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The Altmetric Score: A New Measure for Article-Level Dissemination and Impact

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HISTORICAL PERSPECTIVE

The explosion of scientific literature in recent years¹ makes it increasingly important and difficult for clinicians to identify high-quality articles relevant to their practice, research, education, and advocacy efforts. Theoretically, prestigious journals are read widely because of the high impact of their articles on medical practice; journal prestige has traditionally been quantified with the journal impact factor.

Initially described by Garfield^{2,3} and now published annually by Thomson Reuters,⁴ journal impact factor uses citations in other scientific journals to quantify the influence of an original research journal as a whole, calculating the ratio of citations of previous 2 years' articles during the current year to the total number of citable articles published in that journal during those previous 2 years (Figure 1A and B).⁴

Journal impact factor posits that the impact of a journal is the weighted sum of the citations, and therefore the impact, of its articles. Authors' work has increasingly been assessed by the impact of the journal it is published in for the purposes of university promotions, general esteem among colleagues,⁵ and hiring and funding decisions.^{6,7}

Despite its popularity, journal impact factor is widely criticized.⁸ Detractors note that it is inherently slow (citations take months to years to accrue, and journal impact factor is published annually according to 1- to 3-year-old data⁹), narrow (it assesses only this one particular type of impact¹⁰ during a brief 2-year period¹¹), secretive and irreproducible (articles are weighted according to an opaque and subjective classification such as primary, review, or "front matter," classifications that are subject to lobbying by publishers¹¹), and open to gaming (some types of articles are cited much more frequently than others^{10,11}), and fails to identify influential articles published in minor journals.

Other journal-level metrics have been created but fail to address these issues,^{12,13} and the h-index was developed in

2005 to measure the impact of authors rather than journals. It combines an individual's productivity (number of articles) and impact (number of citations) to quantify their contributions.¹⁴ However, it also has drawbacks: it is slow, can be manipulated (eg, self-citation), does not adjust for the number or role of coauthors (particularly because coauthorship has increased significantly¹⁵), and poorly recognizes early-career authors or those with small numbers of articles with high impact.¹⁶

ALTMETRICS: ARTICLE-LEVEL METRICS

Contrary to citation-based metrics like the journal impact factor and h-index, altmetrics (short for "alternative metrics" or "article-level metrics") promptly measure the impact of an individual article's dissemination.¹⁷ The widespread adoption of electronic publishing, paired with the rise of social media for dissemination and discussion of scientific literature, makes it feasible to quantify the discussion of an article on blogs, podcasts, social media platforms, and news media. These measures aim to address many of the failings of traditional impact metrics; they are available nearly instantaneously, measure the dissemination of individual articles, and may more accurately assess total overall readership by incorporating more metrics—primarily measures of social media—rather than simply citations in traditional journals. As a result, highly disseminated articles may be identified within days of their publication.¹⁸⁻²¹

Although altmetrics have certain advantages over citation-based metrics such as the journal impact factor and h-index, the type of impact that they measure, although related, is not the same. We propose that altmetrics be thought of as measures of "disseminative impact," whereas traditional citation-based metrics be considered measures of "scholarly impact." Altmetrics provide a proxy of a specific article's overall readership, and articles capable of generating "buzz" are likely to score more highly.^{19,20} The journal impact factor and h-index are derived from citations and are likely to link more strongly with the importance of

A

A= total cites in 1992
 B= 1992 cites to articles published in 1990-91 (this is a subset of A)
 C= number of articles published in 1990-91
 D= B/C = 1992 impact factor

B

Journal Impact Factor ^①

Cites in 2010 to items published in:	2009 = 351	Number of items published in:	2009 = 45
	2008 = 472		2008 = 49
	Sum: 823		Sum: 94
Calculation: Cites to recent items	823	=	8.755
Number of recent items	94		

Example default score contributions for different sources					
News	Blogs	Q&A forums	Twitter	Google+	Facebook
8	5	2.5	1	1	0.25

To produce these default weightings we asked groups of researchers to rank different sources in order of how important they were to an article's broader impact.

So if your paper has been mentioned by a news story and three tweets it might score:

$$8 (\text{default News contribution}) + 3 (3 \times \text{default Twitter contribution}) = 11$$

We round scores up. If it has one blog post and a Facebook mention it may score:

$$5 (\text{default Blog contribution}) + 0.25 (\text{default Facebook contribution}) = 5.25 = \text{rounded up to } 6$$

Figure 2. Altmetric score calculation and example.²⁶

Figure 1. A, Simplified formula for calculating the journal impact factor.⁴ B, Sample journal impact factor calculation.²²

the article to its scientific field. Although it is logical that journal impact factor and Altmetric scores correlate with each other,¹⁸⁻²¹ broadly disseminated articles may not be cited frequently, and vice versa.^{23,24} As a measure of dissemination, altmetrics may reflect readership among a broader audience of practicing clinicians and not simply impact within academic spheres.

HOW THE ARTICLE-LEVEL METRIC (ALTMETRIC) SCORE IS CALCULATED

Substantial research has been conducted on the characteristics of altmetrics.²⁵ One system, Altmetric.com's proprietary

Altmetric score,²⁷ has gained traction.* This score is a composite quantitative measure of the attention that a scholarly article has received, based on 3 main factors:

1. Volume: With the score increasing as more sources mention the article
2. Authors: Weighted by 3 factors: reach (eg, number of followers), promiscuity (eg, a source that mentions many articles in a short time is weighted less), and potential bias (eg, multiple mentions of the same article by the same publisher are given less weight)²⁶
3. Sources: News articles, blog posts, tweets, Facebook and Google+ posts, and other social media

*We use the plural term "altmetrics" to refer to the broad concept of article-level metrics and "Altmetric score" and "Altmetric" to refer to the proprietary scoring system and its publisher.

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ELSEVIER

Education/residents' perspective

Five Strategies to Effectively Use Online Resources in Emergency Medicine

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Figure 3. Article and Altmetric score.^{28,29}

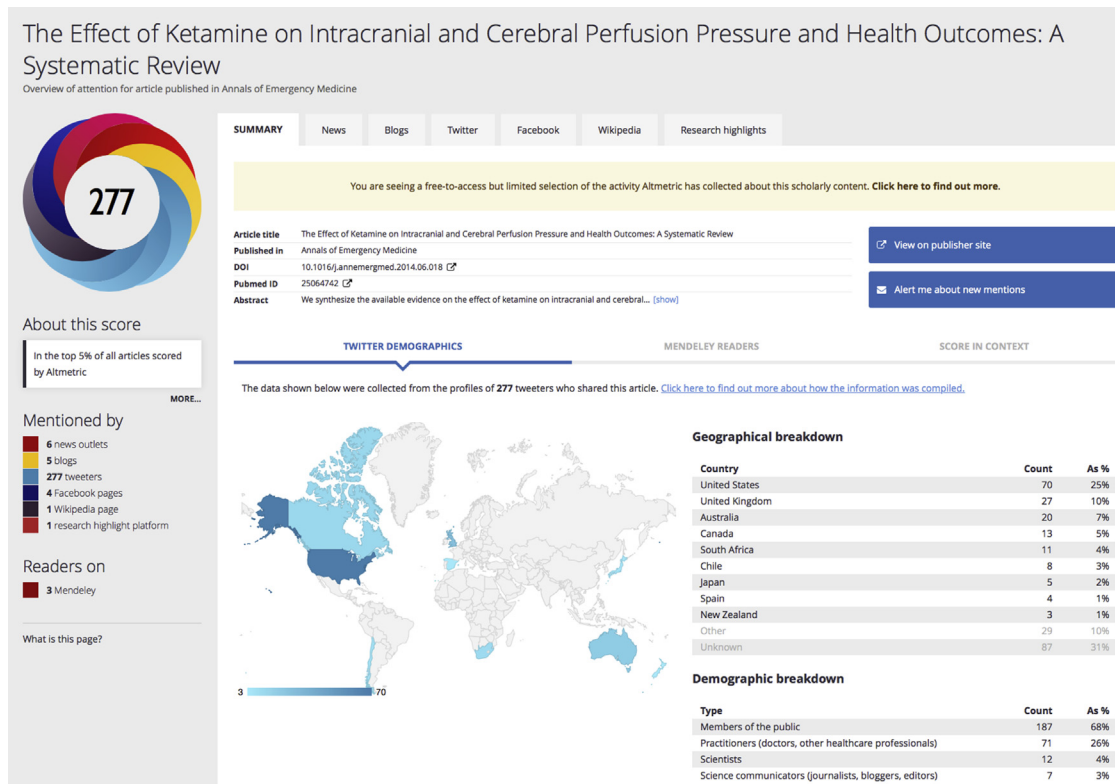


Figure 4. Altmetric doughnut and analytics, highlighting global demographics of tweets for Cohen L, Athaide V, Wickham ME et al.^{30,31}

The Altmetric score is a weighted count of the different sources that mention a particular article. News articles are given greater weight than blog posts, which have greater weight than Twitter or other social media posts, reflecting the relative value of those various sources (Figure 2).²⁶

The resultant Altmetric score reflects the overall attention that an article receives. In notable contrast to journal impact factor, citations in peer-reviewed articles are not included in the calculation of Altmetric scores, so there is less recognition of the formal scientific impact of an item. Unfortunately, like the journal impact factor, the Altmetric score is proprietary and its precise methodology has not been disclosed. In contrast, Altmetric scores for individual articles are freely available, whereas access to journal impact factor scores must be purchased by institutions if they are not disclosed by the journal (most journals publicize their journal impact factor).

THE ALTMETRIC DOUGHNUT: WHAT THE VISUALIZATION MEANS

Altmetric scores are represented visually as a colored “doughnut” or brick,³² which conveys the sources that contribute to an article’s score, and the center of the

doughnut contains the summary numeric Altmetric score. An example is provided in Figure 3.^{28,29}

The article’s page at [Altmetric.com](#) provides detailed information about which news outlets, blogs, and Twitter feeds have mentioned the article, along with selected Twitter statistics. Summary statistics are also provided, comparing the article to other articles in the same journal, articles in all journals, and articles of a similar age (Figure 4).

HOW TO OBTAIN ALTMETRIC INFORMATION

There are a variety of ways to access the Altmetric scores of a given article. Several major publishers, scientific databases (eg, ScienceDirect, which includes *Annals of Emergency Medicine* articles), and many journals list Altmetric scores on the articles’ Web page. Scores for *Annals of Emergency Medicine* articles are now also available on the journal and Elsevier’s Web pages. Individuals can also find the Altmetric scores of particular articles by using a bookmarklet³³ (Figure 5) that finds article data such as a digital object identifier (DOI) or PubMed identification on a Web page. Links to the postpublication comments are provided, and they can generally be accessed without additional accounts or log-ins. The video associated with

1. Add bookmarklet to your bookmarks toolbar
2. Visit any paper
3. Get article level metrics with a single click



Figure 5. Screen shot of Altmetric bookmarklet.³³

this article (available at <https://drive.google.com/file/d/0B6cpRABKGbgdaHN0SkN0V0V6OWM/view>) provides step-by-step instructions on how to access the Altmetric scores and install the Altmetric bookmarklet on your Web browser.

POTENTIAL ALTMETRIC IMPACT FOR AUTHORS AND READERS

Academic authors may consider adding their article's Altmetric data into a curriculum vitae as a way to demonstrate the impact of articles and other nontraditional scholarly products.³⁴ Some academic institutions and grant-funding agencies now recognize altmetrics as alternate forms of impact.¹⁹ Readers seeking context or criticism for an article can review postpublication commentary compiled at an article's Altmetric page, often in blog or podcast format. For example, the recently published trial by Nielsen et al³⁵ on targeted temperature management after cardiac arrest has been discussed extensively on social media platforms,³⁶ many of which can be found on the article's Altmetric page.

THE LIMITATIONS OF ALTMETRICS

Although altmetrics address some of the potential drawbacks of journal impact factor and other traditional quantifiers of impact, limitations persist. As academic social media networks grow, newer articles have an inherent advantage over older ones. Journals, publishers, and specialties with a substantial social media presence may have more articles with higher Altmetric scores than those that have a smaller social media presence. Additionally, the utility and reach of altmetrics may be limited in countries with restricted social media access and in developing countries with scarce Internet resources.

The near-instantaneous nature of the Altmetric score in combination with its widespread dissemination may serve as a double-edged sword. It is often difficult to assess the credibility of commentators and the validity of their comments. Although Altmetric tries to address these limitations by examining and potentially weighting authors' contributions of each mention,²⁶ dissemination scores do not replace the need for readers' independent ability to critique the primary literature and may even help reinforce the quality assurance process of postpublication reviews on social media.

The exclusion of traditional journal citations from Altmetric scores is a limitation to its validity as a metric of scholarly impact, especially in the academic community. However, altmetrics' ability to measure disseminative impact quickly and the correlation with citations¹⁸⁻²¹ suggest that altmetrics may serve as a useful complement to journal impact factor.

CONCLUSION

No single metric provides a reader with a comprehensive measurement of the quality or importance of an article or journal. Journal impact factor informs readers of the overall historic quality and scholarly impact of content published in a scientific journal, as measured through citations; article-level metrics are an increasingly accepted measurement of disseminative impact, quantifying the attention an individual article receives from news outlets and social media. Although these new metrics are not without flaws, careful consideration of all available measures, along with a critical analysis of an article, will assist readers in discerning the importance of the data they encounter. The Altmetrics score for all *Annals* articles are now available on the articles' page at <http://www.annemergmed.com> and on the articles' ScienceDirect page, and the highest-scoring *Annals* articles are listed at <http://www.journals.elsevier.com/annals-of-emergency-medicine/altmetric-articles/>.

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