Development of a New Algorithm and Scoring Metric for the Evaluation of Scientific Conference Impact

LAUDANO, JB[A], HONG, S[A], WEI, G[A], SKIRBE, P[A], MATHEIS, R[B]

[A]MEDMEME LLC, NEW YORK, NY
[B]CELGENE CORPORATION, SUMMIT, NJ

ABSTRACT

Objective: To develop an algorithm and scoring method for the evaluation of scientific conference impact which is useful and accurate.

Challenge/Problem: The use of metrics for the evaluation of impact of scientific publications is well established. Scientific conferences continue to be principle venues for the release of new and important advances in medicine. Unlike journals, there are presently no metrics available for the evaluation and selection of scientific conferences by impact. Based on this need, a new algorithm and ranking score was created for the evaluation of conference impact.

Solution: A random therapeutic area, Multiple Sclerosis (MS) was selected for the test. A composite algorithm was created using an established journal metric (Eigenfactor) and additional qualitative measures: conference weight (presenter's journal author score from publications in a field), conference abstract score (conference abstract relevancy, presentation type and age). Two top twenty lists of conferences for MS were generated; one using the new algorithm and the other by traditional conference volume (number of abstracts posted on a specific topic at a specific conference). The top twenty conference lists were compared and assessed for variance using three years of data.

Outcome: Four conferences (20%) previously not included in the top twenty volume list moved up in rank. The average change in position was 37% among all 20 conferences (range 0 – 113%) and 13 (65%) out the 20 conferences changed rank.

Benefits: The described impact algorithm may provide Medical Affairs Professionals an objective and accurate method for the selection of conferences. Further study and validation is ongoing.

CHALLENGE/PROBLEM

- Selecting the best and most appropriate scientific conference for the submission of research continues to be challenging for Medical Affairs Professionals (MAPs). While useful Scientometrics for the submission of manuscripts to journals are well established, there currently are no formal metrics for the selection of scientific conferences.
- Creation of a scientific conference impact assessment tool has the potential to heighten impact of dissemination of evidence in scientific medical forums
- Traditionally, we assume that conferences with the highest attendance and the highest volume of poster presentations within a selected field are those held in higher esteem for abstract submission, potentially having more "weight" or "reach".[1]
- For journal selection, MAPs typically make their decisions using a number of parameters:
  - Impact metrics (Impact Factor, Eigenfactor, SCImago Journal Rank Factor, etc.) are well established citation-based indicators of journal impact.[2]
  - Targeting tools for journals focusing on several different Article-Level Metrics (ALMs) may also be used as a predictor for manuscript acceptance.[3]
  - Author metrics which measure a scientist's productivity and citation impact (h-index) are also generally employed for study/author selection and the calibre of journals.[4]
- Based on an unmet need for relevant, timely and accurate metrics for the selection of scientific conferences and a "call" for a shift toward assessment of journal impact based on up-to-date ALMs vs. publication metrics (citations)[5], we decided to develop a new algorithm and ranking method for the evaluation of scientific conference impact.
- It was important to us that the impact metric developed incorporate ALMs for application into Conference-Level Metrics (CLMs) in its assessment and that the tool be germane to the needs of MAPs (vs publishers and academics) in terms of therapeutic area relevance and author/presenter calibre. Although there are no studies demonstrating conference impact by using such CLMs, we believe that submission of research to conferences best aligned with subject matter and author/presenter calibre (leaders in a specialty, i.e. Alzheimer's vs. a specific field, Neurology) to be more meaningful for the evaluation of impact

SOLUTION

Data Collection and Collation

- We conducted an extensive search of the Medmeme Database[6] and collected journal and conference abstracts focusing on a random therapeutic area Multiple Sclerosis (MS) over the most recent three and ten year periods
- The conference abstract date range was 2015-2017 for the 3 year calculations and 2007-2017 for the 10 year abstract calculations
- Each abstract was tagged with its title, source name, source type ("conference" or "journal"), publication type (primary, secondary, tertiary / poster or oral presentation), date of publication/presentation, age of abstract (less than two years, 3-4 years, 4-6 years, 6-10 years, 10+ years) and author names
- Scientific conference impact was compared to a control list of conferences relevant to MS. The control list was derived as an aggregate and sorted by total MS abstracts in descending rank order (unweighted volume/density rank) from one to twenty as the "top-twenty" conferences (Table 1).
- Development of a control algorithm solely based on journal publication metrics (citations) adapted for conference impact was not considered for comparison based on the numerous limitations in these impact metrics [7,8,9]
- The conference dynamic impact algorithm was applied to the same search data set as the control and a "top-twenty" list was derived by impact rank. Both lists were compared; the unweighted volume/density rank list being matched (by conference) to the CDIF list in ranked, ascending order (Table 2)
- Where applicable, rank delta scores were calculated and analyzed to determine ALMs/CLMs influence in separation
- To further elucidate the quantitative and qualitative differences in identically ranked conferences (two different conferences ranked in the same position in the compared lists), we analyzed factors underlying the ranking performance (Tables 4 & 5) of one sample set

Range of ALMs Used to Determine Conference Impact Measurement

- The ALMs below were weighted and used to develop four measures of influence to determine conference impact for the relevant therapeutic area, MS: Conference Weight, Abstract Type, Abstract Age and Abstract Volume. Relevant journal ALMs (i.e. journal abstracts, journal authors, etc.) were used to derive the scores for relevant CLMs. The transition of these journal factors into conference factors is shown in the complete DIF algorithm (Figure 1).

Conference Weight

- Journal Weight: Normalized score of the last three years of the journal's Eigenfactor score
- Author Position Score: First and last author position is given a higher score than middle authors
- Journal Author Score: Derived from the volume of work in a therapeutic area for a particular author which is then ranked by the Eigenfactor score of the journal(s) in which the work(s) appeared over the last three years. The author list is then disambiguated and matched to authors/presenters via abstract collation from relevant conferences

Abstract Type

- Journal Abstract Type Score: A value placed on the various types of journal articles (primary, secondary, tertiary, etc.). Scores are used to rank the work by its relevant scientific contribution
- Conference Abstract Type Score: A value on the various types of conference presentations (poster or oral presentation). Scores are used to rank the work by its relevant scientific contribution

Abstract Age

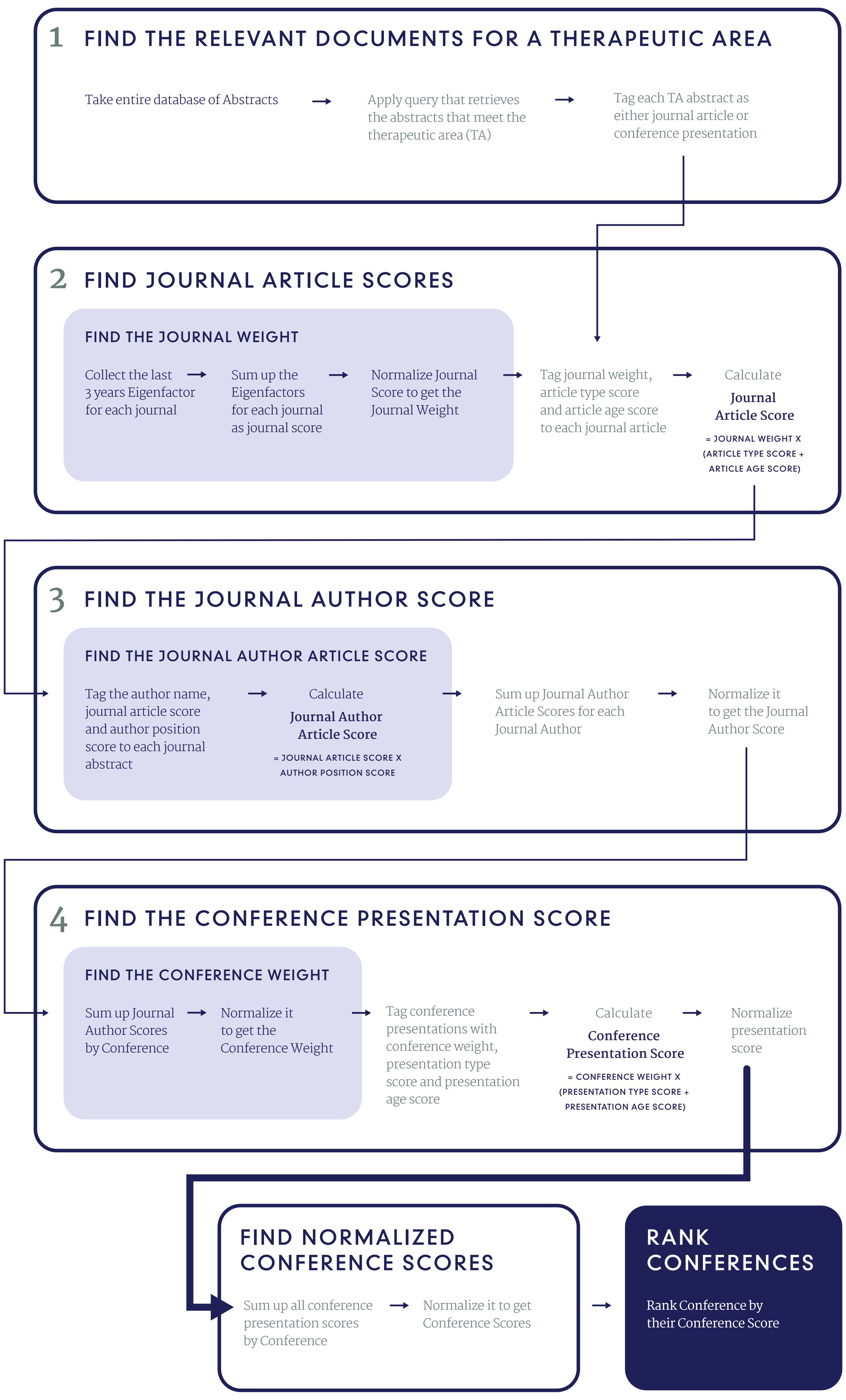
- Scores the age of the conference abstract in the relevant therapeutic area. The more recent the abstract, the higher its age score (Note: This score is important in assessing bodies of relevant works over time for a specific conference. i.e.: a conference that was more "relevant" on a particular specialty ten years ago may be more or less relevant today)

Abstract Count

- The total amount of relevant abstracts from a conference that met the search criteria for the selected specialty (MS)

FIGURE 1

Conference Dynamic Impact Factor



1 FIND THE RELEVANT DOCUMENTS FOR A THERAPEUTIC AREA

Take entire database of Abstracts → Apply query that retrieves the abstracts that meet the therapeutic area (TA) → Tag each TA abstract as either journal article or conference presentation

2 FIND JOURNAL ARTICLE SCORES

FIND THE JOURNAL WEIGHT

Collect the last 3 years Eigenfactor for each journal → Sum up the Eigenfactors for each journal as journal score → Normalize Journal Score to get the Journal Weight → Tag journal weight, article type score and article age score to each journal article → Calculate **Journal Article Score** = JOURNAL WEIGHT X (ARTICLE TYPE SCORE + ARTICLE AGE SCORE)

3 FIND THE JOURNAL AUTHOR SCORE

FIND THE JOURNAL AUTHOR ARTICLE SCORE

Tag the author name, journal article score and author position score to each journal abstract → Calculate **Journal Author Article Score** = JOURNAL ARTICLE SCORE X AUTHOR POSITION SCORE → Sum up Journal Author Article Scores for each Journal Author → Normalize it to get the Journal Author Score

4 FIND THE CONFERENCE PRESENTATION SCORE

FIND THE CONFERENCE WEIGHT

Sum up Journal Author Scores by Conference → Normalize it to get the Conference Weight → Tag conference presentations with conference weight, presentation type score and presentation age score → Calculate **Conference Presentation Score** = CONFERENCE WEIGHT X (PRESENTATION TYPE SCORE + PRESENTATION AGE SCORE) → Normalize presentation score

FIND NORMALIZED CONFERENCE SCORES

Sum up all conference presentation scores by Conference → Normalize it to get Conference Scores →

RANK CONFERENCES

Rank Conference by their Conference Score

TABLE 2

Comparison of Scientific Conference Attributes

SCIENTIFIC CONTRIBUTION	RANKINGS			TOTAL SCORES		ADD'L DYNAMIC IMPACT FACTOR MEASURES		
	DYNAMIC RANK	DENSITY RANK	RANK POSITION DELTA	DENSITY (TOTAL ABSTRACTS)	DYNAMIC IMPACT FACTOR SCORE	MEAN ABSTRACT AGE SCORE	MAIN ABSTRACT TYPE SCORE	AUTHOR SCORE AT CONFERENCE
Congress of the European Committee for Treatment and Research in Multiple Sclerosis	1	1	0	2,923	1,958	0.88	0.5023	1.00
Annual Meeting of the American Academy of Neurology	2	2	0	1,891	1,510	0.91	0.5549	0.7987
Annual Scientific Meeting of the Society for Neuroscience	3	5	+2	597	196	0.82	0.5272	.3279
Congress of the European Academy of Neurology	4	3	-1	958	88	0.92	0.5718	.0922
Annual Meeting of the Consortium of Multiple Sclerosis Centers	5	8	+3	459	65	0.85	0.5624	.1421
European Meeting on Glial Cells in Health and Disease	6	4	-2	679	65	0.92	0.5339	.0954
Annual Scientific Meeting and Exhibition of the International Society for Magnetic...	7	7	0	463	44	0.89	0.5304	.0954
Annual Meeting of the American Association of Immunologists - IMMUNOLOGY	8	11	+3	287	31	0.91	0.5614	.0952
Meeting of the Americas Committee for Treatment and Reserarch in MS	9	9	0	427	27	1.00	0.5441	.1086
World Congress of Neurology	10	6	-4	531	26	0.90	0.5039	.0636
Congress of the Pan-Asian Committee on Treatment and Research of Multiple Sclerosis	11	10	-1	347	16	0.88	0.6015	.0488
Annual Meeting of the Organization for Human Brain Mapping	12	12	0	200	10	0.85	0.5116	.0456
Annual Meeting for the American Society for Neurochemistry	13	26	+13	90	8	1.00	0.5704	.0499
Congress of the German Society for Neurology	14	18	+4	117	6	0.95	0.6026	.0857
Annual Conference of the Federation of Clinical Immunology Societies	15	32	+17	83	5	0.91	0.6912	.0487
Annual Meeting of the American Neurological Association	16	24	+8	93	4	0.92	0.6350	.0562
Annual Meeting of the American Society of Human Genetic	17	17	0	133	4	0.91	0.5500	.0494
International Congress of Immunology	18	31	+13	83	4	1.00	0.6269	.0211
Annual Meeting of the American Society of Neuroradiology	19	14	-5	164	3	1.00	0.8225	.0271
Annual Meeting of the Association for Research in Vision and Opthamalogy	20	19	-1	115	3	0.9043	0.5128	.0271
Biennial International Congress on Autoimmunity	21	35	+14	81	3	1.00	0.5000	.0312
Annual Meeting of the International Neuropsychological Society	22	28	+6	88	2	0.90	0.5816	.0282
Experimental Biology Annual Meeting held jointly with the the American Association of...	23	22	-1	104	2	0.78	0.5700	.0085
Annual European Congress of the International Society for Pharmaeconomics and Outcomes...	24	15	-9	140	2	0.86	0.5000	.0121
Brazilian Congress of Multiple Sclerosis and Neuromyelitis Optics of the Brazilian Committee...	25	13	-12	193	2	1.00	0.5415	.0083
Annual Meeting of the North American Neuro-Opthamology Society	26	16	-10	138	2	0.91	0.5000	.0111
European Congress of Immunology	27	21	-6	111	1	0.75	0.5773	.0129
Annual Meeting of the Peripheral Nerve Society	28	30	+2	83	1	0.75	1.0000	.0164
Biennial Forum of the Federation of European Neuroscience Societies	29	49	+20	53	1	1.00	0.5068	.0244
Congress of the Middle East North Africa Committee for Research and Treatment in MS	30	38	+8	66	1	1.00	0.5000	.0137
Annual Meeting of the Australian Neuroscience Society held jointly with the International...	31	27	-4	88	1	0.75	0.5000	.0103
Annual Meeting of the International Society for Stem Cell Research	32	43	+11	62	1	0.88	0.5132	.0136
Scientific Assembly and Annual Meeting of the Radiological Society of North America	33	39	+6	63	1	0.91	0.5000	.0125
Annual International Meeting of the International Society for Pharmaeconomics and...	34	20	-14	113	1	0.90	0.5323	.0069

TABLE 3

Scientific Conference Position Rank Delta

SCIENTIFIC CONTRIBUTION	RANKINGS			TOTAL SCORES	
	DYNAMIC RANK	DENSITY RANK	RANK POSITION DELTA	DENSITY (TOTAL ABSTRACTS)	DYNAMIC IMPACT FACTOR SCORE
‡ Congress of the European Committee for Treatment and Research in Multiple Sclerosis	1	1	0	2,923	2,923
‡ Annual Meeting of the American Academy of Neurology	2	2	0	1,891	1,510
Annual Scientific Meeting of the Society for Neuroscience	3	5	+2	597	196
Congress of the European Academy of Neurology	4	3	-1	958	88
Annual Meeting of the Consortium of Multiple Sclerosis Centers	5	8	+3	459	65
European Meeting on Glial Cells in Health and Disease	6	4	-2	679	65
Annual Scientific Meeting and Exhibition of the International Society for Magnetic...	7	7	0	463	44
Annual Meeting of the American Association of Immunologists - IMMUNOLOGY	8	11	+3	287	31
Meeting of the Americas Committee for Treatment and Reserarch in MS	9	9	0	427	27
World Congress of Neurology	10	6	-4	531	26
Congress of the Pan-Asian Committee on Treatment and Research of Multiple Sclerosis	11	10	-1	347	16
Annual Meeting of the Organization for Human Brain Mapping	12	12	0	200	10
Annual Meeting for the American Society for Neurochemistry	13	26	+13	90	8
* Congress of the German Society for Neurology	14	18	+4	117	6
Annual Conference of the Federation of Clinical Immunology Societies	15	32	+17	83	5
* Annual Meeting of the American Neurological Association	16	24	+8	93	4
* Annual Meeting of the American Society of Human Genetic	17	17	0	133	4
International Congress of Immunology	18	31	+13	83	4
* Annual Meeting of the American Society of Neuroradiology	19	14	-5	164	3
Annual Meeting of the Association for Research in Vision and Opthamalogy	20	19	-1	115	3

☐ NO CHANGE IN RANK ▨ RANK DELTA ≤ 5 ■ RANK DELTA > 5 ≤ 10 ▩ RANK DELTA > 10

TABLE 4

Attribute Comparisons of Identically Ranked Conferences by CDIF & Density

SCIENTIFIC CONTRIBUTION	RANKINGS			TOTAL SCORES		ADD'L DYNAMIC IMPACT FACTOR MEASURES		
	DYNAMIC RANK	DENSITY RANK	RANK POSITION DELTA	DENSITY (TOTAL ABSTRACTS)	IMPACT FACTOR SCORE	MEAN ABSTRACT AGE SCORE	MAIN ABSTRACT TYPE SCORE	AUTHOR SCORE AT CONFERENCE
European Meeting on Glial Cells in Health and Disease	$\boxed{6}$	4	-2	679	65	0.9230	0.5339	0.0954
World Congress of Neurology	10	$\boxed{6}$	-4	531	26	0.9025	0.5039	0.0488

OUTCOME

- Results from the analysis of the two compared impact scoring methods are listed in Table 2
- The average change in position was 37% among all 20 scientific conferences (range 0 – 113%). Thirteen (65%) out the twenty conferences changed rank. This change was primarily influenced by conference weight (Table 3)
- The top two scientific conferences ranked by unweighted volume/density rank maintained their rank positions when the CDIF algorithm was applied to the same conference data set for scoring (‡ Table 3)
- Four conferences (20%) previously not included in the top twenty volume list moved up in rank. Change in rank was primarily influenced by conference weight (* Table 3)
  - Annual Meeting of the American Neurological Society from Density Rank 24 to CDIF rank 16
  - Annual Meeting of the American Society of Neurochemistry from Density Rank 26 to CDIF Rank 13
  - International Congress of Immunology from Density Rank 31 to CDIF Rank 18
  - Annual Conference of the Federation of Clinical Immunology Societies Denisty Rank 32 to CDIF Rank 15
- Analysis of two scientific conferences identically ranked in either list (European Meeting of Glial Cells in Health and Disease {EMGCH}) vs The World Congress of Neurology {WCN}) showed little difference in mean abstract age score and mean abstract type score (Table 4). However, mean Journal Author Score was notably higher for the EMGCH vs the WCN (0.35562 vs 0.27824 respectively). Further separation occurred when analysis was conducted with 10-year data (0.48873 vs 0.30544 respectively) (Table 5)
- Influence of abstract age on scientific conferences appears to increase within a 10-year period as compared to its influence within a 3-year period, suggesting that conference impact should be assessed over time, i.e., a conference that may have been impactful for a relevant therapeutic area in the past may not be as impactful in the present or vice versa (Figure 2)

TABLE 1

Scientific Conferences: Unweighted Volume Rank

SCIENTIFIC CONFERENCES	DENSITY (TOTAL ABSTRACTS)	DENSITY RANK
Congress of the European Committee for Treatment and Research in Multiple Sclerosis	2923	1
Annual Meeting of the American Academy of Neurology	1891	2
Congress of the European Academy of Neurology	958	3
Annual Meeting of the Consortium of Multiple Sclerosis Centers	679	4
Annual Scientific Meeting of the Society for Neuroscience -	597	5
World Congress of Neurology	531	6
Annual Scientific Meeting and Exhibition of the International Society for Magnetic...	463	7
European Meeting on Glial Cells in Health and Disease	459	8
Meeting of the Americas Committee for Treatment and Reserarch in Multiple Sclerosis	427	9
Congress of the Pan-Asian Committee on Treatment and Research of Multiple Sclerosis	347	10
Annual Meeting of the American Association of Immunologists - IMMUNOLOGY	287	11
Annual Meeting of the Organization for Human Brain Mapping	200	12
Brazilian Congress of Multiple Sclerosis and Neuromyelitis Optics of the Brazilian ...	193	13
Annual Meeting of the American Society of Neuroradiology	164	14
Anual European Congress of the International Society for Pharmaeconomics and Outcomes...	140	15
Annual Meeting of the North American Neuro-Opthalmology Society	138	16
Annual Meeting of the American Society of Human genetics	133	17
Congress of the German Society for Neurology	117	18
Annual Meeting of the Association for Research in Vision and Opthamalogy	115	19
Annual International Meeting of the International Society for Pharmaeconomics and ...	113	20

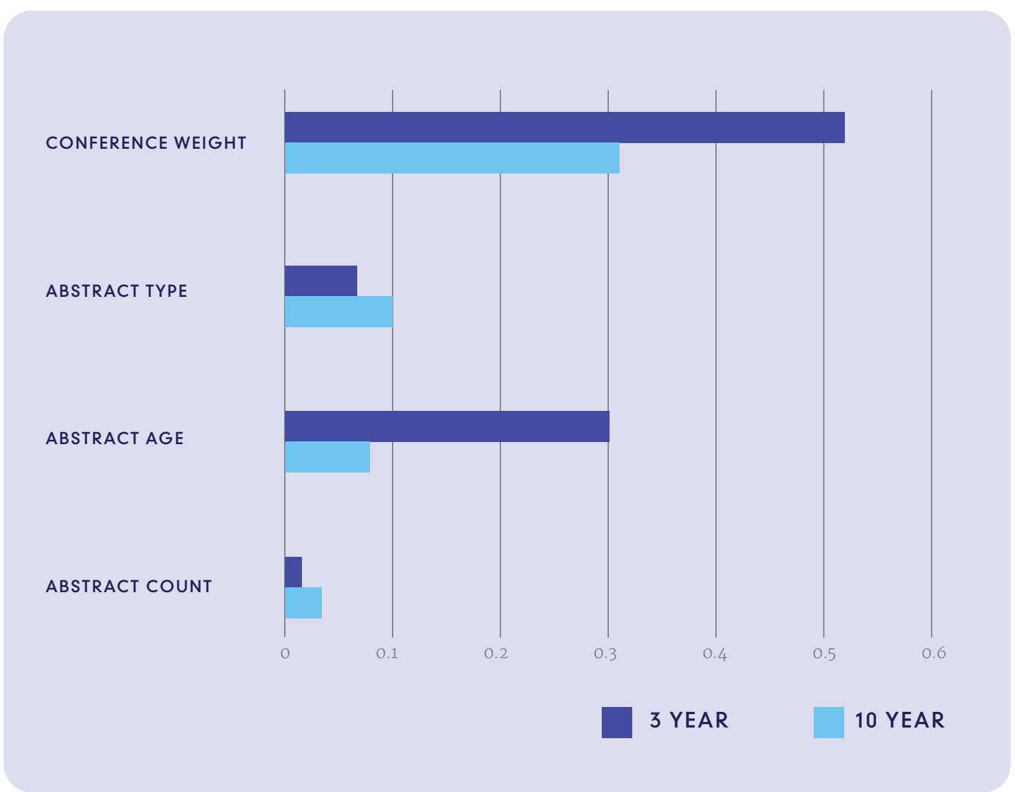
TABLE 5

Mean Author Score Comparisons: Identically Ranked Conferences by CDIF & Density

3-YEAR TIME FRAME		
CONFERENCE	MEAN AUTHOR SCORE	CONFERENCE ABSTRACT COUNT
European Meeting on Glial Cells in Health and Disease	0.35562	672
Congress of the European Academy of Neurology	0.27824	998
10-YEAR TIME FRAME		
CONFERENCE	MEAN AUTHOR SCORE	CONFERENCE ABSTRACT COUNT
European Meeting on Glial Cells in Health and Disease	0.48873	4,475
Congress of the European Academy of Neurology	0.30544	5,398

FIGURE 2

Influence of Ranking Factors Over 3 Years of Conference Data vs. 10 Years of Conference Data



BENEFITS

- To our knowledge, CDIF is the first empirical algorithm developed to evaluate scientific conference impact and appears to be a useful scoring method for the selection of scientific conferences, thus, fulfilling a previously unmet need for MAPs
- Using CDIF as a conference impact assessment tool has the potential to heighten the impact of dissemination of evidence in scientific medical forums
- The use of up-to-date article-level metrics (ALMs) vs. publication metrics (citations) appears to be a useful foundation for the the development of Conference-Level Metrics (CLMs) for the evaluation of scientific conference impact
- Since the key factor influencing rank with CDIF, Conference Weight, focuses on relevancy of research and calibre of authors by specific meeting, CDIF may provide MAPs with a more objective and up-to-date method for conference selection than unweighted volume/density rank
- Evaluation of authors on the age of their work within a relevant field and the volume of presentations at conferences within a relevant field over time appears to be useful in considering selection. Conference impact should be assessed over time since a conference that may have been impactful for a relevant therapeutic area in the past may not be as impactful in the present or vice versa
- This study used a single therapeutic area of multiple sclerosis to demonstrate the usefulness of an impact algorithm for the scoring of scientific conferences. Further application of this algorithm in other therapeutic areas is suggested to validate these findings.

REFERENCES

1. Higgins C, Horner A, Wassef-Birosik L, D'Irio S. Integrating Measures of Journal Impact Provides Additional Insights in Scientific Literature Gap Analyses. Presented at the 13th Annual Meeting of ISMPP; May 1-3; 2017; National Harbor, MD. Poster #9.
2. Garfield E. The History and Meaning of the Journal Impact Factor. JAMA. 2006;295(1):90-93.
3. Dokku M, Sridharan K, Rajeev P. Manuscript Strength Finder Tool: An Aid in Determining Potential Journal Acceptance. Presented at the 11th Annual Meeting of ISMPP; April 27-29, 2015; Arlington, VA. Poster #19.
4. Hirsch JE. An index to quantify an individual's scientific research output. Proceedings of the National Academy of Sciences of the United States of America. 2005;102(46):16569-16572.
5. San Francisco Declaration on Research Assessment (DORA). Annual Meeting of The American Society for Cell Biology (ASCB),December 16, 2012, in San Francisco, CA. https://sfdora.org/
6. Medmeme Database. Proprietary database of published medical science.
7. Callaway E. Publishing elite turns against impact factor. Nature. 2016;535:210–211.
8. Time to remodel the journal impact factor.[Editorial].Nature.2016535:466.
9. The European Association of Science Editors (EASE) Statement on Inappropriate Use of Impact Factors. Retrieved 2018-01-19.

ACKNOWLEDGEMENTS

The Authors would like to thank Mr. Won Kim, Mr. Siddhartha Naithani and Mr. Jonathan Kendall for the expert assistance in data collection and interpretation. We would also like thank Mr. Jeff DeGeorgia for his creative direction in the development of this poster.

AUTHOR DISCLOSURE

Dr. Joseph B. Laudano, Dr. Saman Hong, Mr. George Wei and Mr. Paul Skirbe are employees of Medmeme LLC, New York, NY. Dr. Robert Matheis is an employee of Celgene Corporation, Summit, NJ. No animals were harmed in the production of this poster.

Presented at the 2nd Annual Meeting of The Medical Affairs Professional Society (MAPS) February 25-27, 2018, Miami Florida, USA.

Please address questions and requests for reprints to Dr. Joseph B. Laudano at J.Laudano@Medmeme.com

Study Funded by Medmeme LLC, New York, NY.