



# **Graphical and video abstracts are not associated with increased Altmetric attention score or citations in sport science.**

Supplementary materials:

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*Please cite as:* Bennett, H., & Slattery F. (2022). Graphical and video abstracts are not associated with increased Altmetric attention score or citations in sport science. *SportRxiv*. DOI: 10.51224/SRXIV.147

All authors have read and approved this version of the manuscript. This article was last modified on April 27, 2022.

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## ABSTRACT

**Objective:** Graphical (GA) and Video (VA) abstracts provide a summary of a study's key findings to direct more viewers to the published paper. The present aim was to determine if papers published with a GA or VA in the field of sport science are likely to receive higher Altmetric attention scores and more citations than papers published without.

**Methods:** A multivariate Poisson regression analysis was used to determine whether Altmetric attention scores and citation counts were different between articles published with or without a GA or VA. Included articles were published between January 2019 and December 2020 from three journals ranked within the top quartile of the category of "Sport Science".

**Results:** Of 562 articles, 101 were published with a graphical abstract (n = 96) or video abstract (n = 5). Articles with GA or VA received a lower Altmetric attention score than those without (Incidence rate ratio = 0.76 (0.73 – 0.80) [95% CI = 0.73 – 0.80];  $p < 0.001$ ; *small effect*) and were cited less often (incidence rate ratio = 0.64 [95% CI = 0.60 – 0.69];  $p < 0.001$ ; *small effect*).

**Conclusion:** This study found no apparent benefit to publication with a GA or VA with respect to Altmetric attention scores and citations. Further research should consider investigating how factors such as design quality, distribution, and research importance influence these outcomes in similar studies.

## INTRODUCTION

Over the last two decades, there has been an exponential increase in the number of English-language peer-reviewed scientific articles, with approximately three million published in 2018.<sup>1</sup> Despite this large increase in published content, the readability of science is declining.<sup>2</sup> As a result, researchers are encouraged to improve the way they communicate their findings, from writing differently,<sup>3</sup> improving how they produce scientific posters,<sup>4</sup> or by embracing graphical abstracts (GA) or video abstracts (VA).<sup>5</sup>

Like a movie poster or trailer, GAs and VAs provide a summary of a study's key findings and aim to direct more viewers to the published paper, in an attempt to increase the paper's reach and further disseminate the findings. Furthermore, if GAs and VAs can improve the reach of sports science research, it is thought that consumers such as clinicians, coaches, athletes, and the general public, stand to benefit. To date, no studies have examined the effect of VAs on article metrics, and only two studies have investigated the effects of GAs. Contrary to expectations, Pferschy-Wenzig et al. (2016) found that manuscripts published in the journal 'Molecules' without a GA performed significantly better in terms of full-text article downloads, abstract views, and total citations, than manuscripts published with a GA.<sup>6</sup> Similarly, Aggarwal (2021) found no significant differences between articles published in the Journal of the American Medical Association, the British Medical Journal, and the New England Journal of Medicine, with and without graphical abstracts with respect to Altmetric attention score or number of page views.<sup>7</sup> Within this, they also found that papers published without GAs received more citations than those published with GAs. While the exact reasons for these findings are unclear, it could be partially related to the fields of research explored, being related to medicine and chemistry. Given the complexity of topics covered in both these areas of research, they may not be as appealing to consumers without an extensive academic background compared to research fields that are more applied in nature, such as sport science. To date, no studies have investigated whether or not GAs/VAs lead to more citations or higher Altmetric attention scores after publication in the field of sport science.

Therefore, the aim of this study was to determine if papers published with a GA or VA in the field of sport science were more likely to receive higher Altmetric attention scores and more citations than papers published without. It was hypothesized that articles published with a GA or VA would receive more citations and higher Altmetric scores.

## **METHODS**

Three journals ranked within the top quartile of the category of "Sport Science" according to Scimago as of January 2022 and had published graphical abstracts since January 2019 or earlier (Journal of Sport and Health Sciences [JSHS]; Exercise and Sport Science Reviews [ESSR]; Psychology of Sport and Exercise [PSE]), were included in the analysis. Article specific data (article type; open access status; publication date), attention-based metrics (Altmetric attention score), and citations were extracted for all full-text articles published

between January 2019 and December 2020 in the journals. This period was selected to provide a sufficient sample size of articles and ensure a minimum of 12 months since publication. A 12-month timeframe was deemed appropriate to provide an accurate indication of Altmetric attention score and citations considering there appears to be a quick uptake of attention-based indicators after publication,<sup>8</sup> and that short-term citation counts are highly correlated with long-term citation counts in peer-reviewed research.<sup>9</sup> Article specific data and Altmetric attention score were extracted using the online Altmetric explorer software on the 11<sup>th</sup> of January 2022, while GAVA status (none; GA; VA) was identified manually. Citations extracted from Altmetric explorer are counted using Dimensions software, which has been shown to have comparable capture to Web of Science and Scopus.<sup>10, 11</sup>

Descriptive information is presented as median (interquartile range) [range]. A Poisson regression was used to establish whether Altmetric attention score or Citation counts (dependant variables) were impacted by GAVA status, open access status, or article type (independent variables). Variables that displayed a significant association with the dependant variables were then included in a multivariate Poisson regression analysis. For all analyses, the number of days since publication (exposure) were included as a covariate, as was the journal of publication (to account for differences in impact factor). Analysis was performed using Stata Statistical Software, release 17. For all outcomes, 95% confidence intervals are presented, and effect sizes were quantified using incidence rate ratios (IRR) and considered trivial (0.77-1.00 or 1.00-1.29), small (0.51-0.78 or 1.30-1.99), moderate (0.25-0.50 or 2.00-3.99), and large ( $\leq 0.24$  or  $\geq 4.00$ ).<sup>12</sup> For all analysis, both GAs and VAs were categorised together.

## Results

A total of 565 full text articles were identified for inclusion into the study. Three were excluded due to being “notes from the editor,” leaving 562 articles for analysis. Of these, 295 were from PSE, 68 from ESSR, and 199 from JSHS. There was a total of 364 original articles, 134 reviews, 50 classified as an editorial, commentary, opinion, perspective, or consensus, and 14 letters to the editor. A total of 101 articles were published with a graphical abstract ( $n = 96$ ) or video abstract ( $n = 5$ ), and 375 articles were published open access. A detailed description of the extracted articles is presented in Table 1.

Table 1: Overview of publication number by journal and by article type

	Open Access		Abstract type			Article type			
Publication number by Journal									
	No	Yes	Written only	GA	VA	Original	Review	Editorial etc.	Letter
PSE	168	127	293	2	0	244	38	9	4
ESSR	19	49	53	10	5	0	58	8	2
JSHS	0	199	115	84	0	120	38	33	8
Publication number by Article Type									
Original	137	227	305	59	0				
Review	39	95	93	37	4				
Editorial etc	9	41	49	0	1				
Letter	2	12	14	0	0				

\*Editorial etc. = editorial, commentary, opinion, perspective, or consensus, ESSR = Exercise and Sport Science Reviews, GA = graphical abstract, JSHS = Journal of Sport and Health Sciences, PSE = Psychology of Sport and Exercise, Letter = letter to the editor, VA = video abstract

The median Altmetric attention score was 7 (17) [range = 0 – 1611], and the median number of citations were 7 (10) [range = 0 – 481]. Initial univariate analysis indicated that articles with GAs/VAs received a lower Altmetric attention score than those without (IRR = 0.93 [95% CI = 0.89 – 0.98];  $p=0.003$ ; *trivial effect*) and were cited less often (IRR = 0.76 [95% CI = 0.71 – 0.82];  $p<0.001$ ; *small effect*). Open access articles received higher Altmetric attention scores than those that were not open access (IRR = 1.80 [95% CI = 1.72 – 1.89];  $p<0.001$ ; *small effect*) and were cited more often (IRR = 1.41 [95% CI = 1.32 – 1.50];  $p<0.001$ ; *small effect*). Both reviews (IRR = 2.63 [95% CI = 2.52 – 2.75];  $p<0.001$ ; *large effect*) and editorials (IRR = 1.38 [95% CI = 1.29 – 1.45];  $p<0.001$ ; *small effect*) received higher Altmetric attention scores than original articles, while letters to the editor received less (IRR = 0.85 [95% CI = 0.74 – 0.96];  $p<0.02$ ; *trivial effect*). Similarly, reviews (IRR = 3.28 [95% CI = 3.10 – 3.46];  $p<0.001$ ; *moderate effect*) and editorials (IRR = 2.12 [95% CI = 1.96 – 2.28];  $p<0.001$ ; *moderate effect*) received more citations than original articles. There were no significant differences in the citation counts of letters to the editor compared to original articles (IRR = 1.09 [95% CI = 0.91 – 1.30];  $p=0.331$ ; *trivial effect*). Results of the multivariate analysis are presented in Table 2. The direction and significance of findings remained unchanged, with small changes in effect size.

Table 2: Multivariate Poisson regression exploring the impact of article type, open access status, and abstract type (normal; graphical abstract; video abstract) on Altmetric attention scores and citation counts.

Category	IRR (95% CI)	P =	Effect Size Descriptor
<b>Altmetric attention scores</b>			
<b>Article type</b>			
<i>Original</i>	1.00 (reference)		
<i>Review</i>	2.73 (2.62 – 2.86)	<0.001	<i>moderate</i>
<i>Editorial etc.</i>	1.32 (1.24 – 1.40)	<0.001	<i>small</i>
<i>Letter</i>	0.79 (0.69 – 0.91)	0.001	<i>trivial</i>
<b>Open Access</b>			
<i>No</i>	1.00 (reference)		
<i>Yes</i>	1.82 (1.74 – 1.91)	<0.001	<i>small</i>
<b>GA/VA</b>			
<i>No</i>	1.00 (reference)		
<i>Yes</i>	0.76 (0.73 – 0.80)	<0.001	<i>small</i>
<b>Citation counts</b>			
<b>Article type</b>			
<i>Original</i>	1.00 (reference)		
<i>Review</i>	3.48 (3.30 – 3.68)	<0.001	<i>moderate</i>
<i>Editorial etc.</i>	1.86 (1.72 – 2.01)	<0.001	<i>small</i>
<i>Letter</i>	0.95 (0.79 – 1.13)	0.540	<i>trivial</i>
<b>Open Access</b>			
<i>No</i>	1.00 (reference)		
<i>Yes</i>	1.49 (1.39 – 1.59)	<0.001	<i>small</i>
<b>GA/VA</b>			
<i>No</i>	1.00 (reference)		
<i>Yes</i>	0.64 (0.60 – 0.69)	<0.001	<i>small</i>

\*Editorial etc. = editorial, commentary, opinion, perspective, or consensus, GA = graphical abstract, IRR = incidence rate ratios, Letter = Letter to the editor, VA = video abstract

## Discussion

This study is the first to investigate the effect of GAs and VAs on article attention scores and citation counts in the field of sport science. Contrary to the proposed hypothesis, this study found that including a GA or VA with the publication of an article in three high-ranking sport science-related journals was not associated with higher Altmetric attention scores or citation counts than papers published without a GA or VA. Conversely, papers published with a GA or VA were associated with lower Altmetric attention scores and citation counts.

Video abstracts were far less prevalent than graphical abstracts in this study, and the authors are unaware of any peer-reviewed research examining their effect on similar outcomes.

Although graphical abstracts are not new (they have been commonly used in the chemistry field since the 1970s),<sup>13</sup> their use in other fields is a more recent trend. For example, from 2011 to 2015, the use of graphical abstracts in social science journals increased by an estimated 350 per cent.<sup>14</sup> As a result, the research on their effectiveness is relatively sparse.

In what appears to be the first empirical analysis of the effectiveness of GAs, Pferschy-Wenzig et al. (2016) found similar results to the present study.<sup>6</sup> Manuscripts published in the journal *Molecules* between March 2014 and March 2015 without a GA performed significantly better in terms of PDF downloads, abstract views, and total citations than manuscripts with a GA. A further study by Aggarwal (2021) also found no significant differences between articles with and without GAs on Altmetric attention score and in number of page views, and articles without a GA attracted more citations.<sup>7</sup> Why graphical abstracts would have a negative effect on citations is unclear, but Pferschy-Wenzig et al. (2016) speculated with two potential explanations.<sup>6</sup> Firstly, a generational divide. Graphical abstract use may be more common among early career researchers with a greater propensity to use social media. Conversely, more experienced researchers of greater renown, whose research may be more frequently cited, viewed, and downloaded, may be less likely to use a GA and distribute it via social media. Secondly, the authors speculated that well-designed GAs may produce a negative effect on traditional metrics if viewers are able to effectively obtain all the information they need from the GA alone, without proceeding to the full article. The findings of the current study would support these suggestions.

The aforementioned study by Aggarwal (2021) focused on a particular type of graphical abstract known as the visual abstract,<sup>7</sup> recognizable by its simple, panel-based layout and use of basic icons.<sup>15</sup> Indeed, much of the previous research on GAs has focused on this type, which has become popular among researchers and journals in medical fields. While to date there have only been two studies exploring the effects of visual abstracts on Altmetric attention scores and citation counts, there is small body of research that has focused on the effect of these visual abstracts on native Twitter-based metrics, unanimously finding positive effects. Ibrahim et al. (2017) conducted a prospective case-control crossover study of 44 original research articles published Between July 2016 and December of 2016 in the *Annals of Surgery*.<sup>16</sup> Compared to tweeting the article title alone, tweets featuring a visual abstract experienced a 7.7-fold increase in impressions, an 8.4-fold increase in retweets, and a 2.7-fold increase in article visits.<sup>16</sup> Later, Chapman et al. (2019) conducted a randomized controlled trial

comparing visual abstracts, plain English abstracts, and standard tweets.<sup>17</sup> They found that visual abstracts attracted a significantly greater number of engagements (a composite of tweets, replies and likes) by health care professionals on Twitter compared to plain English written abstracts.<sup>17</sup> However, there were similarly low levels of engagement by the general public between the three types. In another randomized crossover trial including 50 articles, Hoffberg et al. (2020) found that tweets with a visual abstract were associated with a significantly higher number of impressions, retweets, and link clicks compared with text-only abstract tweets.<sup>18</sup> Additional studies have found further evidence of positive performance of visual abstracts on Twitter compared to text tweets or figures from the paper in the fields of urology,<sup>19</sup> nephrology,<sup>20</sup> and orthopaedics.<sup>21</sup> Based on this small body of research, it appears that graphical abstracts do outperform text-based posts on Twitter, despite no study demonstrating a positive effect on citations or Altmetric attention scores. It may be that active researchers in a particular field do not rely on serendipitously finding relevant research on Twitter and remain up to date by other means. It is also important to note that Twitter engagement only provides a small contribution to an articles Altmetric attention score, where mentions in news articles, blog posts, policy documents, peer reviewed research, and patents provide greater contribution.<sup>22</sup> As such, it is feasible to suggest that while graphical abstracts might stimulate greater twitter engagement, the findings of a study are more likely to contribute to their uptake into those detailed publications that have greater weighting within the Altmetric attention score algorithm.

Like the previous research outlined, the present study focused on the effect of publication of an article with or without a GAVA and its effect on key metrics of interest to academics. However, there are many important factors which may affect these outcomes which were not within the scope of this work. Firstly, there have been no investigations on how the effectiveness of GAVAs is altered by their quality: in either an artistic sense, or regarding how well they relay information to their target audience. There are many factors to consider when designing an effective graphical abstract including layout, use of text and graphic representations (icons or other visuals, for example).<sup>23</sup> Poorly produced GAVAs may not have the same level of effectiveness as those produced by skilled researchers, or professional designers and animators. Previous research has shown that approximately 50 percent of graphical abstracts are duplicated from the manuscript's existing visual components (i.e., figures).<sup>14</sup> Given that figures within an article often isolate a particular finding, and are nested within the context provided by the article, this may not be the best method of summarising a



research study as a GA. A further factor worthy of examination is the distribution of GA/VAs and how this affects outcomes. The present study focused only on whether an article was published with or without a GA/VA, whereas GA/VAs may also be additionally (or at times, exclusively) distributed via social media or elsewhere online. Additional factors which may influence research of this nature also include the effect of the author(s) renown or reputation, as well as the significance or appeal of the research itself, neither of which were addressed in the present study, or in previous research.

Taking this into consideration, there are limitations that should be considered with these findings. Given the small volume of articles published with VAs, they were categorised with GAs for all analyses. There is a possibility that these results would not extend to articles published with VAs in isolation. Moreover, as alluded to in the discussion, the quality of the VAs was not accounted for in the analysis. It would be plausible to suggest that those articles published with a well-designed GA or VA would be more likely to improve Altmetric attention scores and citation counts than those that are either poorly designed, or simply based upon a figure within the paper.

## **Conclusion**

The results of the present study suggest that graphical and video abstracts are not effective at increasing Altmetric attention scores or citation counts in the field of sports science. However, further research is needed that addresses likely important factors such as design quality, distribution, and research importance.

## **Contributions**

Contributed to conception and design: HB, FS

Contributed to acquisition of data: HB, FS

Contributed to analysis and interpretation of data: HB, FS

Drafted and/or revised the article: HB, FS

Approved the submitted version for publication: HB, FS

## **Acknowledgements**

The authors wish to thank Altmetric for providing this study's data free of charge for research purposes.

## **Funding information**

The authors received no funding from an external source.

## **Data and Supplementary Material Accessibility**

All data, and code are available on the Open Science Framework project page for this study [www.osf.io/qzex2/](https://www.osf.io/qzex2/)

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