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RELEVANT REVIEW

Could the altmetrics wave bring a flood of confusion for anatomists?

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Abstract

Altmetrics are non-traditional metrics that can capture downloads, social media shares, and other modern measures of research impact and reach. Despite most of the altmetrics literature focusing on evaluating the relationship between research outputs and academic impact/influence, the perceived and actual value of altmetrics among academicians remains nebulous and inconsistent. This work proposes that ambiguities surrounding the value and use of altmetrics may be explained by a multiplicity of altmetrics definitions communicated by journal publishers. A root cause analysis was initiated to compare altmetrics definitions between anatomy and medical education journal publishers' websites and to determine the comparability of the measurement and platform sources used for computing altmetrics values. A scoping content analysis of data from across eight publishers' websites revealed wide variability in definitions and heterogeneity among altmetrics measurement sources. The incongruencies among publishers' altmetrics definitions and their value demonstrate that publishers may be one of the root cause of ambiguity perpetuating confusion around the value and use of altmetrics. This review highlights the need to more deeply explore the root causes of altmetrics ambiguities within academia and makes a compelling argument for establishing a ubiquitous altmetrics definition that is concise, clear, and specific.

KEYWORDS
academics, altmetrics, scholarly impact, social media

INTRODUCTION

Altmetrics, or alternative metrics, are a collection of digital indicators of engagement and activity related to scholarly works.[1] These alternative article-level metrics aggregate data from diverse sources, including from article views, downloads, mentions, and shares, and from across social media (SoMe) platforms, blogs, datasets, podcasts, videos, and mainstream media.[2,3] Due to the heterogeneity of these alternative metric indicators, altmetric data aggregators (e.g., Altmetric LLP, ImpactStory, PlumX Metrics, PLOS ALM) collect metrics from a wide variety of sources to generate composite scores for characterizing an article's visibility.

Altmetrics scores are numerical values assigned to an article that can be used to demonstrate the reach and influence of one's research and scholarly outputs.[4] For example, Table 1 presents *Anatomical Sciences Education's* Top 10 most-downloaded articles from 2017 to 2021 by comparing traditional citation metrics to alternative metrics (i.e., Altmetric Attention and PlumX Metrics Scores). Table 1 demonstrates that ranking articles based on Altmetric Attention Scores yields different results compared to ranking articles based on the

TABLE 1 Top 10 most-downloaded articles from *Anatomical Sciences Education* in 2021.

Author	Publication year, volume (issue)	Accesses in 2021 according to Wiley journal metrics	Citations according to Wiley journal metrics	Altmetric attention score	PlumX Metrics citations[a] |captures|social media	Rank based on accesses	Rank based on citations	Rank based on altmetric attention score
Longhurst J., et al.	2020, 13(3)	67,739	159	41	161|701|81	1	2	2
Franchi T.	2020, 13(3)	11,457	104	7	119|508|143	2	3	5
Pather N., et al.	2020, 13(3)	9718	158	28	174|661|323	3	2	3
Harmon D., et al.	2021, 14(2)	5412	44	21	42|148|23	4	5	4
Husmann P., O'Loughlin V.	2019, 12(1)	3974	58	441	58|466|344	5	4	1
Mendonca C., et al.	2020, 13(5)	3273	NR	NR	26|112|0	6	NA	NA
Cuschieri S., Agius J.	2020, 13(6)	3199	20	2	38|198|1	7	6	6
Yang X., et al.	2021, 14(1)	2912	NR	NR	26|125|0	8	NA	NA
Jones D.	2020, 13(5)	2553	NR	NR	13|103|0	9	NA	NA
Moro C., et al.	2017, 10(6)	2317	290	33	300|951|10	10	1	3

Note: The average number of downloads per article published in ASE 2021 was 298. Across all journals that Wiley publishes in the same subject area, the average number of downloads per article was 300. Altmetric scores and citation counts were collected on July 27, 2022.

Abbreviations: NA, not applicable; NR, not reported.

[a]Citations contain both traditional citation indexes such as Scopus, as well as citations that help indicate societal impact such as Clinical or Policy Citations. Examples of citations include citation indexes, patent citations, clinical citations, policy citations; Captures indicates that someone wants to come back to the work. Captures can be a leading indicator of future citations. These include, bookmarks, code forks, favorites, readers, watchers; Social media includes the tweets, Facebook likes, etc. that reference the research. This can help measure "buzz" and attention. Social media can also be a good measure of how well a particular piece of research has been promoted (About Plumx Metrics[52]).

number of accesses alone. What remains less clear is the value and meaning of these differences.

Example: How altmetrics may be causing confusion

To illustrate how altmetrics may cause confusion among end-users, consider the following hypothetical example grounded in real-world data. Suppose the journal *Anatomical Sciences Education* (ASE) wanted to congratulate a research team on their high-impact educational research with an official award. A review of the top downloaded papers in ASE in 2021 demonstrates an interesting dichotomy between traditional metrics (i.e., citations) and alternative metrics (e.g., social media captures and mentions; Table 1). Longhurst's and colleagues'[5] SWOT analysis of the COVID-19 response was the most downloaded ASE article in 2021 with 159 citations and an Altmetric, LLC score of 41. Comparatively, Husmann's and O'Loughlin's[6] debunking of learning theories was the fifth-most downloaded paper of 2021, but it boasts an Altmetric, LLC score of 441 and was cited 58 times. For this example, we will ignore the fact that the 2019 article may have had more time to accrue notoriety and will assume that both papers were published around the same time. This begs the question, "Which article has more impact?"

Exploring the social media activity of these two articles reveals that Husmann's and O'Loughlin's[6] article received nearly 300 tweets and coverage by 19 news outlets. Conversely, Longhurst's and colleagues'[5] article was tweeted 42 times with coverage by one news outlet. While Longhurst's and colleagues'[5] article may have had more impact among academic circles given its citation count, Husmann's and O'Loughlin's[6] article indisputably had more impact among social media users, and presumably the general public. These things considered, which article deserves the hypothetical award? The challenges raised by this hypothetical award directly relate to the definition of scholarly impact, including how it is calculated and valued.

Uses for altmetrics

Scholarly impact is commonly associated with conventional avenues of scholarly communication and citation-based metrics. The National Information Standards Organization (NISO) purports that scholarly impact is a concept based on stakeholders and the uses of altmetrics are dependent on the values of each stakeholder community (e.g., academic researchers, publishers, promotion/hiring committees, etc.). NISO proposes three use cases for altmetrics: (1) to showcase achievements (i.e., highlight the accomplishments garnered by outputs); (2) for research evaluation (i.e., assessment of impact or reach of the research); and (3) for discovery (i.e., increasing the discoverability of outputs and/or researchers). For academic researchers, 'showcasing' may involve incorporating altmetrics into promotion and tenure portfolios, whereas 'discovery' may allow researchers to identify potential collaborators and/or report how influential research impacted their own. In terms of research evaluation, it is proposed that altmetrics may be used for grant reporting and to track engagement with one's own work.[1] Based on these stakeholder use criteria for altmetrics, it remains still unclear which *Anatomical Sciences Education* article deserves the hypothetical award, and, more broadly, the most effective use of altmetrics in academic applications also remains hazy.

Altmetrics versus traditional metrics

Academics increasing interest in altmetrics seems tied to the progressive featuring of these alternative metrics as a source of evidence for academic impact.[7] Within academic circles, however, there are debates surrounding the inherent value of altmetrics and whether they can be used as a stand-alone measure of scholarly impact, or whether they should only be presented in the context of traditional metrics.

According to Priem et al.,[8] altmetrics were born out of a consumer-focused demand for a broader diversity of article-level statistics, and limitations and failures of traditional scholarly evaluation sources. Recognized limitations of traditional metrics include their neglect of alternative scholarly works (e.g., books, chapters, and policy development), and the increasingly slow pace of the peer-review process and accrual of citations, which effects related metrics (e.g., h-indices and journal impact factors).[9]

Proponents view altmetrics as a more rapid and dynamic measure of the interest, influence, and impact of an article. Some contend altmetrics help to 'level the playing field' by reducing possible publication/recognition biases that are more likely to benefit well-established researchers.[10] Others suggest that altmetrics reach beyond the scholarly impact to measure societal and even cultural impacts[1,2] as they capture one's scientific reach/influence on a global scale, irrespective of where the research originated.[11]

Despite altmetrics' potential for enhancing equity among academics, lingering criticisms of these measures remain, particularly when compared to traditional metrics. Overall, studies have shown a low net correlation between altmetrics and citations, and discrepant convergent validity outcomes,[2,12–17] suggesting that altmetrics are measuring something different than the scholarly impact traditionally credited to citations.[12,13] Rousseau and Ye[18] also conclude that altmetrics are, at best, complements to traditional metrics, but cannot be considered true alternatives, or replacements, to citation-based indicators.

Within academia, altmetrics have stirred up controversy, in part, because of data integrity issues and the ability to game the system through self-promotion by sharing, posting, and linking a product across several media sites.[19,20] Others argue that even traditional metrics can be finagled through authorship manipulations, self-citations of authors and journals, and inflating journal impact factors by publishing highly cited article types such as reviews and meta-analyses.[21] Data collection for altmetrics from social media sites and the ambiguous measurements of aggregated scores[13] are also

cited as problematic. The collection of altmetrics data from a variety of measurement and platform sources leads to confusion about how altmetrics aggregators calculate altmetrics scores and calls into question their measurement validity.[4] While there is growing support for altmetrics' ability to quantify scholarship differently from traditional metrics, there remains concern for more widespread use of these measures in academia due to their interdependence on traditional measures and lack of clarity about how they are calculated.[13]

Growth, use, and value of altmetrics within academia

The diversification of technology, increased presence of academics on SoMe, and rise in demand for altmetrics have incited a paradigm shift whereby scientists are now regularly creating and releasing a sundry of online research products on SoMe platforms.[3] The number of papers published on altmetrics has grown steadily with over 170 publications between 2011 and 2015,[13] a clear indication of the growing interest and use of SoMe within the scientific community.[17] While the extant literature often discusses the "usefulness" of altmetrics, many proposed uses are merely hypothetical and rarely demonstrate how to practically apply altmetrics in academic settings. More so, despite the growing body of literature on altmetrics, studies show that academics have little familiarity with altmetrics, and when they do, they typically do not find them valuable for promotion and tenure (P&T).[22,23]

Despite many academics' unfamiliarity with altmetrics and their value for career advancement, some authors recommend that scholars report altmetrics data in their curricula vitae, promotion and tenure documents, and grant proposals as evidence of their scholarly achievements.[3,9,24,25] However, as of a decade ago, many institutions had yet to adopt such uses,[26] especially as a part of the promotion and tenure process.[27] More recent reviews of promotion and tenure documents reveal that while most guidelines include SoMe and digital scholarship keywords, guidance on their use in promotion and tenure is limited[28] and few guidelines support academics' use of outputs beyond traditional scholarship metrics.[29,30]

The lack of clarity on the value of altmetrics may make it especially challenging for promotion and tenure committees and institutional leaders to navigate this new territory. In an effort to weave altmetrics into the fabric of existing institutional systems, Cabrera et al.[7,31] developed a framework for how social media scholarship and altmetrics can be applied to promotion and tenure. However, it remains unclear if these recommendations have been widely adopted and endorsed across institutions.

Sources of confusion regarding altmetrics' value, use, and impact

Altmetrics are touted for their ability to track article attention (i.e., visibility and popularity) and impacts across media sources[32]; yet, their direct implications and the interpreted value of altmetrics scores remain cloudy for academic researchers.[33] Altmetrics data are becoming increasingly visible and accessible on journals' and publishers' homepages. Until the uncertainty surrounding altmetrics is better understood and reduced, incorporating altmetrics into mainstream academic endeavors is likely to present several challenges given their relative novelty, known study discrepancies, and lack of agreement on use.

Across numerous fields, journal publishers are promoting altmetrics by reporting articles' altmetrics scores on their homepages. Digging deeper, the calculations and algorithms used are often proprietary scoring methods. Providing researchers and journals easy access to altmetrics scores makes using this information even more tempting for evaluating impact and influence at a variety of levels, from individuals to research groups, institutions, and journals. However, two fundamental questions remain, "What are the definitions and characterizations of altmetrics definitions across different publishers?" and "Are inconsistencies between altmetrics definitions and measurement sources from journal publishers a likely source of confusion regarding the value and use of altmetrics?" Perhaps answering these questions will explain why it is so challenging to decide which article should win the hypothetical journal award.

In seeking to understand the sources of ambiguity pertaining to what altmetrics are, how they can be used, and what they measure, the authors used the tenets of a root cause analysis (RCA) framework to investigate the consistency of altmetrics definitions and scores across anatomy and medical education journal publishers. This approach is ideal for determining whether altmetrics definitions and their characterizations represent a potential source of altmetrics confusion for academics. Root cause analysis is a four-step process involving data collection, analysis, root cause identification, and generating recommendations.[34] Root cause analysis is an important first step in addressing potential sources of ambiguity and to understand how journal publishers describe and utilize altmetrics.

Analysis of altmetrics' definitions and measurement sources

This study sourced altmetrics' definitions from publishers' websites to investigate how academic publishers define and conceptualize altmetrics. A subset of included publishers was restricted to those with an "anatomy" subject focus identified through Scopus (n = 105). Publishing houses that were established <20 years ago were excluded to limit the influence of predatory publishing practices. Journals not currently in operation or publishers that lacked altmetrics definitions online were also excluded. To complement anatomy-specific journals, we applied purposeful sampling and the same exclusion criteria to select comparable journals within medical education. The selected journals and their publishers included those identified by Maggio et al.,[35] whose work characterized this field.

Altmetric definitions, measurement sources, and platform sources collated from academic publishers' websites were described and categorized using content analysis.[36] Two investigators (MDL and KMB)

inductively coded the altmetrics definitions using open coding of words and short phrases to identify categories and compared codes frequently to resolve discrepancies between coding frameworks.[37]

Content analysis findings

Content analysis results are presented in Table 2. Two major topics were identified from the journal publishers' website definitions of altmetrics (Table 3): (1) Measurement sources and (2) platform sources. Measurement sources represent *what* is being measured, while platform sources refer to either the specific platforms or sites that were referenced as data examples (i.e., *who* aggregates the data). Traditional measures (e.g., citations), general impact, online conversations of scholarly work, and reach were dominant measurement sources represented in publishers' definitions, *though the terms 'impact' and 'reach' were inconsistently characterized across publishers*.

Publishers characterized *impact* in one of two ways: *General impact* included those statements that did not specify an intended audience, while *societal impact* included statements specific to altmetrics' impact on society and areas outside of academia. Publishers used one or both statements of impact, with no consistency across publishers. *Reach* included statements that detailed altmetrics' range of sharing information. However, similar to impact, the meaning of *reach* was inconsistently applied across publishers.

Online reference managers and social media platforms were dominant platform sources for generating composite altmetrics scores. Overall, publishers' definitions of altmetrics varied widely in both their measurement and platform sources. No single measurement or platform source was characterized across all publishers' definitions, resulting in overall inconsistencies in the meaning of altmetrics scores.

DISCUSSION

The high variability of altmetrics definitions communicated by journal publishers clearly represents one source of ambiguity surrounding altmetrics. This preliminary root cause analysis sought to explore the shared and divergent themes related to publishers' altmetrics definitions to develop a starting point for understanding the source of inconsistencies around the value and use of altmetrics within academic

TABLE 2 Coding matrix of journal publishing groups' available publicly website definitions.

Theme	Codes	Elsevier[a]	Springer[a]	Wiley[a]	WKH[a]	CUP	PLOS	SAGE	T&F
Measurement sources	Societal impact	x		x	x				
	General impact	x	x		x		x	x	x
	Online conversations of scholarly work	x		x		x		x	x
	Re-tweets								x
	Download number								x
	Reach	x	x		x		x		x
	Citations or traditional measures	x	x	x	x		x		
	Social media mentions	x				x	x		x
	Engagement						x		
	Article "attention"		x			x	x		x
Platform sources	Online reference managers[b]	x	x	x	x		x		x
	Plum X	x							
	Altmetric LLP			x		x		x	x
	Social media platforms		x	x	x	x	x		x
	Blogs			x	x	x	x		x
	News			x	x	x			
	Scopus							x	
	Google scholar							x	
	Publons							x	
	Public policy documents				x				x
	Discussion forum		x		x		x		x
	3rd party application							x	

Abbreviations: CUP, Cambridge University Press; T&F, Taylor & Francis; WKH, Wolters Kluwer Health.

[a]Publishers of anatomy journals.

[b]Includes Zotero, Mendeley, EndNote and CiteULike.

TABLE 3 Definitions of altmetrics found on publishers' websites.

Publisher	Example journals	Definition
Elsevier	*Annals of Anatomy; Translational Research in Anatomy; Morphologie*	"Article-level metrics (ALMs) quantify the reach and impact of published research. ALMs seek to incorporate data from new sources (such as social media mentions) along with traditional measures (such as citations) to present a richer picture of how an individual article is being discussed, shared, and used"
Springer	*Advances in Anatomy, Embryology and Cell Biology; Anatomical Science International; Surgical and Radiologic Anatomy*	"Article metrics provide information on the usage and dissemination of published articles. Examples include: article accesses; citations; bookmarking/rating/discussion via bibliographic tools/sites, such as Papers; social media sharing, such as Facebook and Twitter. Article metrics are provided for all articles published by SpringerOpen and BioMed Central to help readers assess the importance and impact of these articles"
Wiley	*Anatomical Record; Anatomical Sciences Education; Developmental Dynamics*	"The Altmetric service is available to all journals on Wiley Online Library and allows you to: • Freely track online activity and discussions about individual scholarly papers from social media sources, including Twitter, Facebook and blogs, the mainstream media and online reference managers such as Mendeley and CiteULike. • See the attention that articles receive in real-time - score is open for everyone to see, follow, and understand. Please note: Altmetrics (aka Alternative Metrics) is a type of data that helps people understand how scholarship is discussed online Altmetric (aka Altmetric.com) is one of several services that report on altmetrics"
Wolters Kluwer Health	*American Journal of Surgical Pathology, Advances in Anatomic Pathology, National Journal of Clinical Anatomy*	"Fundamentally, altmetrics concerns the measurement of the use of your research article beyond the traditional measures of a journal impact factor, which uses citation counts in scholarly information sources. There are many types of "use" measured by altmetrics—mentions in Wikipedia, social media like Twitter, saves in Zotero, links in bookmarking services like Delicious—and much more. Altmetrics measures uses in scholarly and non-scholarly outlets. Think of altmetrics on a continuum, with scholarly impact on one end (traditional citations and bookmarks in reference management databases) to popular and societal impact on the other end (tweets and Facebook mentions)"
Cambridge University Press	*International Journal of Technology Assessment in Health Care*	"Launched in 2011, Altmetric is an alternative metric that looks at the attention to a specific journal article on social media, blogs and mainstream news sites and assigns a resultant score. That score is based on the number of mentions the paper receives, the 'quality' of the source of the mention, and who is mentioning the paper. This means that news articles generally receive a higher score than Facebook posts, and Twitter mentions from a journal publisher score lower than mentions from an independent academic in the field.... It is important to remember that Altmetric is an article-level metric, so the score represents only an individual article and does not reflect the other content in the journal"
PLOS	*PLOS Medicine*	"ALMs are quantifiable measures that document the many ways in which both scientists and the general public engage with published research. Traditional metrics, which consider only citation count and journal name to assess impact, capture a narrow view of a work's value and do so only after the accumulation of citations in academic literature. ALMs track the reach, use and reuse of research outcomes—from articles and figures to datasets and code—to help guide understanding of a work's influence Article level metrics help to assess impact before academic citations accrue, incorporate both academic and social metrics, and reflect changing influence of a work over time. Because ALMs are available shortly after publication and are continually updated, they provide a snapshot of an article's reach at any given moment"
SAGE Publishing	*International Journal of Surgical Pathology; Journal of Medical Education and Curricular Development*	"Our website is integrated with a range of third-party services to support our authors and reviewers. Figshare's data supplement services allows authors to measure the impact of their data. Publons gives reviewers credit for their work. Altmetric tracks online conversations around scholarly research"
Taylor & Francis	*Medical Teacher; Teaching & Learning in Medicine; Medical Education Online; Advances in Medical Education and Practice*	"Article-level metrics help authors to assess this by enabling you to gain a better understanding of the reach of your published research and the attention it is receiving. On Taylor & Francis Online, authors can see their article's number of views, citations (on Web of Science, CrossRef, and Scopus), and the Altmetric Attention Score"

contexts. The operationalization of these new and unique article-level metrics continues to evolve to the point where, anecdotally, publishers may be tailoring altmetrics to best fit their brand's needs. Instead of altmetrics conforming to some type of standardization, just the opposite may be transpiring with altmetrics definitions and scores becoming like a thumbprint unique to each publisher.

The content analysis revealed wide variability in the measurement and platform sources used across a variety of anatomy and medical education journal publishers. Even though the National Information Standards Organization (NISO) published and encouraged the adoption of altmetrics practice guidelines in 2016, this analysis reveals that guidelines have yet to be widely adopted.[1] We provide the following recommendations, based on this root cause analysis and review of the altmetrics literature, that echo those of NISO to provide suggestions to improve clarity on the value and use of altmetrics for academic researchers. These recommendations are contextualized within the three use cases identified by NISO and include: (1) showcasing achievements by standardizing the meaning and measurement of altmetrics, (2) providing academic researchers with clear guidance to evaluate research, and (3) increasing discoverability by supporting faculty engagement in SoMe/altmetrics at the institutional level (Figure 1). At the heart of these recommendations is the fundamental need to provide greater clarity regarding what altmetrics are and how they are to be used. Finally, this section highlights areas ripe for future research based on the gaps identified in this review.

Recommendation 1: Showcasing achievements by standardizing altmetrics definitions

The meaning and utility of altmetrics are confounded by the lack of a shared definition and by variability in terminology, measurement sources, and platform sources. The reporting of altmetrics alongside traditional article metrics on a journal's homepage may implicitly convey to authors and a journal's readership that altmetrics are valuable[24] and that altmetrics represent a singular, precise dimension. However, the content analysis demonstrated varying definitions of altmetrics across anatomy and medical education journal publishers which may result in end-user confusion. The publishers often described a variety of measurement sources that ranged from social media mentions (e.g., tweets) to online conversations of scholarly work. Publishers also referred to measuring *reach* and *impact* but did not specify what these terms meant practically for academic researchers. The co-occurrence of traditional measures in several publishers' altmetrics definitions likely emphasizes the tendency of publishers and the scientific community to define altmetrics relative to historically established metrics. From a more practical standpoint, these results demonstrate that without shared definitions, researchers may struggle to effectively showcase their achievements to other stakeholders when using altmetrics. Using the hypothetical example from earlier, reaching a consensus on who should win the journal award was challenging, primarily due to different platforms and measurements yielding different results.

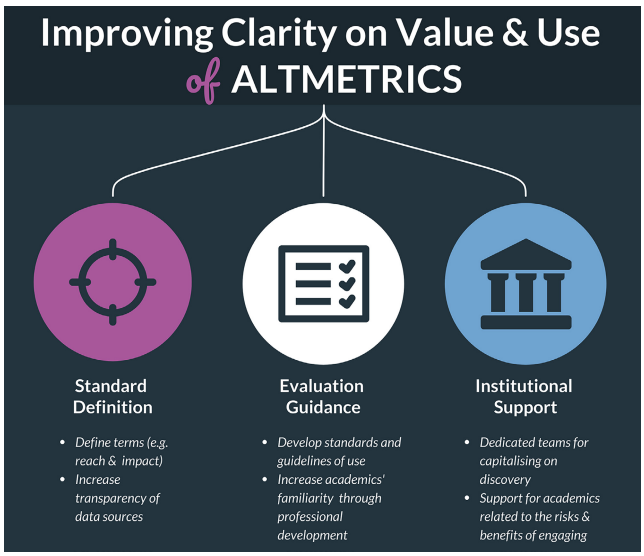

FIGURE 1 Recommendations to improve clarity on value and use of altmetrics.

Some have highlighted the need for a universally agreed-upon altmetrics definition that informs their use and value.[17] In this definition, a shared understanding of what is being measured, and how the measurement is derived, will become increasingly important as the use of altmetrics within the anatomical sciences, and academia, gain further momentum.[24,38] Greater transparency regarding data provision and aggregation may help to ensure the accuracy of the indicators used[1] and may increase academics' trust and confidence in the validity and utility of altmetrics to showcase their achievements and work.

Implementing greater transparency at all levels of the process and reducing the variability of definitions and altmetrics sources may require establishing actionable goals through an altmetrics consortium or a similar collaboration among key stakeholders, including publishers and end-users. Given there is a range of third-party services (e.g., Altmetric LLP, PlumX Metrics) that provide publishers and authors with altmetrics information, standardization may be challenging. For starters, terms such as *impact* and *reach* should be clearly defined across all publishers and altmetrics aggregators. Next, clear examples of the types of measurement sources used to form aggregate scores, such as tweets and retweets, Facebook shares, and citations, to name a few, should be provided. Finally, there should be consistency in referencing the specific types of platforms used, such as data from social media platforms, online reference managers, and altmetrics aggregators. Based on the results of this content analysis, the most prevalent codes for measurement and platform sources across publishers could be used as a starting point for this discussion.

Recommendation 2: Provide guidance for evaluating research

Often, academics are unfamiliar with the use of altmetrics and see little benefit or value in using altmetrics to evaluate research

outputs.[39] The results of this content analysis highlight a possible explanation for why academics devalue altmetrics. If there is not a single clear definition and understanding of altmetrics, what would entice researchers to use them over more established metrics? The development of a standardized altmetrics definition by key stakeholders would allow researchers and decision makers (e.g., promotion and tenure committees) to evaluate and compare altmetrics across journal publishers more effectively. The application of altmetrics could be more than simply highlighting ones' scholarly works. It could prove to be a mechanism for rigorous peer evaluation, a central tenet of the academic landscape.

Recommendation 3: Enabling discovery through institutional support

In a simplistic view, institutional support of altmetrics can lead to the discovery of research products and research collaborators by promoting interest among like-minded stakeholders. While institutional support is not standardized, altmetrics are used by some members of the academic community. For example, academics who use SoMe are more likely to use altmetrics, particularly by sharing content on different platforms.[39] Many academics perceive SoMe to be beneficial for early-career faculty, developing/initiating collaborations, disseminating research products, and self-promotion.[40] Unfortunately, this engagement in SoMe can also have negative consequences. For example, academics may experience pressure to engage in and maintain SoMe accounts due to a hidden threat and potential of altmetrics information being used for evaluative purposes.[19] When also balancing considerable workloads, time can be academics' greatest impediment to fully engaging in SoMe.[41] Academics may be more likely to engage in SoMe and/or altmetrics if they have access to dedicated teams to assist in the promotion of their research. Dedicated teams would help reduce the administrative burden related to SoMe profile management, while also facilitating the dissemination of work and creating collaborative networks.

Support for altmetrics could also be fostered through professional development sponsored by key stakeholders, such as institutional libraries and altmetrics providers.[42] Professional development could highlight the risks, benefits, and uses of altmetrics and/or SoMe as well as provide institutional support to help manage the dissemination of their scholarly products. Therefore, strategically creating teams comprised stakeholders with knowledge and background in showcasing (Recommendation #1) and evaluating research outputs (Recommendation #2) is a final step in the process to reduce altmetrics ambiguities.

Future research to fill identified gaps

Citation counts, representing a form of traditional metrics which often take years to accumulate, have long been the gold standard for measuring the impact of scientific works.[43] However, studies have demonstrated conscious and unconscious bias against women in several traditional metrics, including citation counts and h-indices.[44] Recent work has also identified that changes in authorship patterns in academia result in the decline of correlations of the h-index with major scientific awards,[45] suggesting that even the link between these gold standards and impact is questionable. Additional research is needed to investigate how altmetrics can support and provide complementary information for academics in areas where traditional metrics are flawed. Digital indicators, which tend to reach a larger more diverse audience, may induce a balancing effect whereby research products are more equally accessible and publicized, thus narrowing the demographic divide observed with traditional metrics.[44]

Future research should investigate why institutions choose to adopt altmetrics (or not) and compare institution-specific expectations for how altmetrics are used. Furthermore, considering the tendency of committees to evaluate scholarly productivity using traditional metrics,[29] and the variability in promotion and tenure expectations across institutions,[46] those who promote the use of altmetrics are encouraged to work together to provide specific recommendations for documenting altmetrics for scholarly excellence.

Some academics engage in SoMe for the primary purpose of networking and developing professional collaborations on a global scale. However, results are mixed as to whether SoMe engagement fosters research collaborations.[47,48] During the COVID-19 pandemic, professional conferences were either canceled or converted to virtual formats making opportunities for in-person collaborations and networking obsolete. It is speculated that SoMe may have filled an unanticipated gap as evidenced by increased international research collaborations over this time period.[47] Determining how SoMe and altmetrics enhance networking and research collaborations, particularly among women and underrepresented individuals,[49] may provide useful insights for changing the culture of academic medicine.

Finally, altmetrics are often praised for their ability to track 'scientific reach' outside academia and into the public sector.[11] While one study found most academics are followed on SoMe by other academics, when one reaches the threshold of 1000 followers on Twitter, the audience is more diverse resulting in an exponential increase in reach.[50] More research is needed to better understand how SoMe may bridge the gap between the general public and the ivory tower, and how altmetrics can be used to measure the narrowing of this divide.[51]

CONCLUSIONS

The central theme surrounding altmetrics is a preponderance of heterogeneity: A heterogeneity of definitions, types of indicators, aggregators, study results, samples, temporality, and social media platforms. As such, the general confusion surrounding altmetrics within the scientific community is not surprising. The present work concludes that there is a need to empirically explore sources of confusion surrounding altmetrics and a stepwise approach is needed to enhance the interpretation and use of altmetrics within academia

beginning at the level of publishing houses. Regardless of the metrics employed to evaluate researchers' reach and impact, a clear understanding of each metric's derivation, strengths, and limitations is necessary to interpret their meaning and usefulness in making related inferences. Given every metric is subject to some amount of measurement error, relying on a battery of complementary metrics may be best for evaluating the robustness of one's academic productivity, reach, and impact. However, more transparency, standardization, and research surrounding altmetrics are needed before a series of metrics can be implemented for consistent use within the scientific community. Only once such strides are made will academics truly be able to answer the question, "Which article had the greatest impact?"

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