veterinary Sciences category, impact factor ranged from 0.071 to 3.383 and
41 74/129 (57%) journals had an impact factor of ≤ 1.0 (Fig. 1).

42 While impact factor generally reflects the influence of a journal, it has limitations and
43 should not be taken at face value. First, journals get most of their citations (~80%) from a small
44 proportion of articles (~20%), so citation data are highly skewed, affecting statistical validity.^{2,8}
45 Further, reporting impact factor to 3 decimal places—intended to avoid overlap and facilitate
46 ranking—implies a false sense of discrimination among journals.^{2,8} Instead of 124 unique
47 rankings for 129 veterinary journals, there are only 28 rankings when impact factor is rounded to

48 one decimal place and only 4 rankings when impact factor is rounded to a whole number (the
49 actual precision of the impact factor measurement). Large changes in journal ranking can result
50 from small changes in citations, article categories, or the number of papers published. In addition,
51 the variance around impact factor can be wide, making it difficult to assess meaningful
52 differences; citation rates for journals with impact factors as different as 2.7 and 5.4 were
53 recently found to be indistinguishable statistically.⁶ The abundance of citation errors further
54 affects the precision of the impact factor.² Lastly, Thomson Reuters limits access to its
55 proprietary database, limiting the ability of the scientific community to evaluate or replicate
56 impact factor calculations and test the assumptions behind them. Recently, *PLOS Medicine*
57 editors were stymied in their effort to find out how “citable” articles in their journal were
58 counted, a number that drastically affects the denominator of the ratio, and therefore the impact
59 factor.⁴

60

61 **Factors that influence a journal's impact factor**

62

63 The impact factor varies widely by discipline and reflects the citation practices, size, and
64 interdisciplinary connections of the research community. Because of this it is important to use
65 discipline-specific categories when comparing journals and impact factors (although the rationale
66 for grouping certain journals is not always obvious). The discipline of General and Internal
67 Medicine, for example, has about the same number of journals (n = 150) and median impact
68 factor (1.333) as Veterinary Science (n = 129, 0.907), but encompasses a much wider range of
69 impact factors (0.077 to 54.420 versus 0.029 to 3.426), reflecting the larger size of its research
70 community. Rapidly moving fields like virology have higher impact factors than fields that

71 change more slowly, like agriculture. Disciplines with a high rate of co-citations with adjacent
72 disciplines, such as human health, receive more citations than fields that are relatively self-
73 contained.⁹ Sometimes co-citations work mainly in one direction: an article published in a small
74 animal journal, for example, may cite relevant articles from medical journals, but the small
75 animal article may not be cited by medical researchers unless a defined animal model is involved.

76 Article type, length, study design, and language also affect citations and impact factor.
77 Basic research is cited more often than clinical research; reviews and meta-analyses are cited
78 more often than original research; and original research is cited more often than case reports.^{10,11}
79 In an effort to boost impact factor, many journals have discontinued publication of case reports
80 despite their educational value for clinicians and trainees. Importantly, impact factor does not
81 fully measure the influence of an article on clinical practice; veterinary practitioners who benefit
82 from and apply clinical research often don't do research or cite papers themselves. Further,
83 English language articles are cited more often than non-English articles. This has not deterred
84 veterinary journals in Europe, Asia, and Latin America from publishing in their national
85 language to better communicate with veterinary practitioner communities.⁹

86 Impact factors also are affected by editorial practices and policies, such as limiting the
87 number of references in articles or selecting articles based primarily on novelty or
88 newsworthiness. Impact factor tends to correlate with a journal's rejection rate, but journals
89 accept papers for different reasons. Journals with broad scope have large research communities
90 and hence more submissions, so are more selective for articles that not only are high quality but
91 are likely to generate strong interest. *Nature*, for example, has an acceptance rate of only 8%, and
92 an impact factor of 38. Other journals, such as *PLOS ONE*, accept papers based solely on
93 scientific and technical validity; it has a relatively high acceptance rate (69%) and a 2013 impact

94 factor of 3.5.¹² Specialty journals like *Veterinary Clinical Pathology* serve a small research
95 community and have relatively low impact factors, but are committed to publishing a wide range
96 of educational, diagnostic, policy, and research content in their specific fields.

97 Impact factors are easily manipulated, mainly by self-citation. Editorial staff at some
98 journals encourage (and sometimes require) authors to add references to their manuscript that
99 increase their journal’s citations and impact factor.¹³ Thomson Reuters reports impact factor both
100 with and without self-citations, and monitors citation patterns to identify journals that appear to
101 have inappropriately inflated their impact factor with self-citations. They recently suspended
102 several Brazilian journals for “citation stacking”, a scheme devised by the editors to boost each
103 others’ citations and impact factors; the plan grew out of frustration with Brazil’s policy of using
104 impact factors to evaluate graduate programs.¹⁴

105

106 **Impact factor does not correlate with the quality of individual articles or with readership**

107

108 An impact factor reflects the citation rate and, by that measure, the general quality and prestige
109 of a journal; a journal’s impact factor does not measure or correlate with the quality of individual
110 articles or authors. The citations a journal receives are averaged across its articles and only a few
111 articles get cited often; many other articles—in the same journal with the same impact factor —
112 get few or no citations.² Similarly, journals with a low impact factor may contain high quality
113 articles. Further, impact factor does not differentiate positive from negative citations. Was an
114 article cited as an example of a biased or flawed study or because it was successfully replicated
115 by the work of others? Impact factor can measure influence, but not quality. A recent study in the
116 *Journal of Veterinary Internal Medicine* found that poor quality studies were cited just as often

117 as high quality studies.¹⁵ Thus, other metrics and methods of assessment are needed to evaluate
118 the quality and influence or “impact” of individual articles and authors.

119 Where you publish is a key factor in your ability to reach certain audiences.¹⁶ Submitting
120 your article to a journal based primarily on impact factor does not ensure your research will be
121 read by others in your field unless they specifically look for and find your article in a database.
122 Submitting your manuscript to a specialty journal or one aimed at a veterinary audience makes it
123 more likely relevant experts and end-users will browse and read it. Because the editorial board of
124 specialty journals like the *Journal of Veterinary Cardiology* includes some of the top experts in
125 the field it can also mean a more rigorous peer review process; but what better measure of
126 scientific quality than to be evaluated by your peers?

127 A colleague once advised: “To be successful, never publish in a journal with ‘veterinary’
128 in its title”. This advice reflects in part the value placed on high-impact journals. Submitting your
129 research to a journal based *solely* on impact factor will pretty much guarantee that veterinary
130 journals never have the opportunity to publish the best papers in the field. Because impact factor
131 is used so pervasively in the assessment of individuals and their research, investigators have little
132 incentive to publish in low-impact journals, regardless of how well the scope and audience fit.

133

134 **Looking to the future: shifting the focus in academic evaluation**

135

136 Efforts are underway to shift the focus of academic evaluation away from using a journal’s
137 impact factor to assess the scientific quality of individual articles and authors. In 2012, a group
138 of editors and publishers established the *San Francisco Declaration on Research Assessment:
139 Putting Science into the Assessment of Research*. Among the recommendations was “the need to

140 eliminate the use of journal-based metrics, such as the Journal Impact Factors, in funding,
141 appointment, and promotion considerations.”¹⁷ The International Association of Veterinary
142 Editors is one of 484 organizations and nearly 11,000 individuals that have signed the San
143 Francisco Declaration. Thomson Reuters also has acknowledged the inappropriate use of impact
144 factors in evaluating the quality of individual articles.¹⁸

145 If not a journal’s impact factor, what measures can be used to evaluate the quality of an
146 author’s research article? As of yet, a single alternative widely accepted metric remains elusive.
147 Rather, a wide range of publication metrics, as described in an excellent recent review, is likely
148 to be most effective for highlighting academic productivity and research impact.¹⁹ The *h*-index is
149 an author-specific metric that uses citations to measure the impact and productivity of scientists
150 working in the same discipline. Thomson-Reuters is unveiling a new set of metrics (InCites) that
151 link impact factor with article-level data.²⁰ Article-level metrics, including the number of times
152 an article is viewed, cited, saved, downloaded, discussed, and recommended are calculated by
153 many open access and online publishers and citation indexes.^{19,21} *Frontiers* journals allow
154 readers to score the academic excellence and social relevance of its articles. These and other
155 alternative metrics or “altmetrics” based on social media and other web-based environments are
156 growing rapidly as new benchmarking tools of research quality for academic assessment.
157 However, all of these metrics have different strengths and limitations that must be weighed
158 accordingly within a particular context or discipline. Importantly, the quality of a scientific
159 article—and its impact—cannot be summarized in a single number. On a broader scale, national
160 initiatives are underway, such as the Research Excellence Framework in the United Kingdom, to
161 define criteria—both quantitative and qualitative—that measure the economic and social impact
162 of medical research.²² Concerted efforts such as this one are contributing to new definitions and

163 parameters of research quality for assessing programs, universities, and healthcare services that
164 could limit reliance on the journal impact factor and keep this controversial metric in it's
165 appropriate place.

166

167 *The Journal of Veterinary Cardiology*

168

169 *The Journal of Veterinary Cardiology* will soon receive its first impact factor. What can you do
170 to keep the impact factor in perspective while supporting your journal as an important
171 publication for cardiovascular research in animals and animal models?

- 172 • Use the impact factor as only one of many indicators of journal quality; do not use the
173 impact factor as a measure of the quality of individual articles or authors.
- 174 • Consider the reputation of the *Journal of Veterinary Cardiology*, whose editorial and
175 review boards include many of the top experts in veterinary cardiology.
- 176 • Focus on readership: what audience do you want to reach most directly? Which clinicians
177 and investigators are likely to follow and read your target journal most closely?
- 178 • Remember the other ways a journal can influence its field: does it publish guidelines that
179 set the standard of practice? Does it publish educational articles for trainees and
180 practicing veterinarians? Does it publish work by underrepresented groups?
- 181 • Make sure your institution subscribes to the *Journal of Veterinary Cardiology* so its
182 articles are widely available locally.
- 183 • Encourage efforts to enhance the accessibility of articles in the *Journal of Veterinary*
184 *Cardiology* and to explore new metrics of article quality, relevance, and influence on
185 policy and clinical practice.

- 186 • Work with your institution to promote appropriate measures of academic evaluation for
187 decisions on hiring, promotion, and funding.

188

189 **Conflict of interest statement**

190 Dr. Christopher is the coordinator of the International Association of Veterinary Editors, which
191 receives sponsorship from Wiley and Elsevier. She co-authored *Writing for Publication in*
192 *Veterinary Medicine*, which is published by Wiley. Dr. Christopher was Editor-in-Chief of
193 *Veterinary Clinical Pathology* for 12 years and currently is Field Chief Editor for *Frontiers in*
194 *Veterinary Science*. She is a former member and chair of the NIH National Library of Medicine
195 Literature Selection Technical Review Committee for MEDLINE.

196

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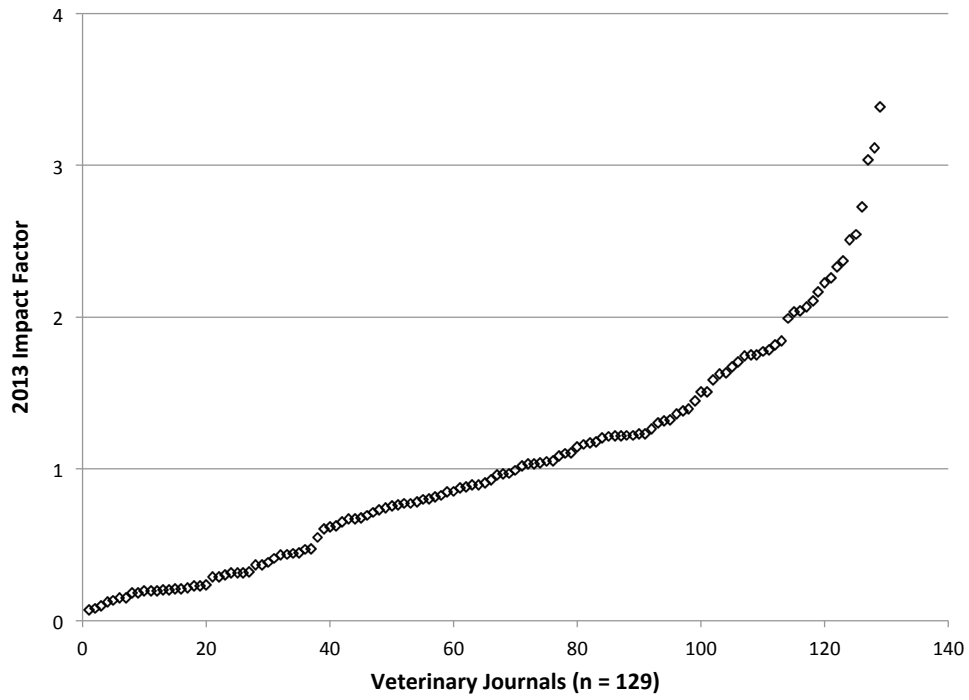
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247 **Figure Caption**

248 Figure 1. Impact factors (2013) for journals in the Veterinary Science category.



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