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Citation patterns and trends of systematic reviews about mindfulness

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ABSTRACT

Objectives: We performed a citation analysis of the literature about mindfulness aimed at describing the most significant topics and the impact of more relevant papers.
Methods: We classified 128 systematic reviews about mindfulness-based intervention retrieved in Scopus according to their object, the population included and the type of mindfulness proposed. The citation counting was reported. The cumulative citation numbers per chronological years and article life were analyzed thorough a linear regression model.
Results: 1) We observed a general increase in the number of reviews published from 2003 to 2016; 2) two reviews collected the 33% of the overall citations; 3) citation counting for clinical and mixed population collected the 90% of total citations; 4) clinical reviews had higher cumulative citation per publication/year growth.
Conclusions: As mindfulness research advances, higher attention should be given to the mechanisms by which mindfulness interventions work so as to provide fruitful insights for future research.

1. Introduction

In the last two decades, the concepts of both mindfulness and clinical interventions based upon mindfulness meditation practice have received growing attention within the scientific community [1–3]. The concept of mindfulness is rooted in Buddhist philosophy and mindfulness meditation practice is a key element of several types of Buddhist meditation including, among others, Vipassana [4] and Zen [5] meditation. The original term of what is commonly referred to as mindfulness is *Sati*, a Sanskrit word traditionally used to indicate a state of lucid awareness of what is occurring within the phenomenological field [6]. Specifically, mindfulness is commonly defined as a direct understanding of what is occurring before or beyond conceptual and emotional classifications, about what is taking or has taken place [7]. Although traditional descriptions provide an intuitive understanding of mindfulness, they do not easily lend themselves to an operationalization that could be employed within modern psychological theoretical frameworks [1,8]. Indeed, there is not yet complete consensus within modern Western psychology as to how the construct of mindfulness should be properly conceptualized (e.g. Refs. [1,8–10]). However, there is at least some consensus over the fact that mindfulness involves both intentional attention directed towards present moment experience, coupled with a specific attitude with which such attention is directed, characterized by acceptance and non-judgement of such experience as it is (e.g. Refs. [11–13]). While considering the term “mindfulness”, a critical issue relevant to its scientific investigation concerns the notion that the such term is frequently used in different contexts, including: (1) traditional long-term meditation practices, including Vipassana and Zen Meditation, designed to cultivate and maintain a state of mindfulness, usually within spiritual paths such as Buddhism, (2) modern shorter clinical interventions aimed at reducing psychological and/or physical suffering related to different clinical conditions, (3) a specific state that arises only when the individual is purposely attending to present moment experience and (4) a mental trait that is thought to be inherent within everyone's experience that could differ both among and within different individuals at different time points [1,11,14,15]. It is worth noting that, during recent years, large attention has been given to several modern secular Mindfulness Based Interventions (MBIs). The first of these interventions was Mindfulness Based Stress Reduction (MBSR). MBSR is an 8 weeks meditation program, including weekly 2-h-and-a-half sessions, a 1-day retreat, daily homework and the request to mindfully attend to

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present moment experiences one or more times daily as a means to generalize formal practice to one's own life, originally developed for people suffering from various chronic pain conditions [12,16]. Mindfulness Based Cognitive Therapy (MBCT) was later developed as an 8 weeks mindfulness meditation program, combining elements of the MBSR program [12] with elements of cognitive behavioral therapy for major depression [17] with the aim to reduce the risk of depression in people with a prior history of major depression episodes [18]. Several other mindfulness-based interventions have subsequently been developed based upon these interventions and modified for specific psychological and medical conditions, including, among others, Mindfulness Based Relapse Prevention (MBRP) [19], Mindfulness based Fitness Training [20] and Mindfulness based Childbirth and Parenting [21]. Although some of the available studies are limited by some methodological shortcomings a large amount of evidence currently suggests the clinical efficacy of such interventions (e.g. Refs. [2,22]), even when they are delivered as online programs [23].

Additionally, the effects of mindfulness training have occasionally been investigated as a brief (e.g. 10 min) mindfulness induction interventions (e.g. Refs. [24,25]). Some authors pointed out that such interventions should be better labeled as brief "acceptance-based processing" (or with other labels that take into account the specific subcomponents of mindfulness treatments under investigation in each study) rather than mindfulness training or mindfulness-based interventions [15]. However, such brief laboratory induction have also been considered as an important means to investigate state mindfulness, as well as an aspect of understanding how the cognitive system incorporates new information or procedures and what short term effects such change can have [1,15].

Finally, in other cases, mindfulness is described as a dispositional mental trait (e.g. Refs. [26,27]) which could arise as a result of a complex interaction of genetic predisposition, environmental circumstances but also explicit training [14]. Indeed, although levels of dispositional mindfulness can vary both among different and within single individuals at different time points depending on factors other than explicit training, there is consistent evidence to suggest that mindfulness training increases dispositional mindfulness levels and that these changes are, in turn, associated with clinical outcomes [28,29].

On the other hand, it is worth mentioning that mindfulness (often referred to as "open monitoring" as well) training is sometimes associated with concentration (or "focused attention") meditation training, a different kind of meditation practice in which subject's attention is directed towards a single point as a way to achieve a state of mental absorption [30–32]. Similarly, other kinds of meditation exist in which particular qualities, such as loving-kindness or compassion, are evoked. Although these practices are linked to traditional mindfulness meditation practice, such that they are frequently cultivated in conjunction with mindfulness practice, consistent evidence suggests that they are associated with significantly different neuropsychological and neurobiological correlates (e.g. Refs. [31–34]). Consequently, these meditation practices are excluded from the present review, unless a given review focuses on different approaches including both interventions mentioned in this paragraph and other conceptions of mindfulness mentioned above (see the methods' section for more details).

Additionally, a number of psychological interventions including, among others, Dialectical Behavior Therapy (DBT) [35] and Acceptance and Commitment Therapy (ACT) [36], are sometimes included among modern mindfulness-based interventions [22,37]. Note, however, that interventions such as DBT and ACT only partially rely on formal mindfulness training. Indeed, they are largely based on cognitive exercises and are characterized by significant differences compared with the descriptions of mindfulness mentioned above [9,38]. Accordingly, reviews focusing on these interventions will also not be considered, unless a given review focuses on different interventions including both interventions mentioned in this paragraph and other conceptions of mindfulness mentioned above (see the methods' section for more details). Finally, this review does not address Langer's model of mindfulness [39,40]. Indeed, Langer's model of mindfulness includes factors such as alertness to distinctions, contexts, multiple perspectives, and openness to novelty [41] and it usually involves working with material external to the participants, such as information to be learned or manipulated. As Langer herself has explained [39], such mindfulness training should be distinguished from other types of mindfulness.

In Pubmed, the most popular biomedical database, the word "mindfulness" has been indexed has "Mesh terms" in 2014. On August 2, 2016 the search for "mindfulness" in Title yielded 2136 papers, 74% of them were published in the last 5 years, the oldest dated 1982 [42]. In Scopus, a multidisciplinary database, the documents retrieved were 4119, the oldest dated 1979 [43].

The rich collections of studies concerning "mindfulness" have required comprehensive and exhaustive summaries of the outcome of all published studies to draw some useful conclusions, opportunity provided by the reviews of the literature. It is worth noting that several reviews have been conducted specifically to bring more knowledge to clinical practice. In addition, reviews of the literature, if conducted systematically, are better in quality, as they provide a detailed description of both the search strategy and the criteria of the studies that can be included [44]. Often, when data made it possible, reviewers also performed meta-analyses, a statistical combination of the result of more papers.

In recent years, the scientific community has seen an increment in the use of a new tool for the treatment of scientific literature results: the bibliometric and citation analysis. Databases such as Scopus, Web of Science and Google Scholar, have been recognized by scholars as useful tools for assessing the scientific relevance of a research topic. By using bibliometric indicators and citation counting, the trends of scientific topics can be better assessed, core journals can be better identified and the productivity and quantification of the impact of papers can be better evaluated as well.

To date, most scientific fields have been investigated by bibliometric and citation analysis; in medicine they include: cancer [45,46], neuroimaging [47], engineering [48], management [49], computer sciences [50] and social sciences [51]. Nevertheless, the use of citation data is controversial and citation behavior is studied in information science and sociology; their use allows for the evaluation of the scientific impact of the literature avoiding any presumption about their quality.

Recently, the increasing interest of scholars and healthcare professionals in using social media and e-tools, has led to new approaches to control the visibility of a journal article. Altmetrics Score (AS), introduced by Priem and Costello [52], is the impact of a work based on metrics such as article views, downloads, or mentions in social media or news media. The final score is a weighted composite score that includes, among others, Twitter, Facebook, Wikipedia, Mendeley (an online reference management and sharing portal). Priem and Costello [52] found that Twitter citations are generated considerably more quickly than traditional citations, with 40% occurring within 1 week of the cited resource's publication.

The citation analysis applied to systematic reviews allowed us to

achieve our double aim: a) provide a clear representation of the application fields of mindfulness (traditional mindfulness practices, modern mindfulness-based interventions, dispositional mindfulness and state mindfulness) and b) show the most significant topics for the scientific literature through the use of citation analysis and bibliometric measure of source journals.

2. Methods

2.1. Data extraction

To retrieve the documents we used the Scopus database. Developed by Elsevier in 2004, it covers over 21500 peer-reviewed journals (100% Medline) of all fields in life and health sciences, physical sciences, social sciences and humanities. Being a citation database, Scopus gets information about who has cited an article and how many times an author has been cited.

To obtain information regarding the prestige of the source journals we used Scimago Journal Rank (SJR) [53]. Concerning the journals covered by Scopus, SJR is the equivalent of the most known Impact Factor (IF) concerning, on the contrary, the journals covered by Web of Science. SJR, inspired by the PageRank algorithm of Google, differs from IF in calculation: it ranks the journals taking into account both the number of citations received and the prestige of the journals where such citations come from. AS is an application that, within Scopus, runs within the sidebar of abstract page [52]. Our search strategy, carried out on August 4, 2016 is reported in Box 1.

Moreover, we also checked the Cochrane Library to verify if there were systematic reviews not retrieved in Scopus due to our search strategy.

Our inclusion criteria concerned reviews that:

- were published in English language,
- reported the search strategy or a clear specification of the search terms used,
- reported a detailed description of the inclusion criteria,
- reported the number of, or the possibility to calculate, the studies included,
- reported a detailed description in terms of population type, intervention, outcome,
- reported mindfulness as modern clinical intervention (MBSR, MBCT, MBRP, MBIs) or Buddhism-based practices (Zen, Vipassana) proposed as unique practice or in combination with others not mindfulness-based interventions, e.g. ACT or concentration meditation.

Box 1

((TITLE(review*) OR TITLE(meta-analysis)OR TITLE(meta-nalysis))) AND (((TITLE(meditat*)) OR (TITLE(mindfulness)) OR ((TITLE(mindfulness) AND TITLE(trait)OR TITLE(dispositional))) Or ((TITLE(MBSR) OR TITLE(mindfulness-based stress reduction)))) OR (((TITLE(MBCT) OR TITLE(mindfulness-based cognitive therap*))) OR ((TITLE(MBRP) OR TITLE(mindfulness-based relapse prevention))) OR (TITLE(vipassana)) OR (TITLE(zen)) OR (TITLE(zazen)))) AND (LIMIT-TO(DOCTYPE, "re") OR LIMIT-TO(DOCTYPE, "ar")) AND (LIMIT-TO(LANGUAGE, "English")).

No limits were set as to years of publication. Reviews concerning other types of meditation, like meditative movements or techniques based on cognitive approaches and not contemplating at least one of MBIs mentioned above, were excluded. Two authors (GM, TF) screened independently the full text of the all papers, as abstracts did not always allow us to obtain the data required.

2.2. Data analysis

Publications output (authors, title, publication year, source journal, citation counting and AS) were converted to Excel file to manage all the information and to perform data analysis with R software (https://www.r-project.org/).

All the reviews were classified according to object/aim, type of meditation proposed and health status of the population under examination.

To evaluate the scientific impact of the papers we used the citation counting as follows: a) as the total number of citations since publication (TC); b) as the citations per publication (CPP) and c) as the citations the paper has collected within the first 2 years after the publication (TC2). Note that self-citations were excluded from the citation counting.

The cumulative citation numbers (i.e. cumulative CPP) per chronological years and article life were analyzed by a linear regression model [54]. Our model used log-scaling and was expressed as $\log(C) = B \times Y + A + E$, where C represented the response cumulative citations per publication in the calendar year, Y the explanatory "article life", and E the model error term. The model parameters were: B, the log-citation rate (log-number of times cited/year) and A, the potential visibility when the paper is published (the log-number of times cited in the publication year). For output interpretation, the slope parameter (B) was re-expressed on the original counting scale, i.e. $C = 100^{*}(\exp(B)-1)$ represents the average percentage of the annual growth of the cumulative number of citations.

3. Results

The search in Scopus yielded 208 reviews. After the exclusion of 80 reviews, 128 met the inclusion criteria and were included in our analysis (see Fig. 1 and Appendix). Any Cochrane review fulfilled our criteria. The reviews trend included in our study for each publication year is displayed in Fig. 2. We observed a general increase in the number of reviews published from 2003 to 2016. Overall, the average increase was about +19% per year.

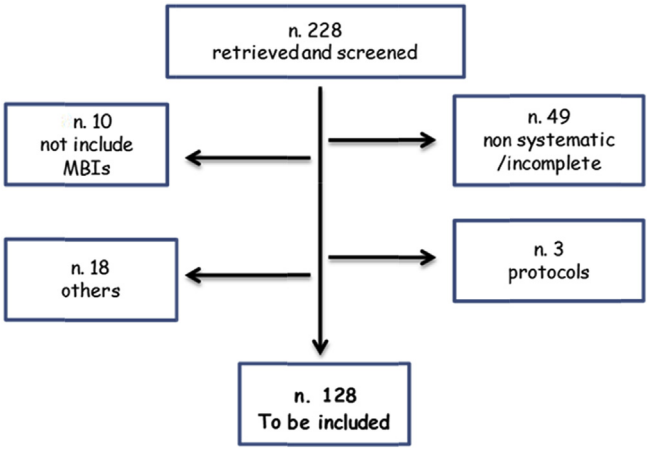

Fig. 1. Flow diagram used to identify eligible studies for bibliometric analysis.

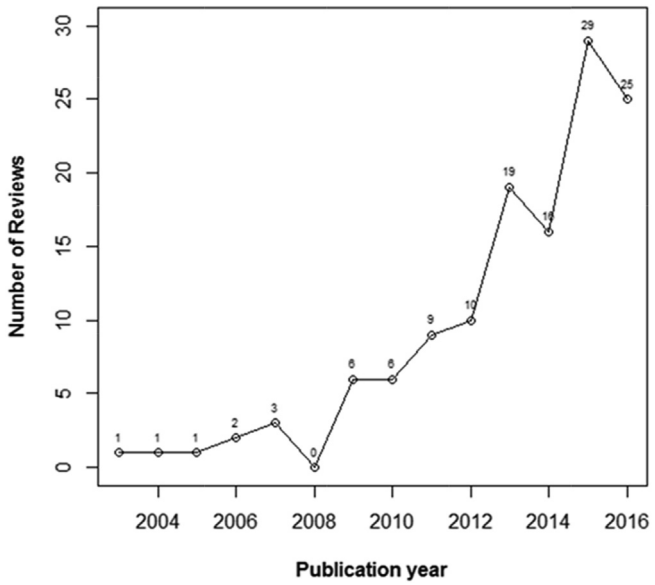

Fig. 2. Number of systematic reviews on mindfulness published over time.

Since the low frequencies of missing data, we could state that papers included in all the reviews were about 2536. The mean number of papers included was 19.8; the maximum of papers included (n = 209) referred to the review of Khoury et al. [55] whose eligibility criteria included any study examining the pre-post effects of Mindfulness based Therapies (MBT). The minimum of papers included (n = 3) referred to the reviews of Cramer, including only randomized control trials aimed at evaluating MBT in patients with breast cancer [56] and low back pain [57].

3.1. Papers classification

The majority of the reviews (n = 113: 88%) concerned the evaluation of clinical efficacy as well as the psychological and/or neuropsychological effects of the interventions under examination. These reviews were grouped in three year cohorts (2003–2007; 2008–2012; 2013–2016), and classified depending on the health status of the population included in (Table 1A): **a**) "clinical" if they referred to a specific pathology or any type of pathological conditions (n = 64: 57%), **b**) "healthy" if they referred to non-clinical subjects (n = 4: 3%), **c**) "mixed" if they referred to both clinical and non-clinical subjects (n = 20: 18%). Moreover, some reviews did not specify health status as they focused on particular subject category, e.g. supposed to be in stressful state because of their work or familiar condition such as caregivers or health-profession related. In these cases these reviews were classified as **d**) unspecified (n = 25: 22%).

Other reviews (n = 15: 12%) not concerned with the evaluation of the therapeutic effects of the intervention, focused on (Table 1B): neuroimaging of functional and structural brain changes, analysis of the mechanism underlying the therapeutic effects and biological correlates. There was only one review each for the following aims/objects: length of intervention and mindfulness as trait. Two reviews had two main foci: neuroimaging and clinical efficacy [2,58].

Considering the type of intervention (Table 1C), the reviews were classified into five groups: MBIs (n = 55: 44%) in which more than one mindfulness-based practice was explored (e.g. MBSR, MBCT), MBCT (n = 6: 5%), MBSR (n = 24: 19%), Vipassana in which the reviews included only one type of meditation (n = 1: 0.79%) and Mixed (n = 40: 32%) in which both MBIs and other types of meditation not referable to a Buddhist context (e.g. ACT) were included. Two reviews about trait mindfulness and self-reported instruments were not categorized; the only review about Vipassana dated 2010 [58]. The frequency distribution per 4-year cohorts of the reviews focusing on the clinical efficacy of mindfulness-based interventions in clinical/mixed populations was similar to the overall trend over years (6%; 26%, 67%) and vice versa in the "unspecified" category i.e. the increase was higher in the last four years (0%; 12%; 88%).

3.2. Most prolific authors

The total number of authors involved in the reviews we analyzed was 411, 367 of these authors have contributed to only one review, among the other 44 authors, 30 have contributed to two reviews while only 14 authors have been involved in more than two reviews.

The average number of authors was 3.8, with a single author for 9 reviews (7.03%), two authors for 27 reviews (21.09%), three to five authors for 74 reviews (57.81%), between the remaining 18 reviews, 8 had more than seven authors. The majority of the reviews had three authors (29.69%).

Table 2 shows the authors (resulting as first and last) with 3 or more reviews. Chiesa A. and Serretti A, the most prolific authors, are co-authors in the same reviews.

3.3. Source journals and subject categories

The total number of journals that published systematic reviews dealing with mindfulness was 87. Eighteen of these journals published more than one review, while 64 journals (74% of the total journals) published only one review. The subject category and the ranking in SJR of the 18 journals which two or more reviews are shown in Table 3. "Mindfulness" is the only journal that published more than 10 papers, followed by "Clinical Psychology Review" with 8 reviews. Four journals (0.5%) published about a quarter of all reviews. The majority of the journals are in the first quartile, to attest the high impact of these journals in their category. We noted the great variability of the journals and the diffusion of these reviews outside the specialized journals.

We performed the citation analysis of the 103 reviews published from 2003 to 2015. Table 4 reports for each year the total number of reviews, their TC, TC2 and CPP. The TC up to August 30, 2016 were 8092 (without considering self-citations), with an average of 6.5 per year. The only one work of 2003 [37] and the work of 2004 [59] collected the 33% of the overall citations. For the two-year period (TC2), the years with more than 30 average citations per review were 2010 (TC2/6 = 56) and the previous two reviews of 2003 (TC2/1 = 54) and 2004 (TC2/1 = 35).

Citation counting (Table 5) for clinical and mixed population collected the 90% of TC. However, the four reviews concerning healthy people had overall more citation/review than the clinical (CPP: 107 vs. 48, and TC2/n.reviews: 21 vs. 19). Considering the intervention type, MBI reviews were the most cited over the long-term as well as the short-term (TC = 3572, and TC2 = 920), while the MBSR reviews were the most cited/review (CPP = 141).

Fig. 3A and B display the growth of the cumulative CPPs over article life. The reviews with mixed population and MBI were the most cited at the publication year, while the growth over the article life (slope) shown that clinical reviews had higher cumulative CPP/year growth (slope = +112%), and MBSR reviews had a greater slope than MBI (slope % = +88% vs. +55%).

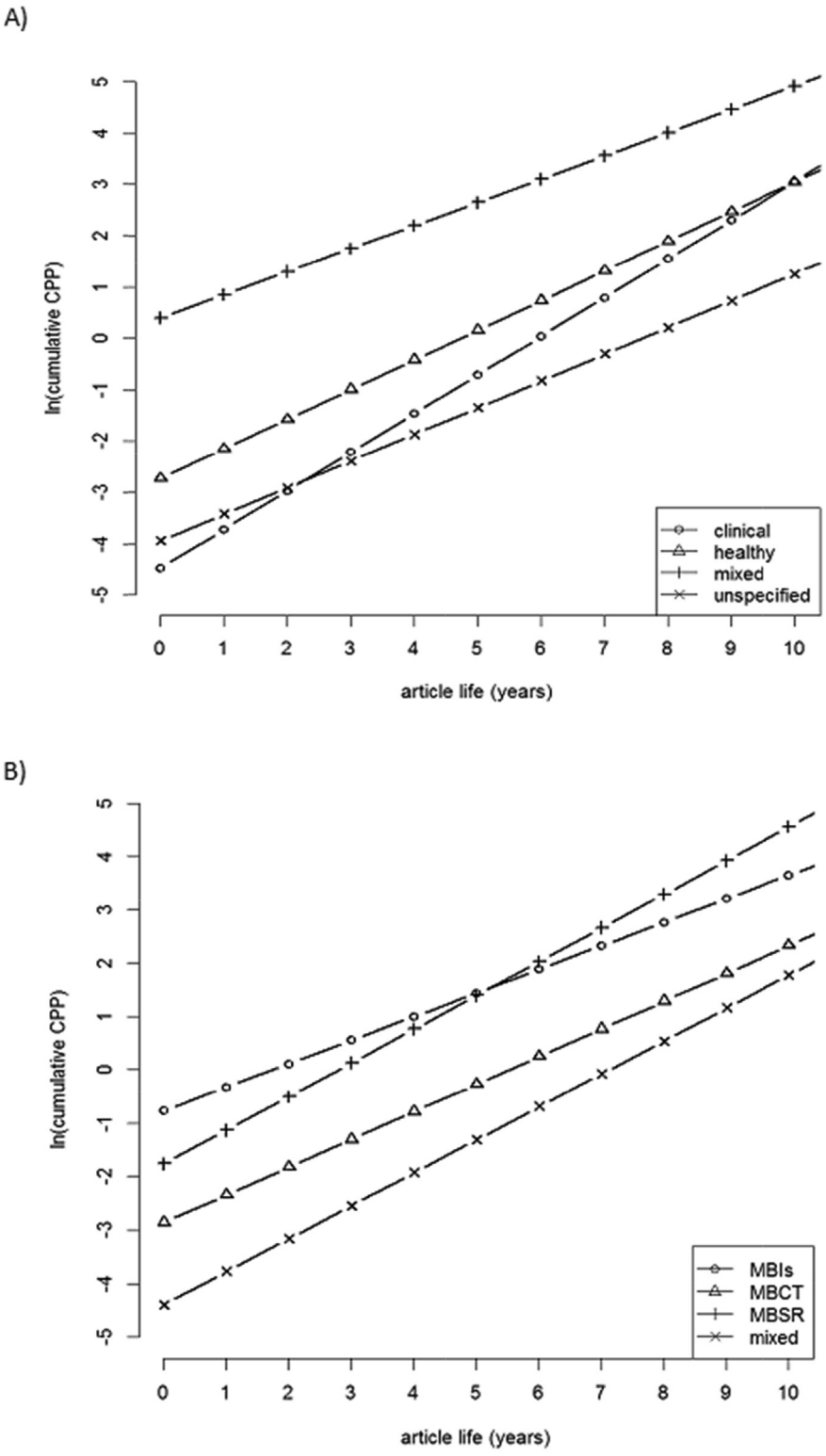

Fig. 3. Regression lines of cumulative citations (CPP) on article life for each therapeutic/clinical effect (A) and for each type of intervention (B).

Table 6 shows the most (top-10) cited reviews by TC (A) and by TC2 (B). Six reviews were present in both lists. The first in ranking for TC was Baer [37], seventh with respect to TC2; while the first in ranking for TC2 was Goyal [60]. As for the other authors, the ranking position is similar in both A and B lists, except for Bohlmeijer [61]. Khoury [55], third for TC2, was not present in top cited for TC and, on the contrary, Grossman [59], second for TC was not present in the list of TC2. Ten reviews collected the 60% of the all citations. AS did not reflect citation counting. Ledesma [62] had an AS of 1 although its ninth position for TC2, and Baer [37], first in ranking for TC had an AS of 7. Goyal [60], first in ranking for TC2, had the higher AS (n. 975) compared to the other authors.

Table 1
Classification of the reviews by (A) therapeutic/clinical effect, (B) non therapeutic/clinical effect and (C) type of meditation for each cohort.

A) Therapeutic/Clinical Effect (Population)	2003-2007	2008-2012	2013-2016	Total
Clinical	6	17	41	64
Healthy	0	2	2	4
Mixed	2	7	11	20
Unspecified	0	3	22	25
Total	**8**	**29**	**76**	**113**

B) Non Therapeutic/Clinical Effect (Aim/object)	2003-2007	2008-2012	2013-2016	Total
Neuroimaging	0	1	5	6
Length of intervention	0	0	1	1
Mechanism of action	0	0	3	3
Property and Evaluation of self-reported measurement	0	0	2	2
Biological correlates	0	0	2	2
Mindfulness as trait	0	0	1	1
Total	**0**	**1**	**14**	**15**

C) Type of intervention	2003-2007	2008-2012	2013-2016	Total
Mindfulness-based Interventions (MBIs)	1	11	43	55
Mixed Interventions	1	8	31	40
Mindfulness-Based Stress Reduction (MBSR)	6	9	9	24
Mindfulness-Based Cognitive Therapy (MBCT)	0	2	4	6
Vipassana	0	1	0	1
Total	**8**	**31**	**87**	**126**

Table 2
Authors with 3 or more reviews as first or last name.

Author	Number of reviews
Chiesa A.	8
Serretti A.	7
Strauss C.	6
Cavanagh H.	4
Khoury B.	3
Walach H.	3
Sedlmeier P.	3
Dobos G.	3
Piet J.	3
Lauche R.	3
Kuyken W.	3
Cramer H.	3
Black D.S.	3
Baer R.A.	3

4. Conclusions

Our aim was to show an overview of published reviews focusing on mindfulness, including traditional mindfulness meditations, modern MBIs, state mindfulness and trait mindfulness, to provide: a comprehensive understanding of the patterns and the trend of application fields and to quantify the attention raised in the scientific community.

The direct observation is the considerable increase in the number of reviews published from 2003 to 2015: an average of +19% per year. The mean of citations per year was 6.5, confirming the mean of 6.6 citation per year found by Royle [69] in her bibliometric analysis of 1261 systematic reviews retrieved in Scopus in 2008 with a cohort of 4 citation years. Of note, the reviews with mixed population and MBIs intervention had the higher immediacy citation impact. The growth over the article life showed that clinical reviews had higher cumulative citations growth, while MBSR reviews had a greater growth than MBI reviews. Our work also shows that, with ongoing time, increasing interest has been directed towards the effects of mindfulness-based interventions proposed to "unspecified" people. Of note, in this category the presence of several reviews regarding the efficacy of the effects of mindfulness on health-care professionals and caregivers was observed.

These results are also suggestive of the increasing interest towards the potential usefulness of mindfulness on the enhancements of such attitudes as loving-kindness, compassion and acceptance, sometimes described as the "sisters of mindfulness" [70] in people taking care of others. It is worth mentioning that both health care professionals and caregivers are often exposed to chronic stress and that they are at higher risk of developing negative consequences of stress, such as burn-out, as compared with other categories of subjects (e.g. Refs. [71–73]).

However, increasing evidence suggests that mindfulness practice has the potential to reduce negative stress consequences in this categories of subjects (e.g. Refs. [74–76]). Furthermore, increased awareness of one's own bodily responses and sensations, one of the main foci of mindfulness practices, has been associated with increased empathy [33], a crucial quality for such workers as health care professionals [77,78].

Note also that, although the focus of most reviews has remained over years the clinical efficacy of interventions that employ mindfulness practice as a means to deal with several clinical and non-clinical conditions, in the last years increased attention has been given to the mechanisms by which mindfulness practice can be efficacious for specific target populations. These findings include neuroimaging findings (e.g. Refs. [2,68]), biological findings (e.g. Ref. [79]), neuropsychological findings (e.g. Ref. [64]) and psychological correlates [29] of mindfulness. The increasing number of publications and of reviews specifically dealing with these topics seem particularly timely and useful. Indeed, a better understanding of the specific and of general mechanisms of action of mindfulness could address future research and provide clinicians and researchers with evidence-based information as to how current mindfulness-based interventions could be modified so as to best fit with new discoveries deriving from these fields of investigation. As some authors have pointed out (e.g. Refs. [80,81]) this, in turn,

Table 3
List of journals with more than one review with their subject category and position in ranking (defined by quartiles (Q): Q1 is the best ranking while Q4 is the worst ranking).

Journals	N. Reviews published (%)	Subject category/Scimago quartile (reference year 2015) (Q = quartile)
Mindfulness	13 (10.1)	Applied Psychology, (Q2) Developmental and Educational Psychology, (Q2) Experimental and Cognitive Psychology, (Q3) Health (social science) (Q1) Social Psychology (Q2)
Clinical psychology review	8 (6.2)	Clinical Psychology, (Q1) Psychiatry and Mental Health (Q1)
Journal of Psychosomatic Research	5 (3.9)	Clinical Psychology, (Q1) Psychiatry and Mental Health (Q1)
Journal of Alternative and Complementary Medicine	5 (3.9)	Complementary and Alternative Medicine (Q1)
PLoS ONE	4 (3.1)	Agricultural and Biological Sciences (miscellaneous), (Q1) Biochemistry, Genetics and Molecular Biology (miscellaneous), (Q1) Medicine (miscellaneous) (Q1)
Psycho-Oncology	3 (2.3)	Experimental and Cognitive Psychology, (Q1) Oncology,(Q1) Psychiatry and Mental Health (Q1)
Journal of Clinical Psychology	3 (2.3)	Arts and Humanities (miscellaneous) (Q1) Clinical Psychology (Q1)
Neuroscience and Biobehavioral Reviews	3 (2.3)	Behavioral Neuroscience (Q1) Cognitive Neuroscience (Q1) Neuropsychology and Physiological Psychology (Q1)
Aggression and Violent Behavior	2 (1.6)	Clinical Psychology (Q1) Pathology and Forensic Medicine (Q1) Psychiatry and Mental Health (Q1)
American Journal of Lifestyle Medicine	2 (1.6)	Health Policy (Q3) Medicine (miscellaneous) (Q2) Public Health, Environmental and Occupational Health (Q3)
Annals of the New York Academy of Sciences	2 (1.6)	Biochemistry, Genetics and Molecular Biology (miscellaneous) (Q1) History and Philosophy of Science (Q1)
Behavior Modification	2 (1.6)	Arts and Humanities (miscellaneous) (Q2) Clinical Psychology (Q2) Developmental and Educational Psychology (Q2)
Complementary Therapies in Medicine	2 (1.6)	Advanced and Specialized Nursing (Q1) Complementary and Alternative Medicine (Q1) Complementary and Manual Therapy (Q1)
Evidence-based Complementary and Alternative Medicine	2 (1.6)	Complementary and Alternative Medicine (Q1)
Frontiers in Psychology	2 (1.6)	Psychology(miscellaneous) (Q1)
Journal of Child and Family Studies	2 (1.6)	Developmental and Educational Psychology (Q3) Life-span and Life-course Studies (Q2)
Journal of Consulting and Clinical Psychology	2 (1.6)	Arts and Humanities (miscellaneous) (Q1) Clinical Psychology (Q1) Psychiatry and Mental Health (Q1)
Oncology Nursing Forum	2 (1.6)	Oncology (nursing) (Q2)

Table 4
Distribution of reviews and citations by year of publication.

Publication year	Number of reviews	TC	TC2	CPP
2003	1	1381	54	1381
2004	1	1294	35	1294
2005	1	118	9	118
2006	2	184	27	92
2007	3	264	39	88
2009	6	844	127	141
2010	6	1407	336	235
2011	9	963	274	107
2012	10	428	157	43
2013	19	513	345	27
2014	16	533	533	33
2015	29	163	NA	6
Total	**103**	**8092**		

TC: Total citation since publication until August 30, 2016 for each group.
TC2: Total citation within year 2. For example a TC2 for a review published in 2003 would be the number of times being cited before the end of 2005. NA (Not Available) means that for that review group we cannot calculate TC2.
CPP: Citation per publication, calculated as TC divided by the number of reviews published in that year.

Table 5
Distribution of reviews and citation by Population/Type of intervention.

Population/Type of intervention	Number of reviews	TC	TC2	CPP
Clinical	56	3233	1083	57
Healthy	4	429	85	107
Mixed	17	3780	484	222
Unspecified	15	325	138	22
Total	**92**	**7767**		
MBIs	42	3752	920	89
Mixed	4	387	103	97
MBSR	21	2952	410	141
MBCT	32	920	469	29
Total	**99**	**8011**		

TC: Total citation since publication until August 30, 2016 for each group.
TC2: Total citation within year 2. For example a TC2 for a review published in 2003 would be the number of times being cited before the end of 2005.
CPP: Citation per publication, calculated as TC divided by the number of reviews published in that year.

could lead to omit such practices and parts of modern mindfulness based interventions that consume time and energy and do not lead to clinical benefits and to give higher emphasis to such practices and parts that more deeply and/or more quickly enhance clinical benefits.

When we focused of most cited articles, several significant

Table 6
Most (top-10) cited reviews by total citation (TC) (A) and by total citation within the first 2 years after publication (TC2) (B).

(A) Authors	Year	TC	Altmetric Score	N. of studies	N. of subjects	Breakthroughs
Baer R.A [37].	2003	1381	7	22	1435	Therapeutic effects/mixed population/MBIs
Grossman P. et al. [59]	2004	1294	99	20	1605	Therapeutic effects/mixed population/MBSR
Hofmann S.G. et al. [3]	2010	775	124	39	1140	Therapeutic effects/clinical population/MBIs
Chiesa A. et al. [63]	2009	307	6	10	671	Clinical effects, Healthy, MBSR
Bohlmeijer E. et al. [61]	2010	205	3	8	667	Therapeutic effects/clinical population/MBSR
Chiesa A. et al. [2]	2010	205	56	52	3996	Therapeutic effects and Neuroimaging/mixed population/MBIs
Chiesa A. et al. [64]	2011	197	29	23	1557	Neuropsychological effects, mixed, MBIS
Piet J. et al. [65]	2011	193	71	6	593	Therapeutic effects/clinical/MBCT
Ledesma D. et al. [62]	2009	171	1	10	583	Clinical effects/Clinical population/MBSR
Fjorback L.O. et al. [66]	2011	170	44	21	1992	Clinical effects/Mixed populations/MBIS
(B) Authors	**Year**	**TC2**	**Altmetric Score**	**N. of studies**	**N. of subjects**	**Breakthroughs**
Goyal M. et al. [60]	2014	167	975	47	3515	Therapeutical effects/clinical population/mixed intervention
Hofmann S.G. et al. [3]	2010	164	124	39	1140	Therapeutic effects/clinical population/MBIs
Khoury B. et al. [55]	2013	103	124	29	12145	Clinical effects/clinical population/MBIS
Chiesa A. et al. [2]	2010	59	56	52	3996	Therapeutic effects and Neuroimaging/mixed population/MBIs
Chiesa A. et al. [64]	2011	57	29	23	1557	Neuropsychological effects/mixed population/MBIS
Chiesa A. et al. [67]	2011	55	26	16	866	Clinical effects/Clinical population/MBCT
Baer R.A [37].	2003	54	7	22	1435	Therapeutic effects/mixed population/MBIs
Bohlmeijer E. et al. [61]	2010	53	3	8	667	Therapeutic effects/clinical population/MBSR
Fjorback L.O. et al. [66]	2011	53	44	21	1992	Clinical effects/mixed population/MBIS
Fox K.C.R et al. [68]	2014	51	132	21	997	Neuroimaging/mixed intervention

findings were observed. First of all, as reported above, the main focus of these articles concerns the clinical effects of mindfulness based interventions. This is consistent with the analysis of all published reviews dealing with the topic of mindfulness showing that only a minority of papers deal with features of mindfulness other than clinical efficacy. However, when we examine more closely the specific populations under investigation of each study, we can observe that most reviews specifically deal with clinical or mixed populations rather than with healthy subjects. This is an interesting finding considering that most reviews focused on modern mindfulness based interventions and that these interventions have mainly been developed to target specific clinical conditions, such as chronic pain [42] and major depression [82]. Taking into account the increasing interest towards the usefulness of mindfulness for non-clinical subjects it will be interesting to understand whether current interest directed towards these subjects will continue to increase in the following years. Furthermore, it is worth mentioning that the large interest directed towards reviews focusing on mixed clinical effects of mindfulness in mixed populations of subjects could be related to the increasing interest directed towards mindfulness and approached based upon mindfulness practice. However, with ongoing time, it could become increasingly important to understand which specific mindfulness based interventions could best fit to a specific clinical conditions. Also, it will be interesting to understand whether this need for higher specificity will be reflected into the publications and the citations of reviews more specifically concerned with this topic in future research. In line with this issue, we found that most articles focused on either MBSR or mixed mindfulness based interventions mainly based upon MBSR.

Even though this is in line with the longer availability of MBSR as compared with more recently developed mindfulness based interventions, other interventions are worthy of investigation as well. As an example, MBCT have been recently suggested in both European and American Guidelines as a treatment of choice for the reduction of major depression relapse/recurrence [83,84]. Also, other approaches such as MBRP are receiving increasing attention. However, no reviews have yet specifically focused on these interventions. As a consequence, more attention should probably be given to interventions other than MBSR so as to best tailor mindfulness to the needs of specific clinical and non-clinical populations.

Only 10% of the all reviews were published on “Mindfulness”; the journal, edited by Springer, started in 2010 and collecting manuscripts in advance research, clinical practice, and theory on mindfulness from diverse viewpoints. In any case, it is noteworthy that 4 reviews were published in a multidisciplinary journal like Plos One and the 3 reviews were published by a specialized journal in oncology. These journals were in the first quartile in 30 subjects categories of a total of 43.

Publishing in journals with a high impact factor is often regarded as an indication of the quality of the research published and, by implication, of the quality of their authors. On the basis of our findings, we can argue that the contemplative approach of meditation has conquered the academic world. Any analysis about the AS has to consider its meaning. In accordance with the opinion expressed by Truger [85], we underscore that “Altmetrics be thought of as measure of disseminative impact whereas traditional citation-based metrics be considered measure of scholarly impact”. An editorial of Jama [86] consider Altmetric as completion of citation scores and Peters [87] recognized the potential of social media and encouraged psychiatrics to embrace their use. In our opinion, AS could be particularly suitable in the field we explored. Indeed, the high altmetric score observed for several articles can be considered as a confirmation of the spread of science in non-academic channels. As an example, the Facebook page of Jon Kabat-Zinn, the founder of MBSR, is currently followed by over 22000 subjects (https://www.facebook.com/pages/Jon-Kabat-Zinn/104042902964383?fref=ts; access date 01/02/2017). As a further example, the OMC Oxford Mindfulness Centre's Facebook page, the page of the main centre providing MBCT in the United Kingdom, is followed by over 6000 subjects (https://www.facebook.com/Oxfordmindfulness/?fref=ts; access date 01/02/2017).

In conclusion, our review suggests that both the concept of mindfulness and interventions based upon mindfulness practice are receiving growing attention. Although within modern western psychology mindfulness was originally addressed to specific clinical population, increasing attention has been given to non-clinical

conditions for which mindfulness could likewise be useful. Also, increasing attention has been given to the mechanisms by which mindfulness can lead to the observed benefits. This could further improve future research on this topic.

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Appendix A

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