Comparing alternative and traditional dissemination metrics in medical education

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CONTEXT The impact of academic scholarship has traditionally been measured using citation-based metrics. However, citations may not be the only measure of impact. In recent years, other platforms (e.g. Twitter) have provided new tools for promoting scholarship to both academic and non-academic audiences. Alternative metrics (altmetrics) can capture non-traditional dissemination data such as attention generated on social media platforms.

OBJECTIVES The aims of this exploratory study were to characterise the relationships among altmetrics, access counts and citations in an international and pre-eminent medical education journal, and to clarify the roles of these metrics in assessing the impact of medical education academic scholarship.

METHODS A database study was performed (September 2015) for all papers published in Medical Education in 2012 (n = 236) and 2013 (n = 246). Citation, altmetric and access (HTML views and PDF downloads) data were obtained from Scopus, the Altmetric Bookmarklet tool and the journal Medical Education, respectively. Pearson coefficients (r-values) between metrics of interest were then determined.

RESULTS Twitter and Mendeley (an academic bibliography tool) were the only altmetric-tracked platforms frequently (> 50%) utilised in the dissemination of articles. Altmetric scores (composite measures of all online attention) were driven by Twitter mentions. For short and full-length articles in 2012 and 2013, both access counts and citation counts were most strongly correlated with one another, as well as with Mendeley downloads. By comparison, Twitter metrics and altmetric scores demonstrated weak to moderate correlations with both access and citation counts.

CONCLUSIONS Whereas most altmetrics showed limited correlations with readership (access counts) and impact (citations), Mendeley downloads correlated strongly with both readership and impact indices for articles published in the journal Medical Education and may therefore have potential use that is complementary to that of citations in assessment of the impact of medical education scholarship.

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INTRODUCTION

Academic researchers and educators in the field of medical education are expected to disseminate education scholarship. Further, when an individual applies for tenure or promotion, academic promotion committees must assess the quality of that person’s scholarly contributions. Conventionally, the impact of scholarship has been judged by metrics related to citation counts. The journal impact factor (JIF), which is based on the average number of citations made to articles in that journal typically over the previous 2 years, is also commonly used to assess quality of scholarship. However, there are a number of caveats regarding the use of citation-based metrics to assess the quality of scholarship. For example, citations can take years to accumulate, the JIF is a journal-level metric that does not necessarily reflect the number of citations of any particular paper, and numbers of citations can be manipulated by the making of self-citations. Finally, a popular notion that is being raised by medical educators on social media suggests that the value of citations as an index of impact should be discounted as most academic papers are never cited.

It has been suggested that, in the modern era of rapid dissemination through various online platforms such as social media, altmetrics (a term that has been used in the literature to refer to both article-level and alternative metrics) related to an article’s online visibility may have a role in determining the impact of scholarship. There are several advantages to the use of altmetrics in comparison with traditional metrics. Twitter mentions (Tweets) regarding a paper tend to accumulate rapidly compared with citation metrics. Altmetrics may also capture general public interest in an article, which may be an important consideration when assessing impact. The altmetric service (Altmetric.com) tracks altmetrics related to a paper’s visibility on various platforms (including social media, professional networking and bibliography tools). Moreover, Altmetric.com also generates an altmetric score, which serves as a composite metric characterising an article’s overall online visibility across various public platforms. Altmetrics appear to be of perceived value to academic journals (and, implicitly, to their readers and authors) as they are generally available when accessing a journal’s online content (including online articles for Medical Education).

On one hand, advocates for the use of altmetrics would suggest these data are readily available and may complement citation-based information in determining impact. On the other hand, there may be hesitation around the formal incorporation of altmetrics in the assessment of scholarship as altmetrics are relatively new entities and may have their own, yet to be defined, limitations. How online ‘popularity’ relates to ‘impact’ is also of concern. An earlier study indicated that article mentions on Twitter (within days of publication) correlated highly with eventual citations, suggesting that altmetrics could be utilised as timely indicators of impact. However, more recent studies have determined that altmetrics (including Twitter mentions) have limited and weak relationships with article citation counts and access counts. Moreover, to date, there has been limited work characterising the relationships between altmetrics, access metrics and traditional impact (citation) metrics specific to the field of medical education. With these considerations in mind, the goal of this preliminary study was to explore the relationship between altmetrics and traditional research impact metrics for individual papers in the journal Medical Education. This journal is a high-impact (its JIF typically places it first or second amongst 40 journals in its education category), peer-reviewed journal that disseminates international scholarship across the general field of health professions education. Papers published in the years 2012 and 2013 were characterised in this study (conducted in September 2015) in order to ensure that material published well within the timeframe during which social media has been used extensively in dissemination, and to allow the passage of approximately 2–3 years for the accumulation of citations and access counts.

METHODS

Data collection

Citation counts for articles in the dataset were obtained using institutional access (University of Ottawa) to Scopus, one of the largest and most complete databases of peer-reviewed literature and a conventional resource for the study of citation metrics. Altmetrics were derived from the Altmetric Bookmarklet tool downloaded from the website Altmetric.com. This tool provides data related to the attention publications receive across various social media platforms (e.g. Twitter) and
Correlation analyses

The focus of this analysis was to determine which altmetrics featured the strongest correlations with access counts (considered to be an index of general interest and readership) and citations (considered to be an index of traditional scholarship impact). Pearson correlation coefficients ($r$-values) were calculated for relationships of interest. Correlation analyses and statistical significance ($p < 0.05$) were determined using StatPlus statistical software (Analysoft, Inc., Bracknell, UK). The data were assessed for outliers by boxplot analysis. Outliers were identified as any data points situated more than three times above or below the interquartile range. Where outliers were identified, the calculation of Pearson correlations with the outlier data removed did not alter the statistical significance or conclusion drawn for a given relationship. As such, all data points were retained in the correlations presented. Analysis was initially performed in subsets of full-length articles (typically of six pages or more, disseminating novel findings related to research or innovation) and short articles (typically of two pages or less, including items such as letters, commentaries and short reports on innovations published under ‘Really Good Stuff’), but correlations were similar across article types. Therefore, the data presented represent correlations for all articles.

RESULTS

Initial survey of citations, access counts and altmetrics

Using the Altmetric.com Bookmarklet tool, we investigated which altmetrics were used in the dissemination of Medical Education articles. The majority of platforms were seldom used in the dissemination of articles. Platforms used for less than 10% of the entire population ($n = 482$) of articles included Facebook, Google+, Reddit, blog posts, CiteULike and LinkedIn. Therefore, no further analyses of these metrics were performed. Platforms that were frequently used ($> 50\%$) to disseminate this journal’s articles were Twitter and Mendeley. Although Mendeley counts are not factored into the calculation of the composite altmetric score, the correlations between altmetric scores and Tweet counts were very strong (Fig. 1). The correlation between these variables was very strong both without ($r = 0.96$) and with ($r = 0.98$) the inclusion of the outlying data point in 2013 (altmetric score: 104; Tweet counts: 220).

Further analyses of Twitter, Mendeley and altmetric score correlations with citation counts and access counts were performed. There is evidence in other fields that full-length research articles are cited and accessed more often, and mentioned on social...
media less often than short articles.14 Full-length articles were cited much more frequently than short articles published in the respective years (Table 1). Moreover, across both years combined, 96% of full-length articles were cited at least once. Larger Mendeley download counts, Tweet mentions and altmetric scores were also observed for full-length papers relative to short papers. In addition, full-length papers were much more heavily accessed in 2012 (3.6 times more often) and 2013 (2.4 times more often) than short articles from the respective years (data not shown).

Correlations with citations and access counts for all articles

Across the whole dataset of papers (for 2012 and 2013), as well as for the isolated 2012 and 2013 cohorts, citations were most strongly correlated with access counts and Mendeley downloads (Table 2). Citations were also weakly (for 2013 articles) to moderately (for 2012 articles) correlated with Twitter mentions, potential exposure to Twitter followers and altmetric scores. Access counts were most strongly correlated with citations and Mendeley downloads for each time period assessed. Access counts featured weak to moderate correlations with Twitter counts, potential exposure to Twitter followers and altmetric scores for each time period analysed. For each metric analysed, correlations were stronger in 2012 than in 2013.

DISCUSSION

Citation-related indices have conventionally been used in assessment of the academic impact of scholarly papers despite established caveats.1 Given the increasing use of social media, it is possible that alternative methods of capturing the dissemination of an article, such as that afforded by altmetrics, should be considered when determining academic impact.2 The current study evaluated correlational relationships between altmetrics, access counts and citations to help identify which metrics may hold value in determining either traditional impact (via

Table 1   Mean ± standard error of the mean citations and selected altmetrics for full-length articles and short articles published in 2012 and 2013 in Medical Education

<table>
<thead>
<tr>
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<th>Full-length articles</th>
<th>Short articles</th>
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<tbody>
<tr>
<td></td>
<td>2012 only 2013 only</td>
<td>2012 and 2013</td>
</tr>
<tr>
<td></td>
<td>2012 only 2013 only</td>
<td>2012 and 2013</td>
</tr>
<tr>
<td>Citations</td>
<td>12.2 ± 1.1 4.7 ± 0.4</td>
<td>8.3 ± 0.6 1.3 ± 0.2</td>
</tr>
<tr>
<td>Mendeley downloads</td>
<td>33.2 ± 2.3 12.9 ± 1.2</td>
<td>22.8 ± 1.4 2.4 ± 0.7</td>
</tr>
<tr>
<td>Tweets</td>
<td>5.5 ± 0.6 6.3 ± 1.1</td>
<td>5.9 ± 0.6 0.7 ± 0.2</td>
</tr>
<tr>
<td>Altmetric score</td>
<td>3.7 ± 0.4 4.0 ± 0.6</td>
<td>3.9 ± 0.4 0.5 ± 0.1</td>
</tr>
</tbody>
</table>

Table 2   Correlations (Pearson coefficients, r) between selected altmetrics and citations, and between selected altmetrics and access counts, for all Medical Education articles published in 2012 (n = 236) and 2013 (n = 246)

<table>
<thead>
<tr>
<th></th>
<th>2012 only</th>
<th>2013 only</th>
<th>2012 and 2013</th>
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<tbody>
<tr>
<td>Correlations between citations and: Access counts</td>
<td>0.77*</td>
<td>0.62*</td>
<td>0.76*</td>
</tr>
<tr>
<td>Mendeley downloads</td>
<td>0.81*</td>
<td>0.61*</td>
<td>0.62*</td>
</tr>
<tr>
<td>Tweets</td>
<td>0.47*</td>
<td>0.18</td>
<td>0.19</td>
</tr>
<tr>
<td>Potential exposure to Twitter followers †</td>
<td>0.42*</td>
<td>0.12</td>
<td>0.28</td>
</tr>
<tr>
<td>Altmetric score</td>
<td>0.57*</td>
<td>0.21</td>
<td>0.25</td>
</tr>
<tr>
<td>Correlations between access counts and: Mendeley downloads</td>
<td>0.79*</td>
<td>0.65*</td>
<td>0.78*</td>
</tr>
<tr>
<td>Tweets</td>
<td>0.55*</td>
<td>0.33*</td>
<td>0.27*</td>
</tr>
<tr>
<td>Potential exposure to Twitter followers †</td>
<td>0.22</td>
<td>0.12</td>
<td>0.16</td>
</tr>
<tr>
<td>Altmetric score</td>
<td>0.52*</td>
<td>0.35*</td>
<td>0.30*</td>
</tr>
</tbody>
</table>

* Statistically significant (p < 0.05).
† Potential exposure to Twitter followers refers to the sum of all followers from all Twitter accounts that mentioned the paper on Twitter as calculated by Altmetric.com
citations) or readership (access counts) in the field of medical education. Based on this single-journal (Medical Education) study, it appears as though readership (access counts) is most strongly correlated with citations and Mendeley downloads (a bibliography platform). Further, the scholarly impact (citation counts) of these papers is most strongly correlated with metrics associated with readership (access counts and Mendeley downloads). This suggests that the traditional metric of citations has current value as an indicator of interest, whereas Mendeley data may be useful as indices for both readership and scholarly impact in an international, high-impact medical education journal.

Not only does this study support the notion that citation counts may be strong indicators of impact, but it demonstrates that 96% of full-length research or innovation articles (and 70% of all papers) were cited at least once within three calendar years of their publication. Moreover, full-length Medical Education papers (typically disseminating innovation and research) were cited and accessed much more often than short articles (letters and commentaries), an observation similar to those in several other fields.14 This finding that most of the articles examined in this study were cited runs counter to the perception amongst some academics that most papers are never cited.3 In fact, the ‘most papers are never cited’ notion has been mistakenly attributed, particularly on social media, to findings from a research study that does not exist, as discussed elsewhere.15 Although citation rates for papers in some fields may be poor, most papers in medicine actually accumulate citations within a few years of their publication.16

With reference to altmetrics, there may be great potential in Mendeley as an index for both invested readership and for impact as data from this particular bibliography tool strongly correlated with both access counts and citations. This may be surprising, given that several academic bibliography options are available. However, the strong correlation between Mendeley readers and citations for articles has been observed previously across academic disciplines.17,18 These data may indicate that Mendeley may be one of the preferred bibliographic tools amongst academics, although it is unclear how its rate of use compares with those of other bibliography tools or other sources for downloading articles (e.g. ResearchGate). In any case, our findings suggest that scholars, institutions and academic promotion committees could incorporate the use of Mendeley statistics into their processes of assessing the impact of papers.

Conversely, most other altmetrics seemed to be of limited use in relating interest or impact in Medical Education. In fact, for the majority of articles, the only platforms used were Mendeley and Twitter, and Twitter was the only tool that factored in the altmetric score. This reveals insight into an important caveat regarding the altmetric score as a measure of impact and visibility across all online platforms. In terms of evaluating papers in this journal, the altmetric score was reduced to a score that is driven exclusively by Twitter visibility. Unfortunately, Twitter metrics (mention counts and potential exposure in terms of followers) had weak correlations with access or citation counts, greatly limiting the utility of the altmetric score as a measure of either reader interest or scholarly impact. Altmetric.com also categorises Tweets by members of the public, health care professionals and scientists, along with several other categories.17 These numbers may quantify a paper’s ability to attract attention from both academics and non-academics (the general public) and thus may be worth considering when determining impact. However, close inspection revealed that many academics are categorised as members of the public even if they are the authors of the paper in question. One must therefore be cautious about interpreting these Altmetric.com data as a reflection of the public’s interest in a paper.

In the present study, the popularity of a Medical Education paper on Twitter was a weak to moderate measure of both readership (access counts) and impact (citation counts), which supports recent findings in other disciplines.6–12,17 Questions arise as to why Twitter metrics do not accurately reflect readership or impact. Twitter may be limited as an impact indicator by the fact that many academics are not consistent users of this platform.19,20 Additionally, a scholar’s activity or visibility on Twitter may not accurately reflect that individual’s impact in terms of citations of their work.19,21 Finally, some topics in medical education are very popular on Twitter, and Twitter metrics may therefore be a reflection of subject matter rather than of any intrinsic impact of the paper itself.22

Limitations

Although many studies of altmetrics and citations catalogue thousands of papers from many disciplines and multiple journals, our goal was to focus on medical education papers in a high-
impact, field-specific journal. The generalisability of this paper may be limited to the papers considered in a single journal. Preliminary analysis has indicated that the findings here may be generalised to articles published in Academic Medicine, another high-impact, general interest medical education journal.\(^1\)\(^,\)\(^2\)\(^,\)\(^3\) Regardless, future characterisations of citation count, access count and altmetrics relationships should be evaluated over longer intervals and in multiple medical education journals. The findings presented here may over-represent altmetric correlations (relative to citations) to access and impact measures as the peak of Twitter mentions for the papers considered was captured, whereas it is likely that the peak of citation data was excluded, and further tracking over multiple years is required to better define long-term correlations among these metrics. The benefits (if any) of open access in terms of increasing altmetric, citation or access counts were not characterised here but must be considered going forward, particularly as there are financial implications involved (journals typically charge authors a fee for open access). Although Mendeley and Twitter are currently the primary platforms used for disseminating scholarship, relative use of online platforms may change over time. Finally, the findings here in a high-impact, highly visible, general interest medical education journal may not necessarily translate to other journals with field-specific medical education scopes that target specialty-specific readerships.

CONCLUSIONS

Citation counts may be strong indicators of readership for articles published in the journal Medical Education, whereas the utility of many altmetrics in predicting a paper’s readership or its scholarly impact (citations) appears to be limited. Even the altmetric score (a consensus score of all online attention) is reduced to serving as a Twitter score for this journal, and is therefore limited by all the caveats related to interpreting a paper’s visibility on Twitter. Mendeley download metrics are, however, strongly correlated with both access and citation counts, and may be useful in determining the impact of scholarly work.

Contributors: AA contributed to the collection and analysis of data. KA contributed to the collection and analysis of data, and assisted in the original drafting of the paper. JJP contributed to data interpretation and to the critical revision of the work with particular reference to outlier treatment. TJW contributed to the interpretation of the findings and was instrumental in responding to reviewer comments regarding the statistical analyses conducted. CJR conceived of this study, led the collection, analysis and interpretation of data, and composed the initial draft of the paper. He also led the revision of the manuscript and the group’s responses to reviewer comments. All authors contributed to the critical revision of the paper, approved the final manuscript for publication and have agreed to be accountable for all aspects of this work.

Acknowledgements: none.

Funding: none.

Conflicts of interest: none.

Ethical approval: This study was considered a database study by the Ottawa Hospital Research Ethics Board and was deemed exempt and not subject to the formal ethical review process.

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*Received 22 November 2016; editorial comments to author 15 January 2017, accepted for publication 19 April 2017*