

# Altmetric analysis of 2015 dental literature: a cross sectional survey

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## In brief

Highlights Altmetric data of all dental articles and journals in 2015.

Demonstrates that the *British Dental Journal* had the first rank, followed by *Journal of Dental Research*, *Journal of Clinical Periodontology* and *Journal of the American Dental Association*.

Shows that Mendeley readers, Twitter, Facebook walls, news outlets and bloggers were the most popular Altmetric data resources.

**Introduction** To report and analyse Altmetric data of all dental articles and journals in 2015. **Methods** To identify all 2015 dental articles, PubMed was searched via Altmetric platform using the following query: ("2015/1/1"[PDAT]: "2015/12/31"[PDAT]) AND jsubsetd[text] NOT 2016[PDAT] on November 12, 2016. Altmetric data of all 2015 dental articles and journals were extracted and analysed by Microsoft Office Excel 2016 using descriptive statistics, graphs and trend-line analysis. To find the most important and influential Altmetric factors, multi-layered perceptron artificial neural network was employed using SPSS 22. **Results** A total of 14,884 dental articles published in 2015 using PubMed database were found, from which 5,153 (34.62%) articles had an Altmetric score. The mean Altmetric score was  $2.94 \pm 9.2$  (95% C.I.:2.703.22). Mendeley readers (73.19%), Twitter (21.48%), Facebook walls (3.67%), news outlets (0.69%) and bloggers (0.57%) were the most popular Altmetric data resources. At journal level, 147 dental journals with valid Altmetric data were included in the study. The *British Dental Journal* had the first rank, followed by *Journal of Dental Research*, *Journal of Clinical Periodontology* and *Journal of the American Dental Association*. Sensitivity analysis showed news outlets, tweeters and scientific bloggers were the most important and influential Altmetric data resources. **Discussion** In comparison with all science subjects and medical and health sciences, 2015 Altmetric scores in dentistry were very low. Uses of new and emerging scholarly tools such as social media, scientific blogs and post-publication peer-review were not common in the dental science. This negligence may be due to lack of knowledge and attitude. An Altmetric score is dynamic and may fluctuate over time.

## Introduction

Altmetric is a new, emerging, diverse and rapid scholarly tool that measures the online attention surrounding journal articles.<sup>1-3</sup> Indeed, it is not a replacement for classic citation analysis which is known as bibliometrics. Altmetrics can be seen a complement to bibliometrics and can provide a better public view of the impact of a research finding.<sup>1,4-7</sup> Altmetric data resources, algorithm for calculation of an Altmetric score, and its advantages

and limitations have been discussed in our previous article.<sup>1</sup> Nevertheless, the aim of this study was to analyse the Altmetric data of all dental articles and journals in 2015.

## Methods

To find all 2015 dental articles, PubMed was searched via the Altmetric platform using the following query: ("2015/1/1"[PDAT]: "2015/12/31"[PDAT]) AND jsubsetd[text] NOT 2016[PDAT] on 12 November 2016. Altmetric data of all 2015 dental articles and journals were extracted and analysed by Microsoft Office Excel 2016 using descriptive statistics, graphs and trend-line analysis.

To find the most important and influential Altmetric factors in 2015 dental literature, the multi-layered perceptron artificial neural network was used. Artificial neural networks are

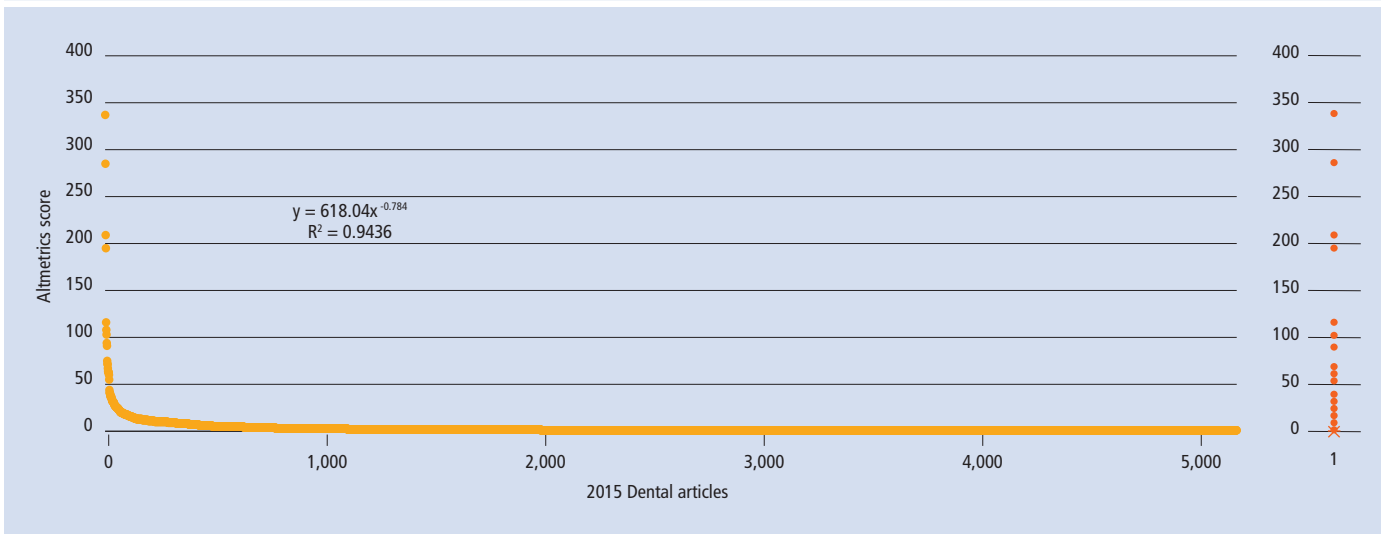
effective and efficient tools to analyse big, complicated and imprecise data. They are computer programmes that analyse data in the same way that the human brain does. They involve networks of extremely interconnected computer processors named 'neurons' that are able to perform parallel and fast computations for data processing and knowledge representation. Of more interest, knowledge can be acquired by artificial neural network through a training process.<sup>8,9</sup> A trained artificial neural network can be used to extract patterns and detect trends that are too complex to be discovered by either humans or other computer systems.<sup>10</sup>

However, the multi-layered perceptron model, one of the most effective and common artificial neural network models, was used.<sup>11,12</sup> The architecture of the proposed feed-forward artificial neural network involved two hidden layers; 70% of the data were chosen randomly for supervised,

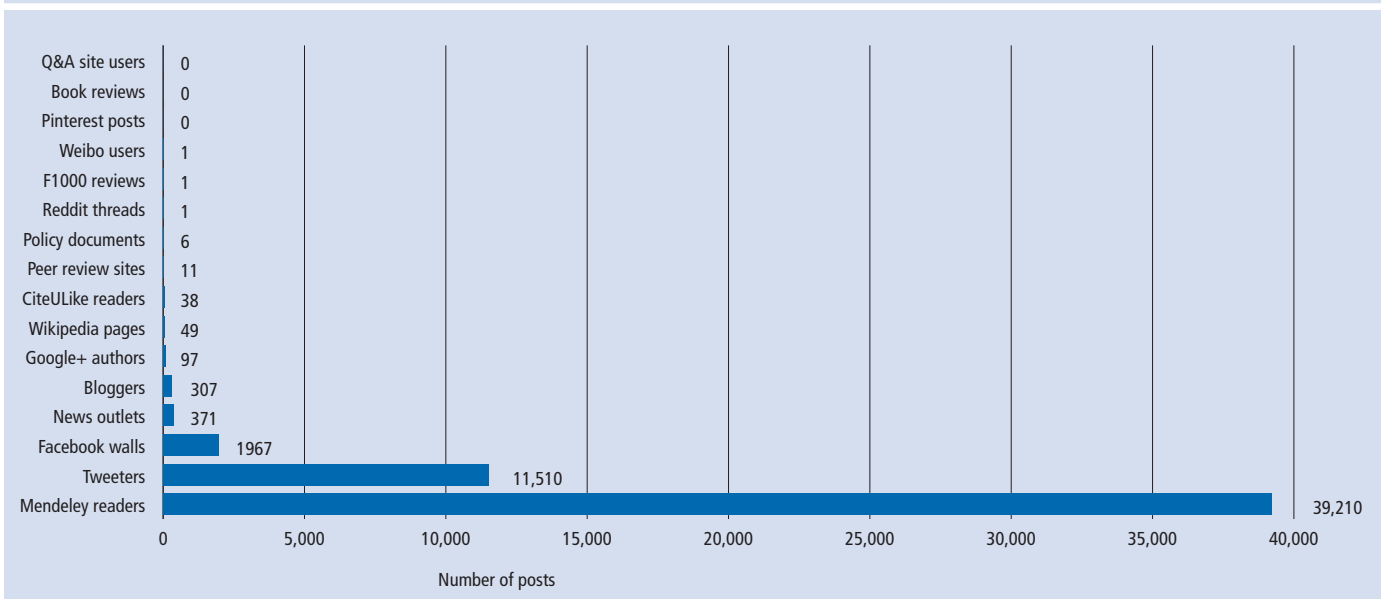
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**Fig. 1** Altmetric scores of 5,153 dental articles in 2015. Altmetric score of 61.6% of articles was 1 and 17.1% was 2. Power Trend-line analysis and R value are also shown. Box and whisker plots of data are shown on the right



**Fig. 2** Sum of scores of different Altmetric data resources of 5,153 dental articles in 2015



batch network training, and the remaining 30% of data were used for network test. The hidden layer activation function is hyperbolic tangent and output layer activation function is identity. Scaled conjugate gradient was used to estimate the synaptic weights. Artificial neural network analyses were carried out by SPSS 22 (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.).

## Results

A total of 14,884 dental articles published in 2015 were found using the PubMed database, from which 5,153 (34.62%) articles had valid Altmetric data and were included in the study. The mean Altmetric score was  $2.94 \pm 9.2$

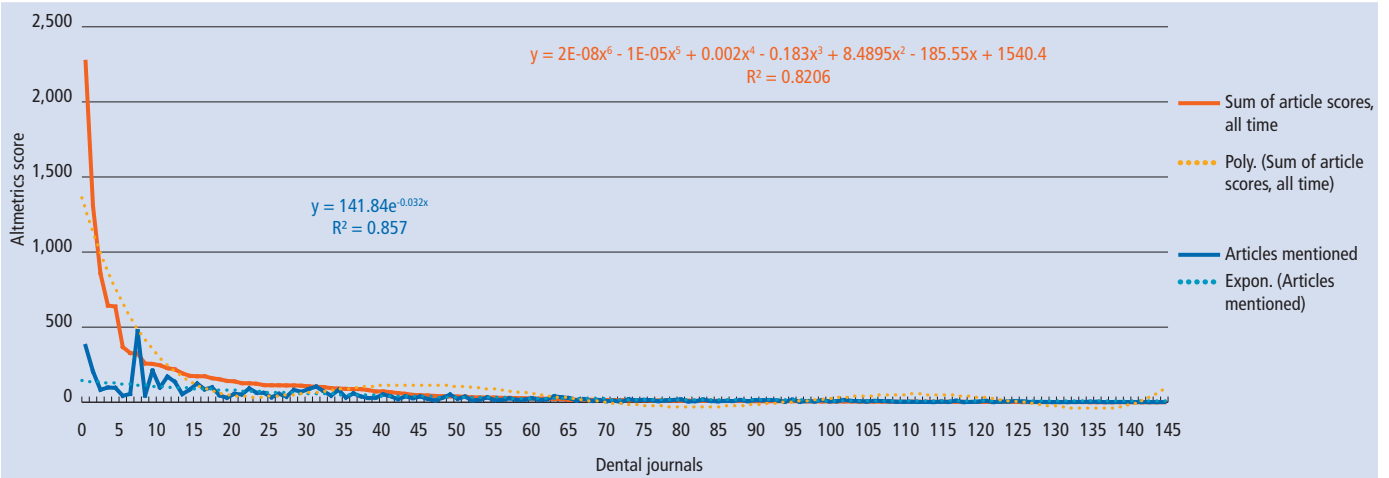
(95% Confidence interval: 2.70–3.22) (Fig. 1). Mendeley readers (73.19%), Twitter (21.48%), Facebook walls (3.67%) news outlets (0.69%) and bloggers (0.57%) were the most popular Altmetric data resources (Fig. 2). Google+ (0.18%), Wikipedia pages (0.09%), CiteULike readers (0.07%), Peer review sites (0.02%), Policy documents (0.01%), F1000 reviews (0.001%), Reddit threads (0.001%) and Weibo users (0.001%) were used infrequently (Fig. 2). There were no records from Pinterest, Q&A sites and book reviews.

At journal level, 147 dental journals with valid Altmetric data were included in the study. The sum of Altmetric scores of articles for each journal (Mean:  $86.34 \pm 240.98$ , 95% Confidence interval: 53.70–133.31) and number of articles

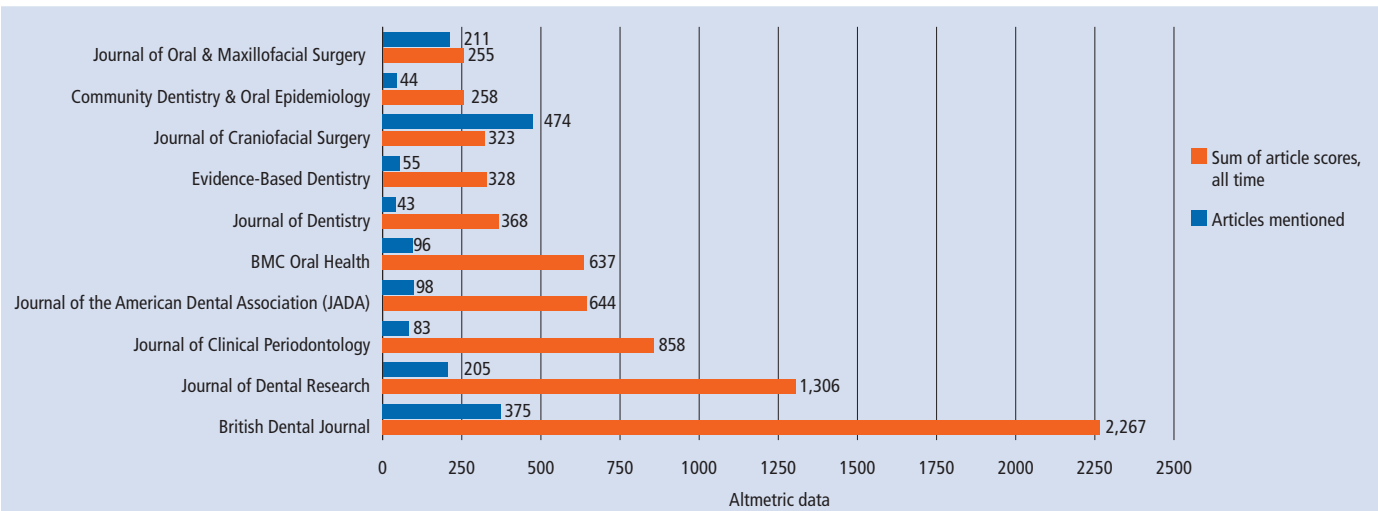
with Altmetric scores (Mean:  $34.55 \pm 59.95$ , 95% Confidence interval: 25.95–45.53) were analysed (Fig. 3). In view of the sum of Altmetric scores of articles, the *British Dental Journal* obtained the first rank, followed by *Journal of Dental Research*, *Journal of Clinical Periodontology* and *Journal of the American Dental Association* (Figs 4 and 5).

With respect to the sum of scores of different Altmetric data resources (Fig. 2), to decrease the complexity of the artificial neural network, the top 5 potentially influential Altmetric resources were included in sensitivity analyses to find the most important and influential Altmetric factor in 2015 dental literature (Fig. 6). The analysis of the model summary provides solid evidence that the model is

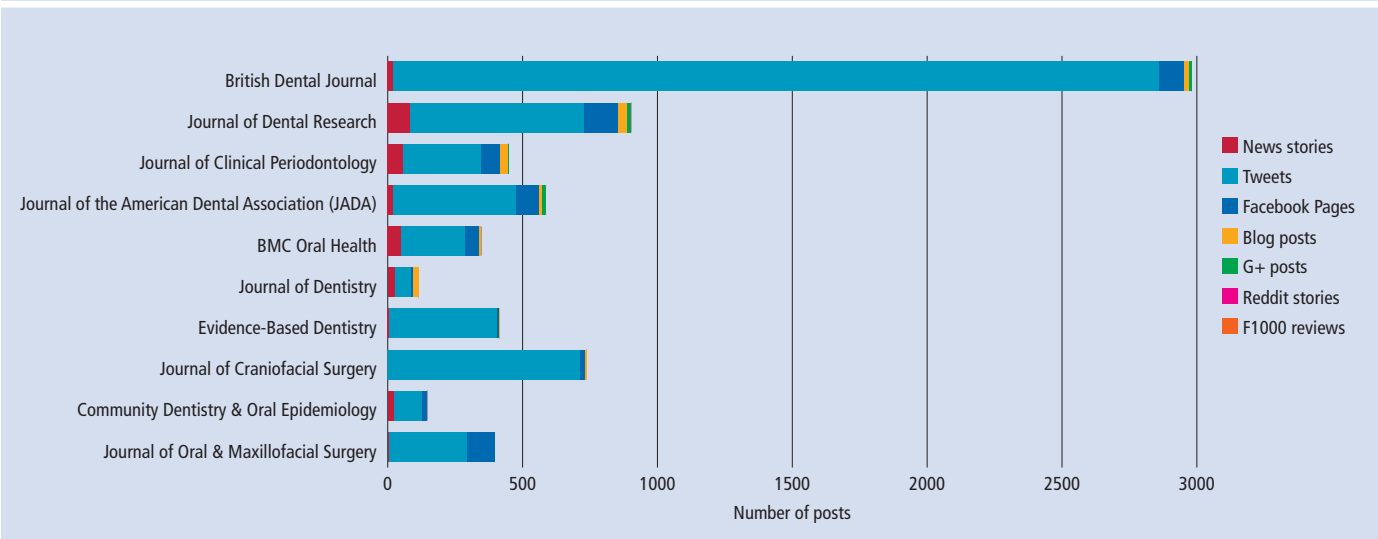
**Fig. 3** Altmetric data of 147 dental journals in 2015. Sum of Altmetric scores of articles for each journal (orange line) and number of articles with Altmetric scores (blue line) are presented. Trend-line analysis and R value are also shown



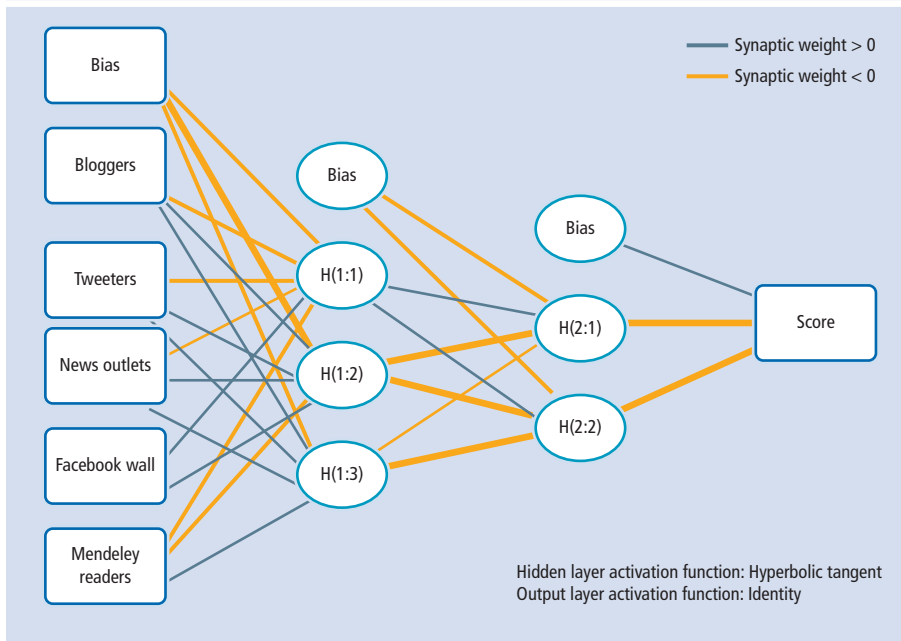
**Fig. 4** Top ten dental journals in 2015 with respect to sum of articles' Altmetric scores (orange line) and number of articles with Altmetric scores (blue line)



**Fig. 5** Breakdown of different Altmetric data resources of top ten dental journals in 2015



**Fig. 6** Feed-forward structure and specification of the proposed multi-layered perceptron artificial neural network, including two hidden layers. Each of the inputs (Altmetric data resources) is shown with 'synaptic connections' to the output layer, which consists of Bias, five accumulator neurons (H terms) and the dependent variable (Altmetric score)

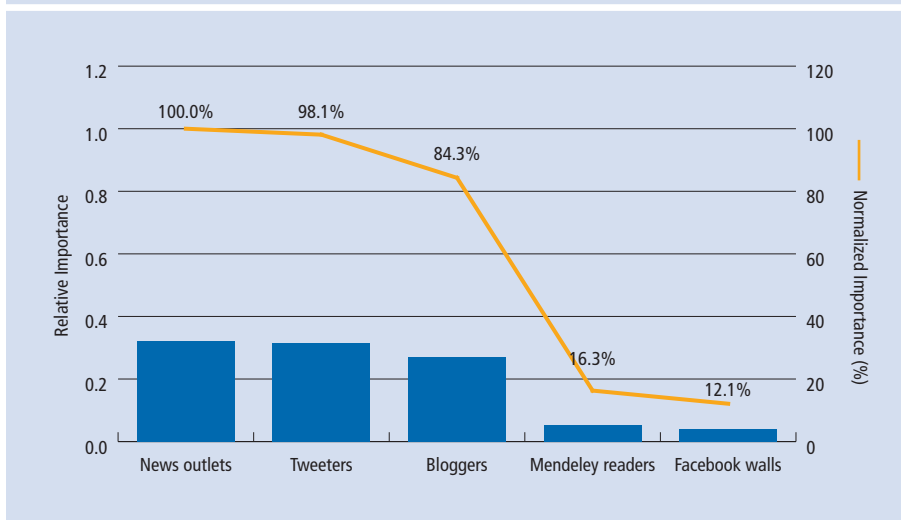


**Table 1** Model summary of the proposed multi-layered perceptron artificial neural network

	Accuracy indicator	Score
Training	Sum of squares error	989.3
	Relative error	0.545
	Stopping rule used	1 consecutive step(s) with no decrease in error
	Training time	0:00:00,29
Testing	Sum of squares error	131.696
	Relative error	0.377

Error computations are based on the testing sample.

**Fig. 7** Sensitivity analysis of the input variables (Altmetric data resources) of the proposed multi-layered perceptron artificial neural network. The value shown for each input variable is a measure of its relative importance



doing its job well (Table 1). Sensitivity analysis showed news outlets, tweeters and scientific bloggers were the most important and influential Altmetric data resources (Fig. 7). As a final point, readers should note that Altmetric analysis is a dynamic process and Altmetric scores may fluctuate over time.

## Discussion

In our previous article, Altmetric top 50, 2014 dental articles were analysed.<sup>1</sup> To achieve a comprehensive view on dental literature, in the present study all 14,884 dental articles published in 2015 and 147 dental journals with valid Altmetric data were analysed. Surprisingly, the results indicated that only 34.62% of 2015 dental articles had an Altmetric score. The highest 2015 Altmetric score in dentistry was 337, while it was 2,782 in medical and health sciences,<sup>13</sup> which shows the public attention on medical subjects.

In this study, we used artificial intelligence to analyse big and combinatorial Altmetric data of the 2015 dental literature.<sup>14</sup> The findings of artificial neural network analysis are interesting, in which Mendeley was the most common Altmetric data resource (73.19%); the artificial neural network showed it has only 16.3% normalized importance. At first glance, these results seem confusing, however, when we refer to the weighting values and calculation algorithm of an Altmetric score,<sup>15</sup> we find out that artificial intelligence has found a suitable pattern in the data.

The use of new and influential scholarly tools such as social medias, scientific blogs, social stack exchange (Q&A) sites,<sup>16</sup> post-publication peer-reviews,<sup>17</sup> F1000 reviews,<sup>18</sup> evidence-based policy making<sup>19</sup> etc, were not common in dental science. This negligence may be due to a lack of knowledge and attitude. This issue has been discussed widely,<sup>20-25</sup> and dental research scientists and journal editors should pay more attention to these emerging concepts.

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