A novel ‘value-based’ metric framework to measure the influence of scientific publications

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Abstract

Objective: Journal impact factor has limited value as an indicator of the influence of scientific publications. Article-level metrics can provide a more direct measurement of influence, but often confuse social media reach and engagement with impact. Publication planners and other stakeholders need simplified, aggregated tools to help better understand publication influence.
We have developed a novel ’value-based’ framework to assess early predictors and long-term impact, and to understand characteristics and enhancements associated with publications with stand-out metrics.

Research design and methods: We used data from Altmetric Explorer, PlumX, CiteScore and PubMed. We conducted an exploratory analysis of metrics from a sample of 2891 phase 3 studies from March 2016 to March 2019 to provide a statistical relationship between the different metrics. A framework comprising metric aggregation and weightings was developed and refined through value assessments provided by a cross-functional team including Scientific Communications, Medical, Commercial, Launch Strategy and Analytics. Predictive reach metrics were developed. The framework was tested and refined using a sample of 74 *New England Journal of Medicine* (*NEJM*) phase 3 publications from 2016, which also formed a reference benchmark.

Results: The resulting framework comprises three parts: scholarly (e.g. citations, Mendeley saves), social (e.g. Twitter, news) and societal (e.g. published and grey-literature guidelines), together with scholarly and social reach scores. These are scaled to the *NEJM* benchmark to define a ‘good’ score.

Conclusions: The framework allows a detailed assessment of the type of influence relevant to different stakeholders and supports assessment of the effectiveness of enhancement solutions used for key publications. Further refinement and application to company publications is ongoing.

Plain language summary

Why was this needed?

- Clinical publications are an important source of timely, accurate and balanced scientific information that can have a significant impact on the practice of medicine. They are talked about and used by a wide variety of audiences, but at the moment it is not easy to measure how much this happens.

What was done?

- We looked at a large number of journal articles, to try to understand trends on how well these journal articles were reaching their audience and how much their audience had interacted with them.
- We measured how much interest there was in social media, on scientific websites and in government and medical society guidelines.

What was the result?

- We created a tool that summarizes all of these data into three groups: social, scholarly and societal impact of these journal articles.
- This gives us an easy way to measure how clinical publications are talked about and their value.

Introduction

- Assessing the value that publications bring to target audiences is critical to measuring the success of publication planning.
- However, the currently available metrics tools do not provide holistic/comprehensive article-level insights.
  - Traditional journal-level metrics (e.g. impact factor) measure only citations and are often skewed by a few highly cited articles, and so do not represent the value of an individual publication.[1]
  - The Altmetric® Attention Score integrates many article-level metrics, but omits Mendeley saves and citations and can often be dominated by news and Twitter®.[2]
- We developed a novel ‘value-based’ framework to assess early predictors and long-term impact, and to understand characteristics and enhancements associated with publications with stand-out metrics.

Methods

The framework development process

Data analysis
- Sample of nearly 3000 phase 3 articles between 2016 and 2019
- Relationship between different existing metrics explored using descriptive statistics, Spearman correlation (r_s) and factor analysis

Conceptualization
- Identified key comments of scoring system
- Constructed the initial framework

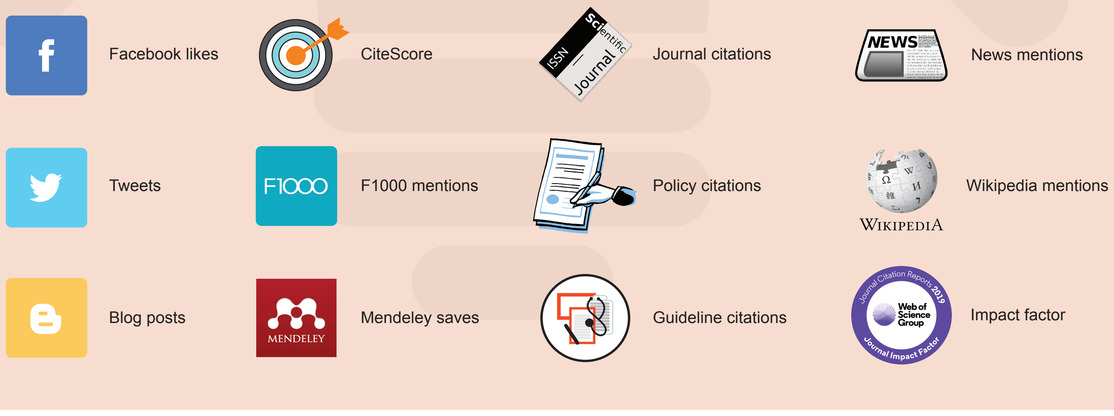
Workshop validation
- A cross-functional team including Scientific Communications, Medical, Commercial, Launch Strategy and Analytics
- Provided value assessments for the different metrics from a Novartis standpoint

Benchmarking and predictor metrics
- Scaled to reference benchmark to define a ‘good’ score
- Created predictor metrics using linear regression

Data sources

- **Publications sample**
  - All phase 3 studies over a 3-year period (obtained on 23 March 2019 via a PubMed search).
- **Benchmark sample**
  - All publications of phase 3 studies from 2016 in the *New England Journal of Medicine* (*NEJM*) were obtained by a manual search and screening.
- **Metrics**
  - Metrics used in the analysis are shown in **Figure 1**.
  - Altmetrics: obtained via Altmetric Explorer or PlumX (in the case of ‘practice guideline citations’).
  - Journal metrics: impact factor (IF) obtained from Sylogent Journal Selector and CiteScore obtained from Scopus.

Figure 1. Metrics used in the analysis.



Results

Data analyses

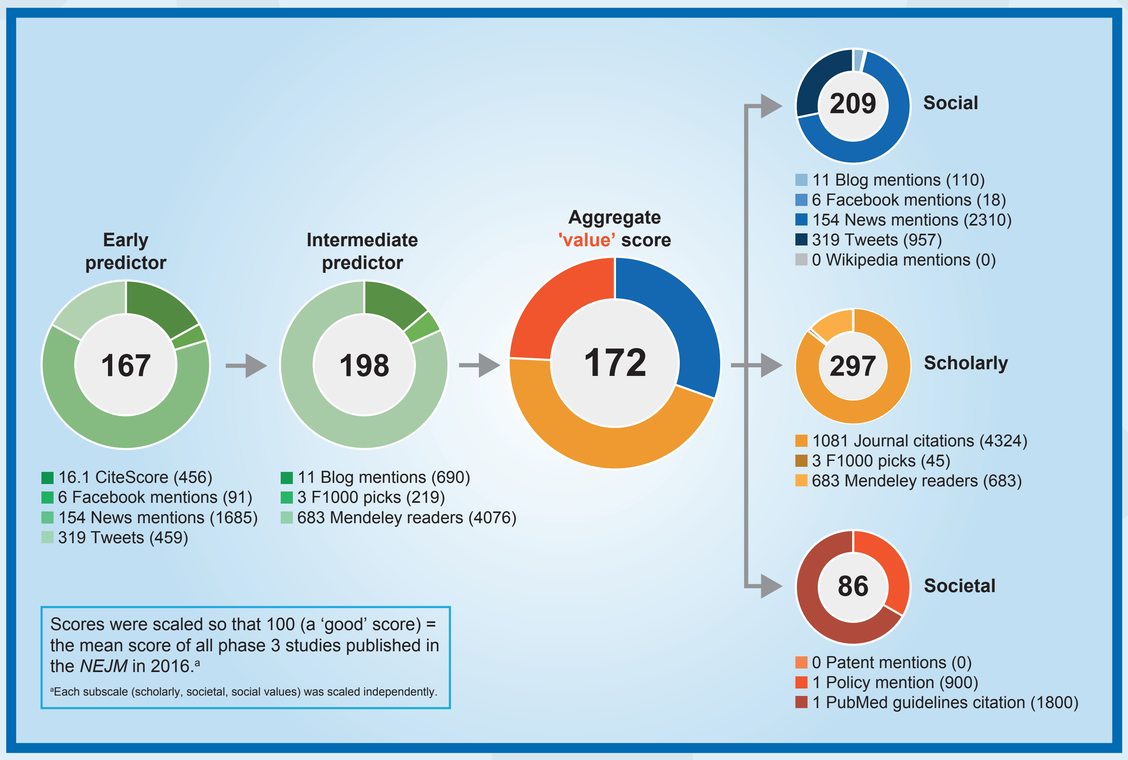
- The publications sample included 3501 phase 3 publications, of which 2891 had altmetrics available.
- Coverage of metrics varied substantially: articles averaged more than 30 tweets and Mendeley saves, but fewer than 10% were mentioned in policy documents or clinical practice guidelines (**Supplementary Figure 1**).
- Mendeley saves correlated strongly with citations, while Twitter, Facebook, news and blogs were moderately correlated (**Supplementary Table 1**).
- Exploratory factor analysis identified some changes in factors in the older half of the sample compared with the newer half, reflecting the changing prevalence of metrics over time (**Supplementary Table 2**).
  - Consistent clustering within a factor included: news with blog posts; Twitter with Facebook; Mendeley saves with citations; clinical guideline citations with policy document citations.

The supplementary materials can be accessed via this QR code

Framework structure

- The framework comprised two reach predictor scores and an aggregate ‘value’ score with three subscores: social, scholarly and societal (**Figure 2**).
  - The societal value subscore was weighted to contribute approximately half of the total value score.

Figure 2. The framework for the value and predictor scores as applied to an example publication from the benchmark sample.



- The value subscores provide richer information than the Altmetric Attention Score or journal-level metrics (**Supplementary Figure 2**).
  - Altmetric Attention Score correlates with the social value score, but not the scholarly or societal value scores (**Table 1**, **Supplementary Figure 2**).
  - Impact factor correlates weakly with the social and scholarly value scores, but not the societal value score (**Table 1**, **Supplementary Figure 2**).

Table 1. Correlation of Altmetric Attention Score and journal impact factor with the social, scholarly and societal value subscores in the publication sample.

	1927	Web of Science Group
Social	Strong correlation	Weak correlation
Scholarly	Negligible correlation	Weak correlation
Societal	Negligible correlation	Negligible correlation

Strong correlation (r_s = 0.96) Weak correlation (r_s = 0.64–0.66) Negligible correlation (r_s < 0.6)

See **Supplementary Figure 2** for scatterplots.

Benchmarking and predictor scores

- The *NEJM* benchmark sample comprised 74 publications.
  - Mean value scores in the benchmark sample were around twice those of the publications sample, mainly owing to higher societal value.
- The early and intermediate predictive scores metrics correlate with the total value score (**Supplementary Table 2**, **Supplementary Figure 3**).

Conclusions

- This multi-component framework uses article-level metrics to provide a richer assessment of publication value versus standalone traditional and alternative metrics.
- By weighting and combining metrics into aggregate subscores, the framework enables publication planners to easily assess the nature of their publications’ impact.
- This framework could be used, for example, to understand the characteristics of stand-out publications and in support of assessing the effectiveness of publication enhancement solutions.
- Further refinement and application to company publications is ongoing.

References

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