Evolution of Treatment Modalities for Posttraumatic Stress Disorder:

Top 100 Cited Articles From 1990 to 2020

Mohsan Ali, MBBS; Bisal Naseer, MBBS; Muhammad T. Siddal, MBBS; Muhammad Talha, MBBS; Damisha Jabeen, MBBS; Areeba M. Mehmood, MBBS; Maheen Hashmi, MBBS; Muhammad U. Ahmed, MBBS; and Mujeeb U. Shad, MD, MSCS

Abstract

Objective: Posttraumatic stress disorder (PTSD) is seen in a substantial proportion of individuals experiencing trauma. The last few decades have been significant in terms of PTSD-related research; however, a quantitative charting of the evolution in evidence-based treatment modalities for PTSD is lacking. The objective of this study was to conduct a bibliometric analysis to bridge this gap in knowledge.

Methods: The database Scopus was searched in November 2022, with a timeframe set from 1990 to 2020. Only original articles were included. The 100 most-cited articles were compiled in the final list via manual screening. The selected studies primarily focused on the treatment modalities of PTSD. These articles were then analyzed for factors such as citation count, citations per year, citation trend, country of origin, and author affiliation. Microsoft Excel version 2016 and SPSS version 26 were used for the analysis.

Results: The 100 most-cited articles were published between 1990 and 2015. The number of citations was 35,549, with a maximum of 1,056 and a minimum of 315 (median = 282, interquartile range [IQR] = 139). The number of citations per year ranged between 7.03 and 46.5 (mean = 20.3009, median = 17.49, IQR = 11.215). Most of these articles were published in the *Journal of Consulting and Clinical Psychology* (25 articles); 2012 was the year with the peak citations per year, and the trend declined notably after 2016. The 5-year average citations reached their maximum during 2014–2018. The trend declined between 2019 and 2022. The year 2003 was the most productive in terms of academic outcome (10 articles). More than half of the 100 articles originated in the United States (77 articles), followed by the United Kingdom (8 articles) and Germany (7 articles). The total number of authors involved was 641 (median = 6, IQR = 4). A possible reason for the increase in citations around these articles is that the planned update to the current *DSM* version motivated considerable research, contributing to the increased citations around its release. Researchers focused on validating new diagnostic criteria and understanding their implications, resulting in a significant surge in publications and citations.

Conclusion: The data show that most of these articles originated from developed countries, pointing out the need to conduct more region-specific research in developing and underdeveloped areas as well.

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Author affiliations are listed at the end of this article.

Bibliometrics is a quantitative research methodology used to evaluate research productivity in a given subject area within a field over time.[1] It is an important mapping tool to establish research priorities and direct the allocation of funds by charting the emerging trends in science and technology. Moreover, bibliometric analysis can be utilized to acknowledge the major contributors in academia, whether they are authors, journals, institutions, or countries.[2]

Trauma is an event that exposes a person to the danger of death, physical injury, or sexual violence.[3,4] *Posttraumatic stress disorder* (PTSD) is defined as the cluster of symptoms caused by "somatic, cognitive, affective, and behavioral effects of trauma."[5(p83-93)] One of every 3 young people experiences trauma, and of the exposed populace, every fourth child develops PTSD by the age of 18 years.[4] In 2017, a World Health Organization survey yielded a PTSD prevalence of 5.0% in the general population of high-income countries, 2.3% in upper-middle–income countries, and 2.1% in lower-middle–income countries, respectively.[6] Moreover, the 2019 Global Burden of Disease report revealed an alarming number of 316 million adult war survivors suffering from PTSD and/or mental disorders

Clinical Points

- The increased research output following the *DSM* updates suggests that clinicians should stay informed about *DSM* changes, as they may drive significant advancements in understanding and treating posttraumatic stress disorder (PTSD).
- A substantial portion of PTSD research and its clinical applications originate in the United States, highlighting the need for international collaboration to address PTSD in diverse populations effectively.
- Barriers to high-impact PTSD research in low- and middle-income countries include limited resources and funding, emphasizing the importance of developing comprehensive health financing policies to improve PTSD treatment outcomes globally.

worldwide, leading to 3 million disability-adjusted life years.[7] Also, the prevalence of PTSD in medical practitioners has been on a continuous rise since the onset of the COVID-19 pandemic; 25.4% of health care workers in the National Health Service screened positive for PTSD in 2021 by *DSM-5* criteria.[8] If not treated in a timely manner, PTSD is said to contribute to increased suicide rates in 53.9% of females and 67.2% of males.[9]

Owing to the subjectively varied responses of PTSD patients to their triggers, diagnosing and treating PTSD has always posed a challenge to mental health experts.[10] Factors such as avoidance, social stigma, limited resources, ongoing conflicts, and wars make it difficult for trauma survivors to seek early professional help and compromise the efficacy of available treatment options.[11] The last couple of decades have seen significant progress in terms of PTSD research.[12] However, there has been no quantitative charting of the evolution in evidence-based treatment modalities of PTSD in terms of improved outcomes. The objective of this study was to conduct a bibliometric analysis to bridge this gap in knowledge and aid the scientific community in determining future directions for PTSD treatment.

METHODS

The database Scopus was used for the bibliometric analysis. Regarding scientific publications, the available evidence and analysis suggest that Scopus has a wider scope than other databases such as PubMed and Web of Science.[13,14] We selected 2 reviewers (M.T. and B.N.) to search the Scopus database in November 2022. The first list contained original research articles, which were segregated from review articles by Scopus filters. To yield the maximum number of articles in the analysis, the research studies on nonhuman subjects, those without abstract availability, and those in languages other than English were also included. The articles published from 1990 to 2020 were included irrespective of their publication journal. The following search term was used for retrieving articles from Scopus: "(TITLE-ABS-KEY(((posttraumatic stress disorder) OR PTSD OR (traumatic stress disorders) OR (trauma-related disorders) OR (complex trauma)) AND ((treatment modalities) OR management OR therapeutics OR (treatment outcomes) OR (interventions integrated treatment) OR psychotherapy OR (pharmacological therapy) OR (drug therapy) OR psychedelics OR (diet therapy) OR (physical therapy) OR (exposure therapy) OR (neuromodulation therapy) OR (combined therapy) OR (accelerated resolution therapy) OR (eye movement desensitization and reprocessing) OR (cognitive behavioral therapy) OR (Stellate Ganglion Block))))."

The selected studies primarily focused on the treatment modalities of PTSD. The appropriateness and relevance of the articles with the inclusion criteria were determined by thoroughly reviewing the abstracts. In case the abstracts were unavailable in Scopus, other sources were utilized to extract the abstracts and assess their suitability. The "cited by" filter was used to gather and organize the yielded articles. The most-cited 100 articles were thus compiled in the final list. Only those articles to which both reviewers agreed based on the inclusion criteria were included in the final list.

The analysis of the final list of articles was carried out using Scopus and manual screening. The total number of citations and number of citations per year were analyzed in terms of mean, median, and interquartile range (IQR). The Thomson Reuters journal citation reports were used to obtain the impact factors of the journals. Appropriate tables and graphs were generated using Microsoft Excel version 2016. SPSS version 26 was used to determine the correlation between the journal's impact factor and its representation regarding the number of articles in the 100 most-cited articles. We considered a P value <.05 as significant. The subsequent search was conducted in the same manner to obtain the second list of most-cited review articles on the treatment modalities of PTSD.

RESULTS

Citation Count, Citations Per Year, and Citation Trends

Table 1 shows total citations and citations per year for the top 100 most-cited articles from 1990 to 2020. The number of citations was a minimum of 215 and a maximum of 1,056, with a median of 282 and an IQR of 139. The number of citations for all the articles was summed to a total of 35,549.

The number of citations per year ranged between 7.03 and 46.5, with a mean of 20.3009, median of 17.49, and IQR of 11.215. Also, if we look at the 10 most-cited

Table 1.

Total Citations, Citations Per Year, and Focus of Content of Top 100 Cited Articles From 1990 to 2020

Article	Year of publication	Time since publication, y	Total citations	Average citations per year	Focus of content
Foa et al[15]	1991	31	1,056	34.06	Psychological treatment
Resick and Schnicke[16]	1992	30	993	33.1	Psychological treatment
Resick et al[17]	2002	20	930	46.5	Psychological treatment
Foa et al[18]	1999	23	751	32.65	Psychological treatment
Pitman et al[19]	2002	20	744	37.2	Medication treatment
Cohen et al[20]	2004	18	741	41.17	Psychological treatment
Cloitre et al[21]	2002	20	721	36.05	Psychological treatment
Foa et al[22]	2005	17	660	38.82	Psychological treatment
Schnurr et al[23]	2007	15	651	43.4	Psychological treatment
Monson et al[24]	2006	16	629	39.31	Psychological treatment
Brady et al[25]	2000	22	587	26.68	Medication treatment
Marks et al[26]	1998	24	555	23.13	Psychological treatment
Resick et al[27]	2008	14	531	37.93	Psychological treatment
Stein et al[28]	2003	19	522	27.47	Psychological treatment
Raskind et al[29]	2003	19	492	25.89	Medication treatment
van der Kolk et al[30]	1994	28	456	16.29	Medication treatment
Krakow et al[31]	2001	21	437	20.81	Psychological treatment
Raskind et al[32]	2007	15	422	28.13	Medication treatment
Cloitre et al[33]	2010	12	413	34.42	Psychological treatment
Vermetten et al[34]	2003	19	409	21.53	Medication treatment
Keane et al[35]	1989	33	406	12.3	Psychological treatment
Vaiva et al[36]	2003	19	400	21.05	Medication treatment
Neuner et al[37]	2004	18	399	22.17	Psychological treatment
Davidson et al[38]	2001	21	397	18.9	Medication treatment
Deblinger et al[39]	1996	26	395	15.19	Psychological treatment
Bryant et al[40]	1998	24	382	15.92	Psychological treatment
Rothbaum et al[41]	2001	21	376	17.9	Psychological treatment
Tarrier et al[42]	1999	23	373	16.22	Psychological treatment
Foa et al[43]	1995	27	362	13.41	Psychological treatment
Marshall et al[44]	2001	21	361	17.19	Medication treatment
Mayou et al[45]	2000	22	360	16.36	Psychological treatment
Taylor et al[46]	2003	19	358	18.84	Psychological treatment
Foa et al[47]	1995	27	358	13.26	Psychological treatment
Lange et al[48]	2003	19	357	18.79	Psychological treatment
Mithoefer et al[49]	2011	11	352	32	Psychological treatment
Najavits et al[50]	1998	24	347	14.46	Psychological treatment
Jaycox et al[51]	1998	24	347	14.46	Psychological treatment
Jones et al[52]	2003	19	340	17.89	Psychological treatment
Roy-Byrne et al[53]	2010	12	331	27.58	Psychological treatment
Foa et al[54]	1995	27	329	12.19	Psychological treatment
Brom et al[55]	1989	33	329	9.97	Psychological treatment
Schnurr et al[56]	2003	19	325	17.11	Psychological treatment
Feder et al[57]	2014	8	323	40.38	Medication treatment
Kataoka et al[58]	2003	19	314	16.53	Psychological treatment
Cloitre et al[59]	2011	11	308	28	Psychological treatment
Bryant et al[60]	1999	23	307	13.35	Psychological treatment
Chhatwal et al[61]	2005	17	305	17.94	Pathophysiology
Davidson et al[62]	1990	32	302	9.44	Medication treatment
Goenjian et al[63]	2000	22	290	13.18	Psychological treatment
van Minnen et al[64]	2002	20	284	14.2	Psychological treatment
McDonagh et al[65]	2005	17	280	16.47	Psychological treatment
Hien et al[66]	2004	18	280	15.56	Psychological treatment
Gelpin et al[67]	1996	26	280	10.77	Medication treatment
Rothbaum et al[68]	2014	8	278	34.75	Medication treatment
Mueser et al[69]	2008	14	278	19.86	Psychological treatment
Aerni et al[70]	2004	18	278	15.44	Medication treatment
Deblinger et al[71]	2011	11	274	24.91	Psychological treatment
Knaevelsrud and Maercker[72]	2007	15	274	18.27	Psychological treatment
Chard[73]	2005	17	274	16.12	Psychological treatment
Stein et al[74]	2002	20	274	13.7	Medication treatment
Tucker et al[75]	2001	21	273	13	Medication treatment

(continued)

Table 1 (continued).

Article	Year of publication	Time since publication, y	Total citations	Average citations per year	Focus of content
van der Kolk et al[76]	2007	15	272	18.13	Psychological treatment
Adler et al[77]	2009	13	268	20.62	Psychological treatment
Rothbaum et al[78]	2005	17	267	15.71	Psychological treatment
Connor et al[79]	1999	23	267	11.61	Medication treatment
Goenjian et al[80]	1997	25	267	10.68	Psychological treatment
Schelling et al[81]	2004	18	264	14.67	Medication treatment
Andrade et al[82]	1997	25	261	10.44	Psychological treatment
Bass et al[83]	2013	9	260	28.89	Psychological treatment
Taylor et al[84]	2008	14	260	18.57	Medication treatment
Melnyk et al[85]	2004	18	255	14.17	Psychological treatment
Hertzberg et al[86]	1999	23	254	11.04	Medication treatment
Eftekhari et al[87]	2013	9	252	28	Psychological treatment
Zatzick et al[88]	2004	18	251	13.94	Psychological treatment
Foa et al[89]	2002	20	250	12.5	Psychological treatment
Paunovic and Ost[90]	2001	21	249	11.86	Psychological treatment
Neuner et al[91]	2008	14	243	17.36	Psychological treatment
Mithoefer et al[92]	2013	9	242	26.89	Psychological treatment
Raskind et al[93]	2013	9	241	26.78	Medication treatment
Zayfert et al[94]	2004	18	241	13.39	Psychological treatment
Wessa and Flor[95]	2007	15	240	16	Pathophysiology
March et al[96]	1998	24	239	9.96	Psychological treatment
Smith et al[97]	2007	15	236	15.73	Psychological treatment
Litz et al[98]	2007	15	235	15.67	Psychological treatment
Cohen et al[99]	2011	11	232	21.09	Psychological treatment
Brady et al[100]	2001	21	232	11.05	Psychological treatment
Bryant et al[101]	2008	14	230	16.43	Pathophysiology
Zucker et al[102]	2009	13	229	17.62	Pathophysiology
Layne et al[103]	2008	14	226	16.14	Psychological treatment
Foa and Rauch[104]	2004	18	225	12.5	Psychological treatment
Braun et al[105]	1990	32	225	7.03	Medication treatment
Mills et al[106]	2012	10	224	22.4	Psychological treatment
Difede et al[107]	2007	15	223	14.87	Psychological treatment
Yehuda et al[108]	2013	9	222	24.67	Pathophysiology
Jaycox et al[109]	2010	12	220	18.33	Psychological treatment
Hien et al[110]	2009	13	220	16.92	Psychological treatment
Morland et al[111]	2010	12	218	18.17	Psychological treatment
Bryant et al[112]	2003	19	218	11.47	Psychological treatment
Scheeringa et al[113]	2011	11	216	19.64	Psychological treatment
Zohar et al[114]	2011	11	215	19.55	Medication treatment

research articles in this field since 2021 as of this writing, as these are the articles that are driving research, driving research, interesting trends towards research in newer treatments such as MDMA and ketamine in the form of robust clinical trials are revealed (Table 2).

Figure 1 shows the total citations of the articles per year. The analysis revealed an exponential increase in the number of citations per year, with the most notable increase occurring between 2010 and 2012 and the peak citations per year being in 2012. After 2012, there was a smaller but almost similar number of citations per year up to 2016. After 2016, the trend decreased during the next few years.

Figure 2 shows the 5-year average citations. Our analysis revealed that the average increased exponentially over the 5-year intervals. Although during the 5 years between 2009 and 2013 the average citations were notably higher than the previous intervals, the most citations per 5 years were within the years 2014 and 2018. However, the average 5-year citations notably went down between the years 2019 and 2022 compared to the previous years.

Year of Publication, Origin, and Authorship

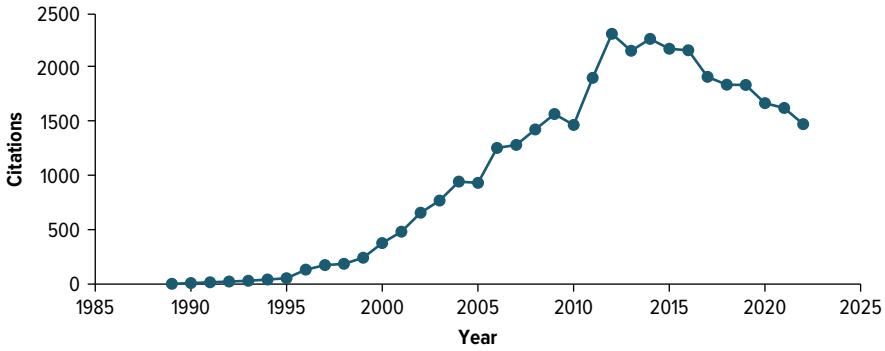
The 100 most-cited articles regarding evolution in therapeutic modalities for PTSD were published between 1990 and 2015. These articles originated from 15 different countries, with 2 being unidentified countries of origin. More than half of these articles originated from the United States (77 articles), followed by the United Kingdom (8 articles) and Germany (7 articles) (Figure 3).

The total number of authors involved in the publication of these articles is 641, with a median of 6 authors per article (IQR = 4). The number of authors in the 100 most-cited articles included in the study ranges from 1 to 21. The authors with 5 or more articles among the most-cited articles are listed in Table 3, which shows

Table 2.
Top 10 Cited Articles Since 2021

Article	Year of publication	Total citations
MDMA-assisted therapy for severe PTSD: a randomized, double-blind, placebo-controlled phase 3 study[115]	2021	446
A large-scale survey on trauma, burnout, and posttraumatic growth among nurses during the COVID-19 pandemic[116]	2021	345
A randomized controlled trial of repeated ketamine administration for chronic posttraumatic stress disorder[117]	2021	121
Moral distress in frontline health care workers in the initial epicenter of the COVID-19 pandemic in the United States: relationship to PTSD symptoms, burnout, and psychosocial functioning[118]	2021	97
Comparison of prolonged exposure vs cognitive processing therapy for treatment of posttraumatic stress disorder among US veterans: a randomized clinical trial[119]	2022	88
Emerging experience with selected new categories in the *ICD-11*: complex PTSD, prolonged grief disorder, gaming disorder, and compulsive sexual behavior disorder[120]	2022	80
MDMA-assisted therapy for moderate to severe PTSD: a randomized, placebo-controlled phase 3 trial[121]	2023	61
Effect of prolonged exposure, intensified prolonged exposure and STAIR+prolonged exposure in patients with PTSD related to childhood abuse: a randomized controlled trial[122]	2021	54
Reducing intrusive memories after trauma via a brief cognitive task intervention in the hospital emergency department: an exploratory pilot randomized controlled trial[123]	2021	47
Posttraumatic stress disorder and complex posttraumatic stress disorder in UK police officers[124]	2022	44

Figure 1.
Citations Per Year of Article Publication



that most of these articles included in the study were coauthored by E.B. Foa (11 articles). Table 3 also shows the authors' H index, which demonstrates the overall impact of the authors as measured by the author-specific citation frequency.

Further, if we analyze the trends of the number of articles published during the specified period (1990-2020) and plot against the year of publication, the year 2003 was the most productive year in terms of academic outcome, with 10 publications in that year (Figure 4). Table 4 shows the journals and respective number of published articles during the study period.

DISCUSSION

We provide a bibliometric analysis of the most-cited articles on PTSD to highlight significant developments in its understanding and management. This analysis can

Figure 2.
Average Citations of Articles Over 5-Year Intervals

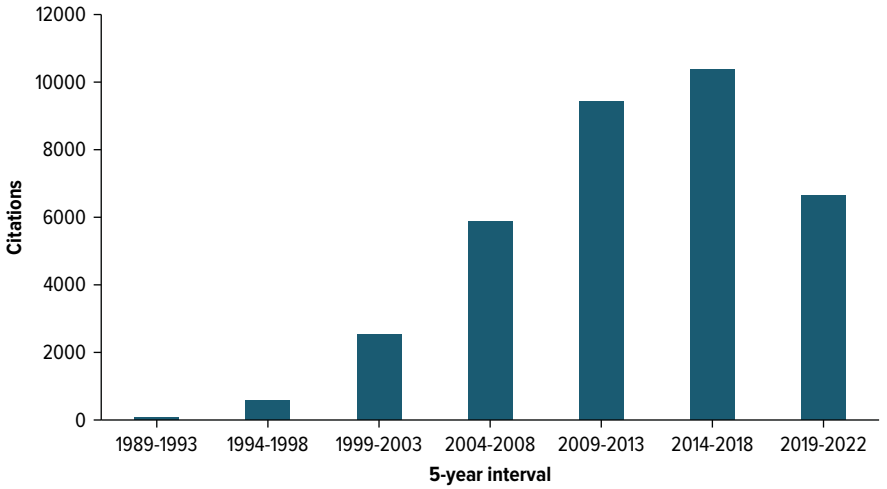


Figure 3.
Number of Articles Published by Country

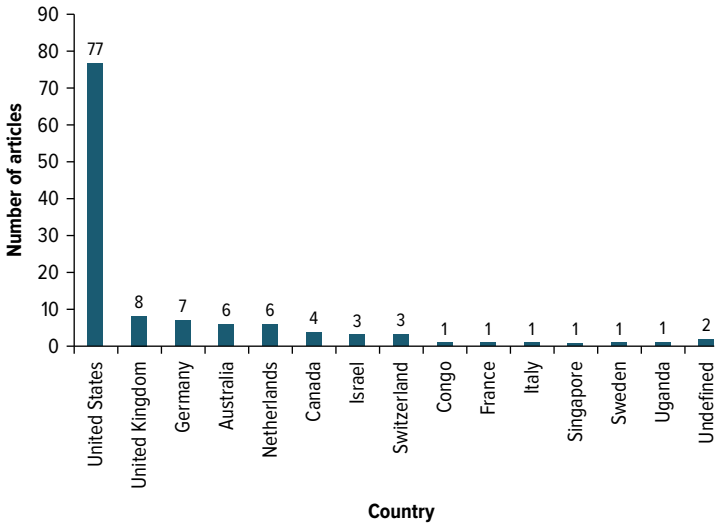


Table 3.
Authors With the Maximum Number of Articles

Author	Total articles	Authorship position			Author affiliation	H-index	Primary area of interest
		First	Last	Other			
E.B. Foa	11	8	0	3	University of Pennsylvania	100	Clinical psychology
R.A. Bryant	5	4	0	1	University of New South Wales Sydney	118	Psychology
J.A. Cohen	5	3	0	2	University of Florida	17	Psychology
L.H. Jaycox	5	2	1	2	RAND Corporation	56	Clinical psychology
P.A. Resick	5	0	1	4	Duke University	67	Mental health
B.O. Rothbaum	5	1	2	3	Emory University	104	Anxiety

Figure 4.
Number of Articles Published Per Year

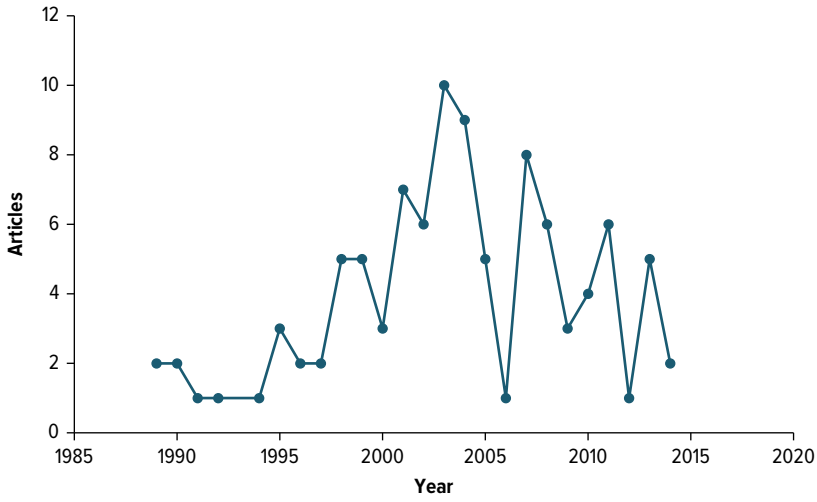


Table 4.
Journals and Number of Published Articles

Journal	No. of published articles
Journal of Consulting and Clinical Psychology	25
American Journal of Psychiatry	13
Journal of Clinical Psychiatry	8
Biological Psychiatry	7
JAMA	6
Journal of Traumatic Stress	6
Archives of General Psychiatry	6
Journal of the American Academy of Child and Adolescent Psychiatry	5
Behavior Therapy	5
Behaviour Research and Therapy	2
British Journal of Psychiatry	2
JAMA Psychiatry	2
Journal of Psychopharmacology	2

highlight critical areas in PTSD, both where research is ongoing and where it might be conducted in the future, which can be of great use to physicians and researchers. It can also aid in the development of collaboration among researchers from many disciplines, enabling them to investigate PTSD research further.

We observed a gradual increase in the number of articles published in the last 2 decades, with the maximum research productivity seen in 2003 and 2007 with 10 and 7 articles, respectively. The leading causes of the gradual increase may be the increasing trend in the prevalence of PTSD over the last decade, as well as the increasing rates of suicide and the everyday difficulties faced by military personnel who have this diagnosis.[125] Over the years, these projects, funded mainly by US government agencies, have contributed to our improved understanding of the brain, human behavior, the consequences of chronic stress on the hypothalamic-pituitary-adrenal axis system, and improved treatment approaches. Still, the scholarly output on PTSD seems to be rising slowly compared to that on other psychiatric illnesses such as schizophrenia,[126] bipolar disorder,[127] and depression.[128]

We chose citations per year as a more trustworthy metric to determine an article's current influence because citation count alone is not an accurate indicator of an article's scientific value.[129] When articles were arranged according to citations per year, the most-cited article was by Resick et al (2002).[17] However, the article with the maximum number of citations was a relatively older article (1991) by Foa et al.[15] This result confirms that, even if an article's impact is greater than that of an older

article, it is likely to rank lower when evaluated only based on its citation count, as newly published articles take time to generate citation count. The author with the maximum number of articles among the top 100 was a female senior researcher, E.B. Foa, while 5 of 6 top performing authors were also female. This is a quite promising finding that female researchers have outpaced their male colleagues in research on PTSD. Still, we cannot negate the traditional gender disparity found in psychiatry[130] and other fields of medicine,[131–133] with only 42% of female psychiatrists in the United States.

About three-fourths of the scholarly output came from the United States, followed by the United Kingdom and Germany. Moreover, 5 of 6 authors and institutes with maximum research output were also from the United States. This trend aligns with many other studies conducted in various research fields.[126,128,134–137] This trend has several causes, the most significant of which is the financial support any nation provides. The US government, private sector organizations, and foundations such as the National Institutes of Health and National Science Foundation invest heavily in research and development. A robust higher education system, an elaborate collaborative network, a research infrastructure, and a competitive peer-review process contribute as well.[138] Although the burden of PTSD in low- and middle-income countries is high,[139] not even a single country with low resources was the primary contributor or leader of these highly impactful studies.[140] The lack of high-impact studies in low- and middle-income countries is attributable to limited human development and expenditure in education and scientific research, limited access to technology and quality education, language barriers, political and social instability, and limited collaboration opportunities.[141] Also, prioritizing basic needs such as health care, nutrition, and sanitation over research is common in low-income countries. Therefore, it highlights the importance of developing a comprehensive health financing policy for these countries, allocating at least 15% of the national budget to health development.[142,143] The journal that published the maximum number of articles was the *Journal of Consulting and Clinical Psychology* (25 articles), while the journal with the maximum impact factor was the *American Journal of Psychiatry* (17.7 in 2022). This pattern suggests that a journal's relevance to the subject matter is more important than its impact factor.

Our results have some limitations. First, some articles might be missed, as only the Scopus database was utilized. Articles published before the 1980s, when a computerized system was put in place, are frequently overlooked by Scopus.[144] Second, self-citations were not removed. Third, most articles were published in English, which could result in bias in the publishing language selection process. Interestingly, the publication of newer editions of the *DSM* often coincides with a surge in research in the relevant areas, as researchers and clinicians try to adapt to newer diagnostic criteria and explore their use. Futher analyses and research might investigate how these updates correlate with the trends in clinical practice.

CONCLUSION

The observed decline in citations in recent years may suggest a redirection of focus toward alternative areas of interest. Furthermore, the data indicate that most reviewed publications were produced in economically affluent nations, underscoring the importance of facilitating research specifically tailored to the unique contexts of emerging and underdeveloped regions.

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Author Affiliations: King Edward Medical University, Lahore, Pakistan (Ali, Naseer, Ahmed); Shaikh Khalifa Bin Zayed Al Nahyan Medical and Dental College, Lahore, Pakistan (Siddal); CMH Medical College, Lahore, Pakistan (Talha); Jinnah Sindh Medical University, Karachi, Pakistan (Jabeen); Sargodha Medical College, Sargodha, Pakistan (Mehmood); Dow University of Health Sciences, Karachi, Pakistan (Hashmi); University of Nevada, Las Vegas, Nevada (Shad).

Corresponding Author: Mohsan Ali, MBBS, King Edward Medical University, Neelagumbad, Anarkali, Lahore 54000, Pakistan (mohsanali@kemu.edu.pk).

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