Research

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Post-Traumatic Stress Disorder After Road Traffic Crashes: A Bibliometric and Science-Mapping Analysis

Karayolu Trafik Kazalarının Ardından Travma Sonrası Stres Bozukluğu: Bibliyometrik ve Bilim Haritalama Analizi

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ABSTRACT

Objective: The aim of this study is to treat road traffic crashes (RTCs) as a distinct area of trauma and thereby to present a field-specific bibliometric analysis of research on post-traumatic stress disorder (PTSD) associated with road traffic accidents.

Method: A bibliometric analysis was conducted on 790 peer-reviewed articles indexed in the Web of Science Core Collection between 1991 and 2025 (n = 790; 41,585 citations; h-index = 104).

Results: The development of the field can be characterized by an initial foundational period (1991–1999), followed by expansion between 2000 and 2014, and subsequent stabilization during 2015–2022. A recent decline in publication output (2023–2025) was observed, although this should be interpreted cautiously due to publication and indexing delays. Scientific influence is dominated by a small group of key authors, while collaboration is primarily concentrated among researchers from English-speaking countries. Five major research themes were identified, including diagnosis, risk factors, treatment, rehabilitation, and global epidemiology.

Conclusion: The RTC–PTSD literature is broad but fragmented. A clear mismatch exists between the geographical distribution of research production and the global burden of road trauma, while connections between trauma research and transport-safety remain limited.

Keywords: Post-traumatic stress disorder, psychological trauma, road traffic crashes, road safety

ÖZ

Amaç: Bu çalışmanın amacı karayolu trafik kazalarını (KTK) daha geniş kategoriler altında ele almak yerine, ayrı bir travma alanı olarak değerlendirmekte ve böylece karayolu trafik kazalarına bağlı travma sonrası stres bozukluğu (TSSB) araştırmalarına ilişkin alana özgü bir bibliyometrik değerlendirme sunmaktadır.

Yöntem: Bu çalışma kapsamında, Web of Science Core Collection veri tabanında 1991–2025 yılları arasında indekslenen 790 hakemli makale üzerinde bibliyometrik analiz gerçekleştirilmiştir (n=790; 41.585 atıf; h-indeks = 104).

Bulgular: Alanın gelişimi, başlangıç ve temellenme (1991–1999), genişleme (2000–2014) ve istikrar kazanma (2015–2022) olmak üzere üç evrede gerçekleşmiştir. 2023–2025 döneminde yayın üretimde bir azalma gözlenmiş olmakla birlikte, bu eğilim yayın ve indeksleme gecikmeleri nedeniyle dikkatle yorumlanmalıdır. Bilimsel etki az sayıda kilit yazar tarafından şekillendirilirken, iş birliği büyük ölçüde İngilizce konuşulan ülkelerdeki araştırma ağlarında yoğunlaşmaktadır. Analiz sonucunda tanı, risk faktörleri, tedavi, rehabilitasyon ve küresel epidemiyoloji olmak üzere beş temel araştırma teması belirlenmiştir.

Sonuç: KTK sonrası TSSB literatürü kapsamlı olmakla birlikte parçalı bir yapı göstermektedir. Araştırma üretiminin coğrafi dağılımı ile trafik travmasının küresel yükü arasında belirgin bir uyumsuzluk bulunmakta, travma araştırmaları ile ulaşım güvenliği araştırmaları arasındaki bağlantılar ise sınırlı kalmaktadır.

Anahtar sözcükler: Travma sonrası stres bozukluğu psikolojik travma, karayolu trafik kazaları, yol güvenliği

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Introduction

Road traffic crashes (RTCs) are a major global public-health problem with serious psychological consequences. According to the World Health Organization (2023a, 2023b), roughly 1.19 million people die each year on the world's roads and between 20 and 50 million more are injured, making road traffic injuries the leading cause of death among children and young adults aged 5–29. Although the United Nations has declared a second Decade of Action for Road Safety (2021–2030) (UN 2021), progress toward the target of halving road-traffic deaths by 2030 has been slow and inconsistent across regions. Most of this burden falls on low- and middle-income countries (LMICs), which account for more than 90% of global road-traffic deaths despite having around 60% of the world's motor vehicles (WHO 2023a, 2023b).

Among the psychological consequences of RTCs, post-traumatic stress disorder (PTSD) has become one of the most common, most disabling, and most clinically important outcomes. Under the DSM-5-TR (APA 2022), post-traumatic stress disorder (PTSD) is defined by four symptom clusters (intrusion, avoidance, negative alterations in cognition and mood, and hyper-arousal) that persist for more than one month and lead to clinically significant impairment in daily functioning. PTSD following road traffic crashes (RTCs) is frequently accompanied by comorbid conditions such as depression, generalized anxiety, and chronic pain, which can further complicate recovery and rehabilitation (Otis et al. 2003, Morris et al. 2012, Papadakaki et al. 2024). Reported prevalence varies widely with when and how symptoms are assessed. In a systematic meta-analysis, Lin et al. (2018) estimated a pooled PTSD rate of 22.3% among RTC survivors, while a recent review reported one-year PTSD prevalence of around 19–21% (Papadakaki et al. 2024). The pooled prevalence of delayed-onset PTSD (assessed using clinician-administered measures at six months or longer post-accident) was 13.5% (Salehi-Pourmehr et al. 2025). Substantial regional variation has also been reported; for sub-Saharan Africa, a recent meta-analysis estimated a pooled PTSD prevalence of approximately 23% among RTC survivors (Aytenew et al. 2025), a geographic pattern that itself deserves closer attention.

Despite this clinical and epidemiological burden, the specific relationship between RTCs and PTSD has received far less attention than the scale of road trauma would suggest. Although the existing literature spans trauma psychology, rehabilitation medicine, public health, and transport-safety research, it remains fragmented and rarely builds on a shared theoretical base (Papadakaki et al. 2024). Compared with neighboring PTSD literatures (combat, disaster, sexual violence), the PTSD-RTC field appears to have fewer review articles, fewer tailored intervention studies, and relatively little policy-oriented research (Heron-Delaney et al. 2013). Representative contributions to the field include the early clinical work of Mayou et al. (1993), the systematic review by Heron-Delaney et al. (2013), and review by Papadakaki et al. (2024). Nevertheless, prior review suggests that intellectual connections between these disciplines remain limited (Papadakaki et al. 2024).

These characteristics make RTC–PTSD research particularly suitable for bibliometric investigation. Bibliometric methods, especially performance analysis and science mapping (Donthu et al. 2021), can reveal the field's intellectual structure, collaboration patterns, and areas where connections remain weak. Such mapping has an important global-equity dimension. Because the burden of RTCs falls predominantly on LMICs (WHO 2023a), any mismatch between where crashes occur and where PTSD-RTC research is produced has direct implications for prevention policy and achieving the 2030 targets of the UN Decade of Action for Road Safety (UN 2021).

In light of this background, the present study aims to make three contributions that distinguish it from earlier PTSD bibliometric research. First, it treats road traffic crashes as a distinct trauma domain rather than subsuming them within broader categories such as injury or civilian trauma, thereby providing a domain-specific bibliometric account of RTC-related PTSD research. Second, it combines performance analysis with layered science mapping (co-authorship, keyword co-occurrence, co-citation, and bibliographic coupling) to develop a more integrated understanding of the field's intellectual structure. Third, it investigates the intellectual connections between trauma psychology and the transport-safety, human-factors, and injury-prevention literatures, thereby providing evidence on the extent of their integration and its implications for the global road-safety agenda (UN 2021, Papadakaki et al. 2024).

Accordingly, the study examines publication and citation trends, identifies the leading authors, institutions, countries, and journals, maps the conceptual and intellectual structure of the field, and highlights emerging themes, research gaps, and geographical imbalances to inform future interdisciplinary research and policy development.

Method

Data Gathering and Processing

Data for this bibliometric analysis were collected from the Web of Science (WoS) Core Collection, chosen for its broad coverage of peer-reviewed scholarly output across sciences, as well as its standardized indexing, citation linkage, and comprehensive bibliographic metadata that facilitate transparent and reproducible bibliometric analyses (Zupic and Čater 2015, Donthu et al. 2021). To improve methodological transparency, the reporting of the search strategy and study-selection process was informed, where applicable, by the PRISMA-S statement (Rethlefsen et al. 2021).

A broad search strategy was employed to maximize recall without sacrificing relevance. An iterative exploration of the literature was first used to identify the principal terms used to denote PTSD and road traffic crashes across journals and subfields; these were then consolidated into the final topic-search (TS) query (Table 1).

Table 1. Research process and data-selection criteria

Step	Process	Result
1. Search query	TS=("post-traumatic stress disorder" OR PTSD) AND TS=("traffic accident" OR "road accident*" OR "motor vehicle accident*" OR "car crash*" OR "traffic crash*" OR "road traffic crash*" OR "vehicle crash*" OR "traffic collision*")	N = 863 documents
2. Document-type filter	Reviews and other non-article document types excluded	N = 791 articles
3. Early-access filter	Early-access article excluded (metadata not finalized)	N = 790 articles
4. Final dataset	Dataset used for the bibliometric analysis	N = 790 articles

TS = topic search (title, abstract, author keywords, Keywords Plus) in the Web of Science Core Collection..

The initial query returned N = 863 records across all document types. Records from 2026 were excluded from inferential and trend modeling because the year was incomplete at the time of the search; the very small number of 2026 records that appeared in the export are reported descriptively only and were not used in the year-by-year trend interpretation. Study selection was performed using predefined eligibility criteria. Only peer-reviewed original research articles indexed in the WoS Core Collection were eligible for inclusion. Reviews, conference proceedings, meeting abstracts, book chapters, editorial materials, letters, and other non-article document types were excluded to ensure methodological consistency and comparability across bibliometric indicators.

Following document-type screening, 791 journal articles remained. One Early Access article was subsequently excluded because its bibliographic information and citation data were not yet stable, resulting in a final dataset of N = 790 journal articles. The complete study-selection workflow is summarized in Table 1.

Throughout this review, the term road traffic crash (RTC) is used consistently, while the original terminology used in cited studies (e.g., motor vehicle accident [MVA] or road traffic accident [RTA]) is retained where appropriate. Furthermore, this study is a bibliometric analysis based solely on previously published, publicly available bibliographic records retrieved from the Web of Science Core Collection; it does not involve any human participants, identifiable personal data, or animal subjects. Therefore, approval from an ethics committee was not required for this study.

Data Analysis

Bibliometric analysis consists of two main components: performance analysis and science mapping (Cobo et al. 2011, Zupic and Čater 2015, Donthu et al. 2021). Performance analysis evaluates the productivity and scientific impact of a research field using indicators such as publication output, citation impact, leading authors, institutions, countries, and journals. Science mapping, in turn, examines the intellectual, conceptual, and social structure of the field through network-based techniques, including co-authorship, co-citation, keyword co-occurrence, and bibliographic coupling. Together, these methods provide a comprehensive understanding of both the scientific performance and the knowledge structure of the research domain.

The retrieved records (Full Record and Cited References) were exported from Web of Science and imported into VOSviewer (1.6.20, Van Eck and Waltman 2017) for network construction and visualization. Descriptive performance indicators (annual publication and citation counts, h-index, average citations per article) were computed directly from the Web of Science Citation Report and cross-checked against the exported records. Python 3.10 was used for data cleaning, frequency analysis, Lotka- and Bradford-law fitting, and figure generation.

Results

Annual Publication Trends

Annual output (N = 790, 41,585 citations, h-index = 104) evolved through three distinct phases (see Figure 1). An emergent phase (1991–1999) was characterized by fewer than ten publications per year, reflecting the early development of research on PTSD following road traffic crashes. A sustained expansion phase (2000–2014) increased annual output to 20–37 articles, reaching a maximum of 37 publications in 2011. This was followed by a stabilization phase (2015–2022), during which annual publication output remained relatively stable at 25–33 articles per year. An apparent reduction was observed for 2023–2025 (n = 12, 17, and 13). However, this apparent decline should be interpreted cautiously because recent publication years are typically affected by indexing delays, incomplete database coverage, and the time required for newly published articles to be fully indexed.

Citation activity lagged behind publication output, with annual citations peaking between 2019 and 2021 (2,243; 2,319; and 2,426, respectively), approximately eight years after the publication peak (Figure 1). Overall, the literature accumulated 41,585 citations, corresponding to an average of 52.6 citations per article and an h-index of 104.

Most Productive Journals, Authors, Institutions, and Countries

Output is strongly concentrated at both the journal and author levels. The Journal of Traumatic Stress alone accounts for roughly 7% of the literature, and the top-3 journals combined contribute well nearly 15% of all articles (Figure 2). Likewise, publication output is concentrated among a relatively small group of authors (Figure 3).

Author productivity closely follows Lotka's Law. Fitting $f(k) = C/k^{\alpha}$ to the 2,563 distinct authors yielded $\alpha = 2.31$ ($R^2 = 0.954$), closely matching Lotka's (1926) theoretical expectation of $\alpha \approx 2$ (Figure 4). Approximately 80% of authors contribute only one article, while a relatively small group accounted for a substantial share of the literature. This pattern is consistent with classical bibliometric theory and previous PTSD bibliometric research (Wan et al. 2025).

Country-level output is dominated by a small set of English-speaking economies (Table 3). The United States produces roughly 38% of all the literature, followed by Australia, the United Kingdom, and Germany. The combined output of all low- and middle-income countries (LMICs) falls below 10%, despite the fact that more than nine in ten road-traffic fatalities occur in LMICs (WHO 2023a).

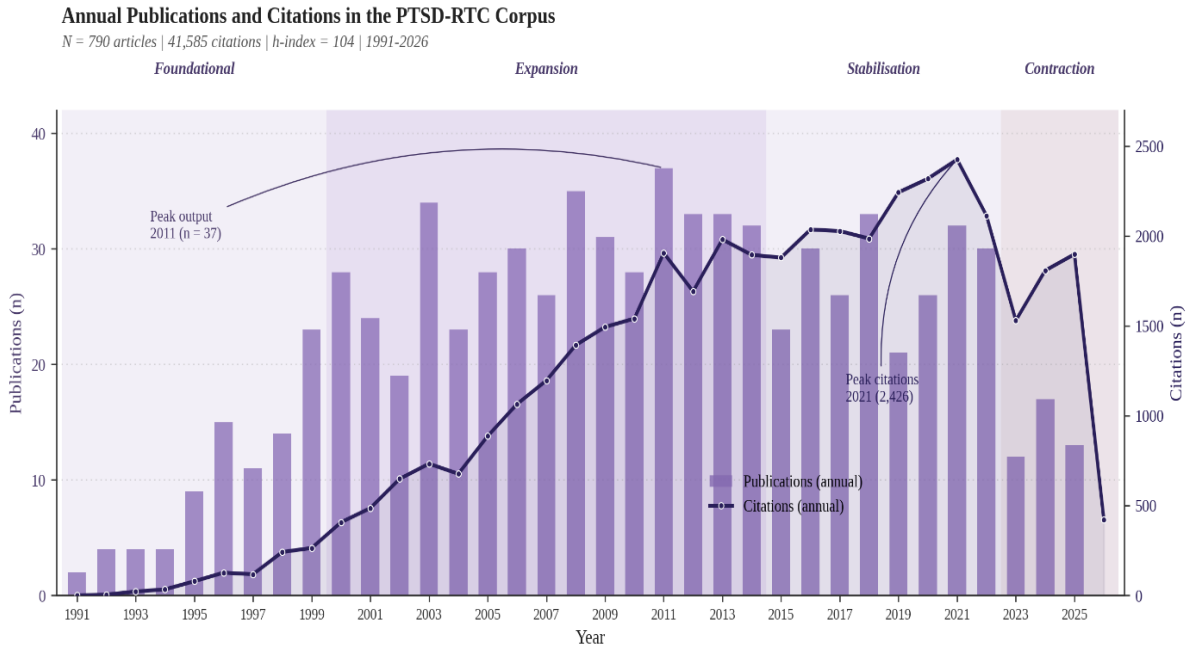


Figure 1. Annual publications and citations* for the PTSD-RTC literature (1991-2025)*

**Lavender bars = number of articles published per year (left axis, exact counts sum to N = 790). Dark line = total citations received per year by the literature (right axis).*

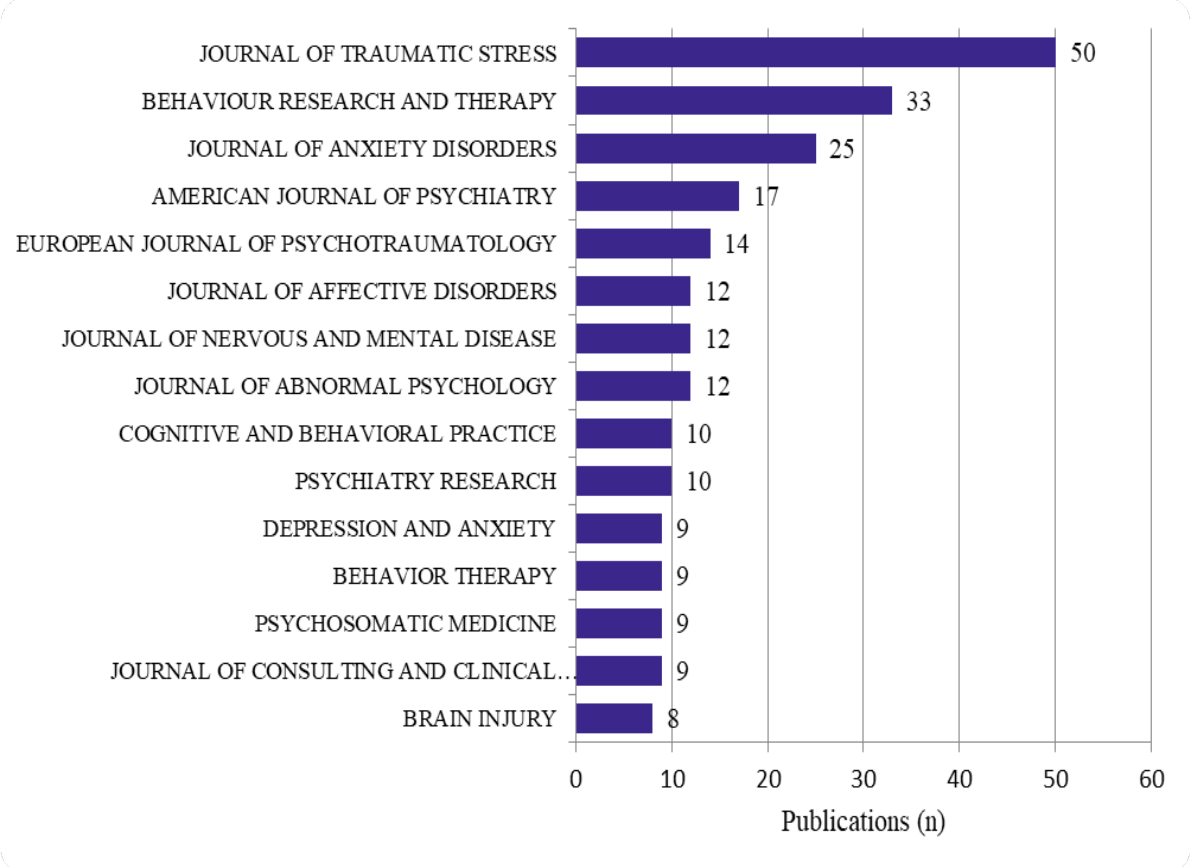


Figure 2. Top 15 source journals for the PTSD-RTC literature

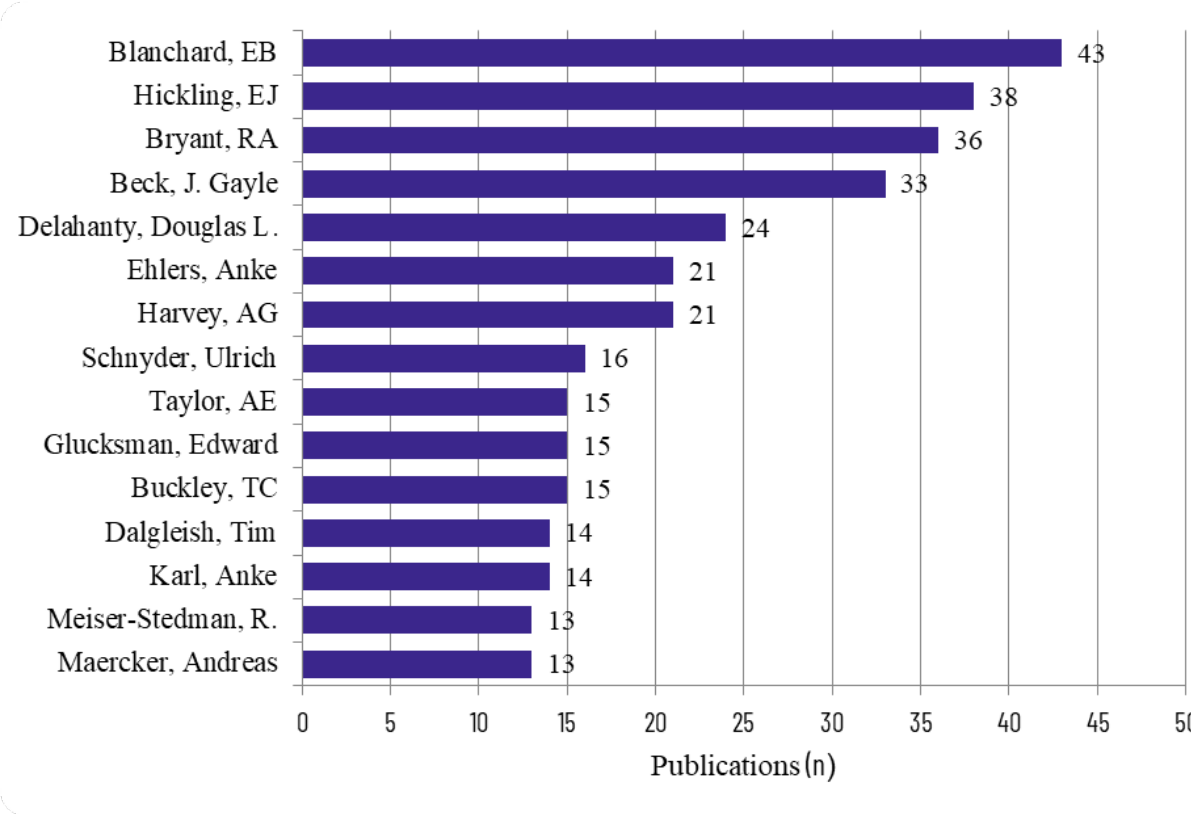


Figure 3. Top 15 authors by publication count

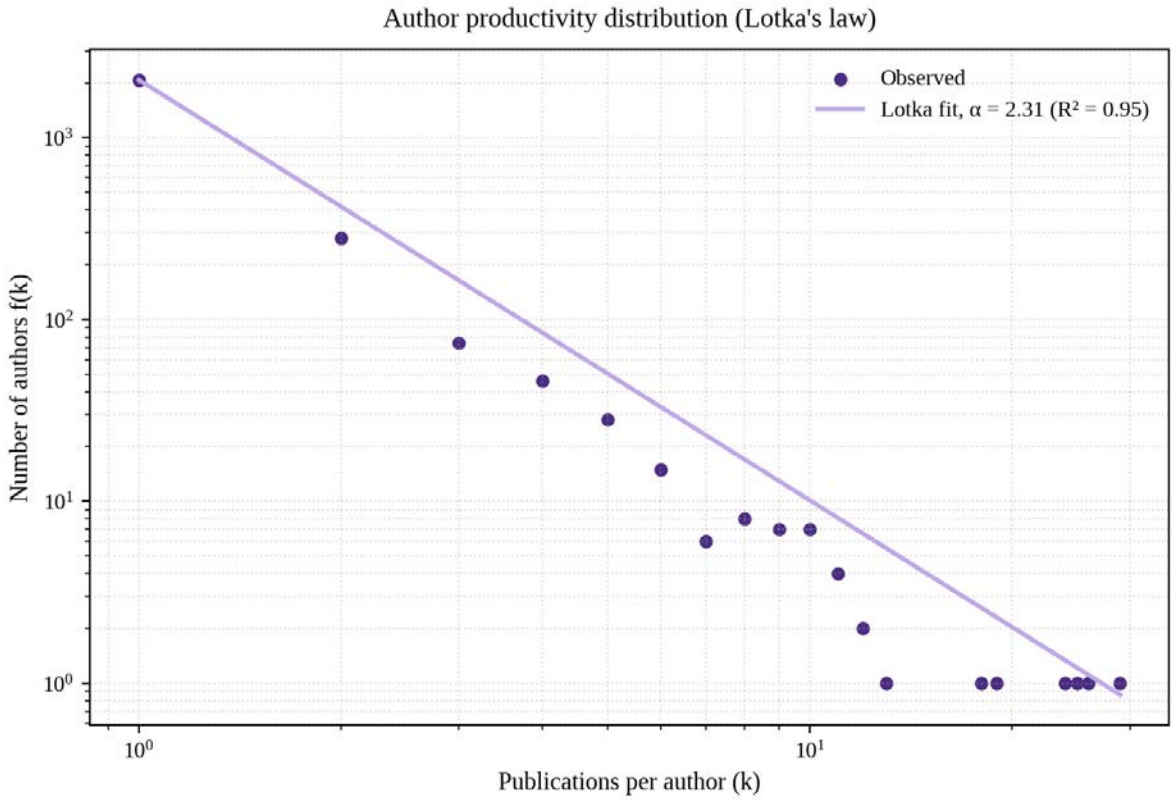


Figure 4. Author-productivity distribution and Lotka's-law fit* (log-log)

*Observed frequency of authors producing k papers plotted against k (log-log). Fit was estimated by ordinary-least-squares regression of log f(k) on log k; the exponent $\alpha = 2.31$ closely matches Lotka's canonical value of 2.

Table 2. Top 10 institutional affiliations contributing to the PTSD-RTC literature (N = 790)		
Rank	**Institution**	**Articles (n)**
1	State University of New York (SUNY) System	69
2	University of New South Wales Sydney	50
3	Harvard University	49
4	US Department of Veterans Affairs	45
5	University at Albany, SUNY	44
5	Veterans Health Administration (VHA)	44
7	Harvard University Medical Affiliates	42
7	University of London	42
9	University of Oxford	34
10	King's College London	33

Counts reflect Web of Science institutional address assignments; multi-author articles are counted once per distinct affiliation. Affiliations can overlap (e.g., SUNY System includes University at Albany, SUNY).

The subject-category and Research Area distributions indicate the interdisciplinary but psychiatrically anchored profile of the field (Tables 4 and 5). Psychiatry and Clinical Psychology dominate both rankings, with secondary contributions from Neurosciences, Public Health, and Rehabilitation. Transport-science, human-factors, and engineering categories are not represented among the leading subject categories, consistent with previous observations that trauma and transport-safety research remain weakly integrated (Papadakaki et al. 2024).

Table 3. Top 10 countries/regions by number of publications (N = 790)			
Rank	**Country/Region**	**Articles (n)**	**Share (%)**
1	USA	300	38.0
2	Australia	111	14.1
3	England	101	12.8
4	Germany	59	7.5
5	Israel	40	5.1
5	Netherlands	40	5.1
7	Switzerland	39	4.9
8	Canada	36	4.6
9	France	25	3.2
10	Poland	24	3.0

Country assignment based on Web of Science author-address metadata. Articles with authors from multiple countries are counted once per country; column totals therefore exceed 100%.

Table 4. Top 10 Web of Science subject categories for the PTSD-RTC literature (N = 790)			
Rank	**Web of Science Category**	**Articles (n)**	**Share (%)**
1	Psychiatry	391	49.5
2	Psychology, Clinical	294	37.2
3	Psychology	75	9.5
4	Clinical Neurology	71	9.0
4	Neurosciences	71	9.0
6	Psychology, Multidisciplinary	65	8.2
7	Medicine, General & Internal	32	4.1
8	Public, Environmental & Occupational Health	28	3.5
9	Critical Care Medicine	26	3.3
10	Rehabilitation	26	3.3

Web of Science assigns each journal to one or more subject categories; articles are therefore counted under every category of their source journal, and percentages sum to more than 100%.

Table 5. Top 10 Web of Science research areas for the PTSD-RTC literature (N = 790)			
Rank	**Research Area**	**Articles (n)**	**Share (%)**
1	Psychology	408	51.6
2	Psychiatry	391	49.5
3	Neurosciences & Neurology	128	16.2
4	General & Internal Medicine	58	7.3
5	Public, Environmental & Occupational Health	28	3.5
6	Rehabilitation	26	3.3
6	Surgery	26	3.3
8	Emergency Medicine	15	1.9
9	Orthopedics	14	1.8
10	Anesthesiology	13	1.6

Research Areas are broader roll-ups of the more granular Web of Science Subject Categories. A single article can be assigned to multiple research areas, so percentages sum to more than 100%

Highly Cited Publications

To identify the most influential works in the literature, articles were ranked by total citations (TC) as reported by Web of Science at the time of data extraction. Table 6 lists the 20 most cited publications, together with total citations and citations per year (TC/yr), which controls for publication age. These 20 papers account for 11,123 citations (26.7% of the all citations), indicating a strongly skewed impact distribution in which a small subset of works drives a substantial share of the field's citation activity. Blanchard et al. (1996) on the PCL (PTSD Checklist) occupies the first citation rank, with Norris (1992) on the epidemiology of trauma in second position; Beck et al. (2008) on the IES-R is the most cited psychometric study after the PCL paper and ranks within the top ten (Table 6). The most highly cited publications include a cognitive-theoretical strand (Ehlers et al. 1998, Ehlers et al. 2003, Brewin 2011). An epidemiological-prognostic strand includes Norris (1992), Lin et al. (2018), and Dai et al.'s (2018) meta-analysis of acute stress disorder prevalence among RTC survivors. A further group of highly cited studies examines biological markers and longitudinal risk factors (Delahanty et al. 2000, Bryant et al. 2000, Heinrichs et al. 2005, the latter in firefighters rather than RTC survivors). While citation counts identify the most influential works, co-authorship analysis shows how collaboration structures shape the production of this knowledge.

Co-authorship Network Analysis

Co-authorship analysis was carried out in VOSviewer at the author, institution, and country levels in order to characterize the collaborative architecture of the PTSD-RTC field. Full-counting weighting was used and the minimum-document threshold was set separately for each network (three documents for authors, three documents for institutions, five documents for countries).

At the author level, the co-authorship network displays a modular structure composed of four relatively dense clusters, including a Japanese group (Kim, Matsuoka, Yonemoto), a European cognitive-trauma group (Ehlers, Ehring, Dalgleish, Meiser-Stedman), a cross-national group centered on Bryant, Schnyder and Seedat, and a North American group around Delahanty, connected to one another only through a small number of weak inter-cluster links. While Bryant, and to a lesser extent Schnyder and Seedat, occupy bridging positions between clusters, Ehlers is connected within the European cognitive-trauma cluster rather than across clusters. Overall, the network indicates relatively limited connectivity between the major collaboration clusters (Figure 5).

Table 6. Top 20 most-cited publications in the PTSD-RTC literature (ranked by total citations in Web of Science)

Rank	Authors (Year)	Title	Journal	TC	TC/yr
1	Blanchard et al.(1996)	Psychometric properties of the PTSD Checklist (PCL)	Behaviour Research and Therapy	3,326	107.3
2	Norris (1992)	Epidemiology of trauma: Frequency and impact of different potentially traumatic events	Journal of Consulting and Clinical Psychology	1,004	28.7
3	Ehlers et al.(1998)	Psychological predictors of chronic PTSD after motor vehicle accidents	Journal of Abnormal Psychology	759	26.2
4	Schneiderman et al.(2008)	Sequelae of injury mechanisms and mild TBI from Iraq/Afghanistan conflicts	American Journal of Epidemiology	622	32.7
5	Mayou et al.(1993)	Psychiatric consequences of road traffic accidents	British Medical Journal	446	13.1
6	Stein et al.(2002)	Genetic and environmental influences on trauma exposure and PTSD symptoms: A twin study	American Journal of Psychiatry	430	17.2
7	Clohessy and Ehlers (1999)	PTSD symptoms, response to intrusive memories and coping in ambulance service workers	British Journal of Clinical Psychology	427	15.2
8	Beck et al.(2008)	The Impact of Event Scale-Revised: Psychometric properties in MVA survivors	Journal of Anxiety Disorders	388	20.4
9	Morris et al.(2012)	PTSD, comorbid major depression, and HPA function: Meta-analysis	Clinical Psychology Review	378	25.2
10	Murray et al.(2002)	Dissociation and PTSD: Two prospective studies of road traffic accident survivors	British Journal of Psychiatry	371	14.8
11	Boscarino (2006)	PTSD and mortality among US army veterans 30 years after military service	Annals of Epidemiology	347	16.5
12	Ehlers and ark. (2003)	RCT of cognitive therapy, self-help booklet, repeated assessments as early PTSD interventions	Archives of General Psychiatry	339	14.1
13	Harandy and Bryant (1998)	Relationship between acute stress disorder and PTSD in MVA survivors	Journal of Consulting and Clinical Psychology	337	11.6
14	Otis et al.(2003)	Relationship between chronic pain and PTSD	Journal of Rehabilitation Research and Development	317	13.2
15	Brewin (2011)	Nature and significance of memory disturbance in PTSD	Annual Review of Clinical Psychology	312	19.5
16	Koren et al.(2002)	Sleep complaints as early predictors of PTSD: 1-year prospective study in MVA survivors	American Journal of Psychiatry	305	12.2
17	Delahanty et al.(2000)	Initial posttraumatic urinary cortisol predicts PTSD symptoms in MVA victims	Biological Psychiatry	264	9.8
18	Steil and Ehlers (2000)	Dysfunctional meaning of posttraumatic intrusions in chronic PTSD	Behaviour Research and Therapy	257	9.5
19	Bryant et al.(2000)	Prospective study of psychophysiological arousal, ASD, and PTSD	Journal of Abnormal Psychology	252	9.3
20	Heinrichs et al.(2005)	Predicting PTSS from pretraumatic risk factors: 2-year study in firefighters	American Journal of Psychiatry	242	11.0

TC = total citations as reported by Web of Science; TC/yr = total citations per year; PTSD = post-traumatic stress disorder; PCL = PTSD Checklist; MVA = motor vehicle accident; ASD = acute stress disorder; TBI = traumatic brain injury; HPA = hypothalamic-pituitary-adrenal; RCT = randomized controlled trial; PTSS = posttraumatic stress symptoms.

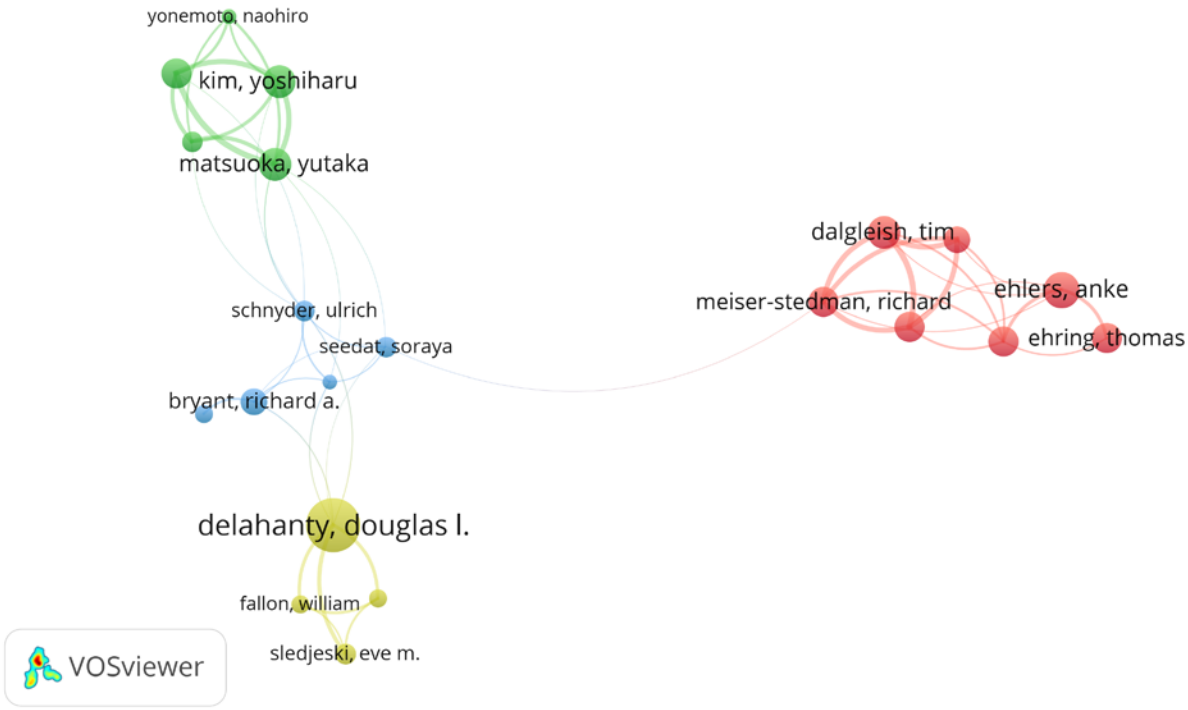


Figure 5. Co-authorship network of the PTSD-RTC literature (author level)

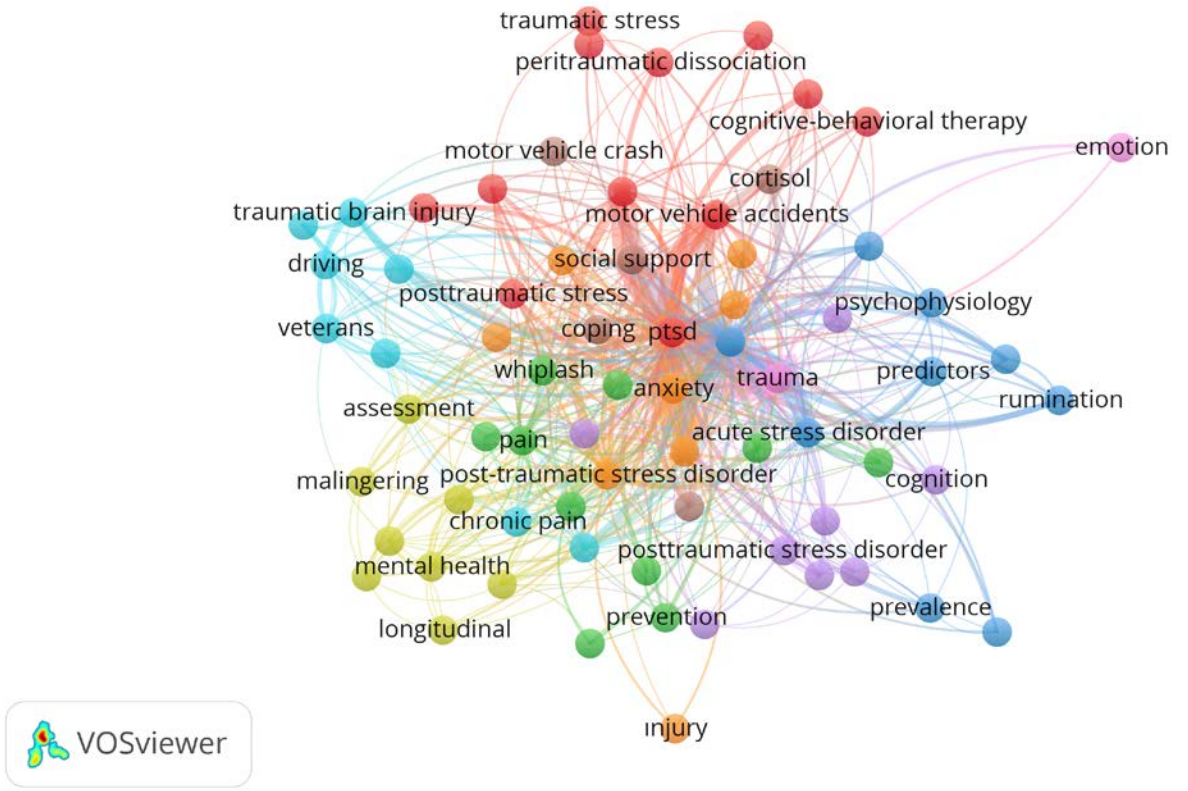


Figure 6. Keyword co-occurrence network of the PTSD-RTC literature*

* Nodes = author keywords meeting the minimum-occurrence threshold; node size is proportional to number of occurrences; edge thickness is proportional to the number of co-occurrences; colors denote modularity-based clusters. Thesaurus merging applied prior to network construction.

Keyword Co-occurrence Clusters

The keyword co-occurrence map (Figure 6) is centered on a small set of high-frequency hub terms (ptsd, trauma, posttraumatic stress disorder, anxiety, and acute stress disorder) that occupy the center of the network and exhibit the densest connectivity. Around this core, four preliminary thematic clusters can be identified: an assessment/diagnosis cluster (assessment, malingering, prevalence, predictors), an intervention cluster (cognitive-behavioral therapy, coping, prevention), an injury/rehabilitation cluster (traumatic brain injury, motor vehicle crash/accidents, whiplash, chronic pain, veterans), and a comorbidity/psychophysiology cluster (psychophysiology, cortisol, rumination, cognition, emotion).

Co-citation Network Analysis

Co-citation analysis was performed separately on cited references, cited authors, and cited sources. Minimum-citation thresholds were 20 co-citations for references, 50 co-citations for authors, and 25 for journals. Full-counting weighting and modularity-based clustering were applied. In the co-citation maps (Figures 7 and 8), author–year labels denote the works and authors identified as network nodes; these represent analytic (network) data rather than sources cited to support specific claims and, unless discussed substantively in the text, are not individually listed in the References.

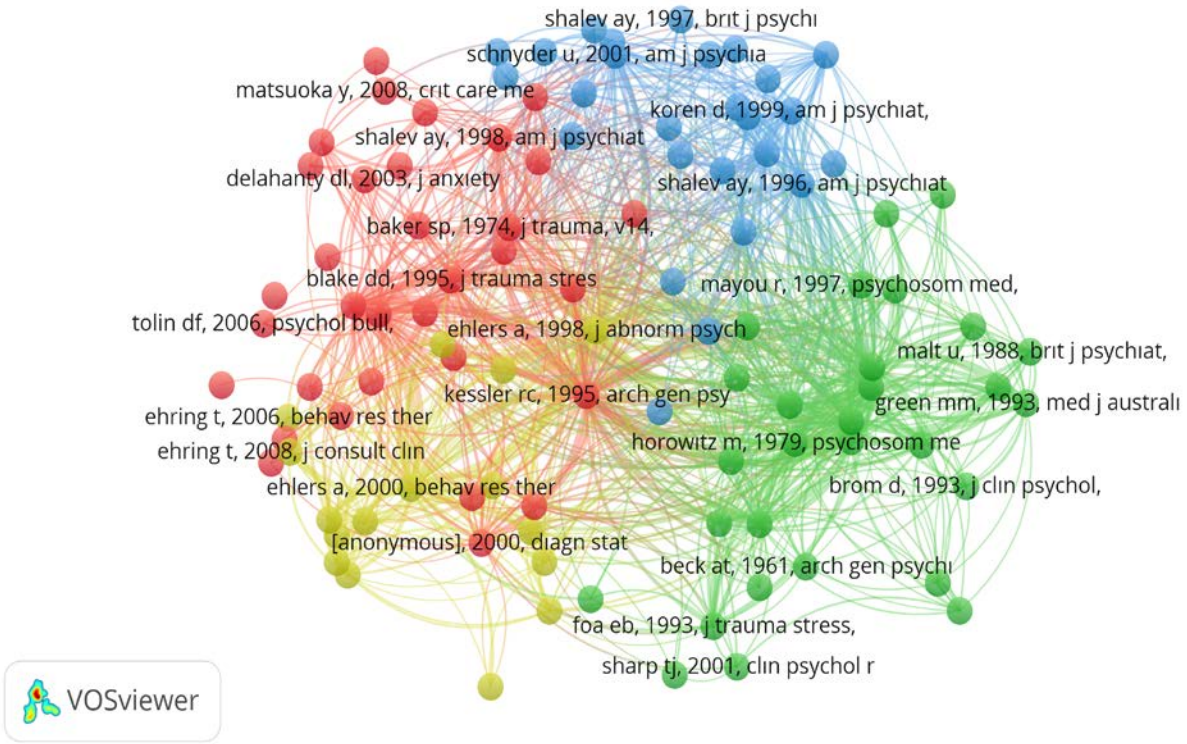


Figure 7. Co-citation network of cited references

*Nodes = cited references meeting the minimum-co-citation threshold; node size is proportional to number of citations received within the literature; edge thickness is proportional to the number of co-citations. Network built from the Web of Science cited-references. Node labels denote first author and year of the items identified in the Web of Science network analysis; they are analytic data and are not individually listed in the References unless discussed in the text

For cited references (Figure 7), the co-citation structure is organized into four major clusters. A first cluster (green, right) comprises foundational epidemiological and early RTC/injury-PTSD studies of the late 1970s–1990s (Horowitz 1979, Malt 1988, Brom 1993, Green 1993, Mayou 1997). A second cluster (yellow, bottom) groups classical assessment, diagnostic and theoretical references, Beck (1961), Foa (1993), Kessler et al. (1995) and Sharp and Harvey's (2001) mutual-maintenance model linking chronic pain and PTSD. A cluster (red, left) includes studies related to cognitive models and cognitive predictors (Ehlers et

al. 1998, Ehlers and Clark 2000, Ehring et al. 2006, Tolin and Foa 2006, Ehring et al. 2008), complemented by the CAPS measurement tradition (Blake et al. 1995) and the Injury Severity Score literature (Baker et al. 1974). A fourth cluster (blue, top) includes studies on biological markers and longitudinal predictors (Shalev et al. 1996, 1997, 1998, Koren et al. 1999, Schnyder et al. 2001, Delahanty et al. 2003, Matsuoka et al. 2008). The four clusters are connected primarily through the Ehlers cognitive-model literature, which occupies a central position within the co-citation network.

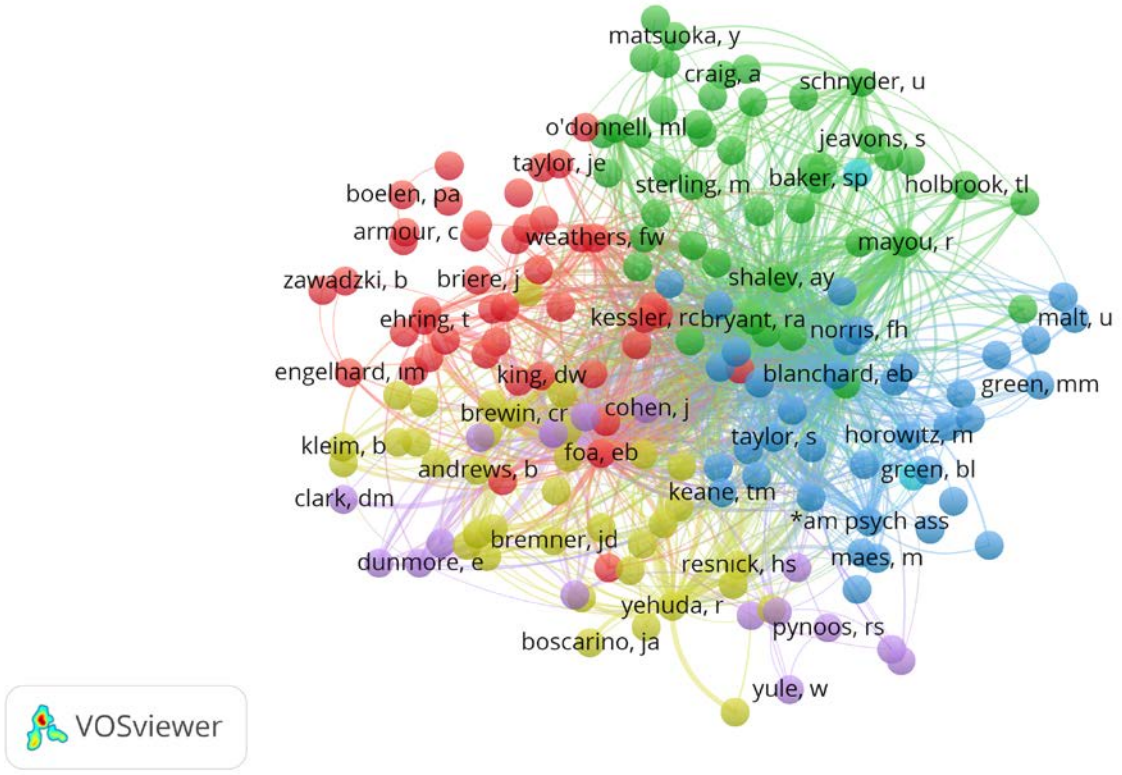


Figure 8. Co-citation network of cited authors*

* Nodes = cited authors meeting the minimum-co-citation threshold; node size is proportional to number of citations; edge thickness is proportional to author-level co-citations. Node labels denote the names of cited authors identified in the Web of Science author co-citation analysis; they are analytic data and are not individually listed in the References unless discussed in the text.

For cited authors (Figure 8), the map organizes into five distinguishable author-communities. A first cluster (red, left) centers on the cognitive-model and cognitive-behavioral literature (Ehring, Engelhard, Clark, Dunmore, Brewin, Kleim, Andrews, Boelen, Foa). A second cluster (blue, center) groups frequently co-cited empirical PTSD researchers linking assessment, acute prediction and intervention (Bryant, Blanchard, Kessler, Shalev, Weathers, Norris, Taylor). A third cluster (green, right) aggregates the RTC/injury and acute-trauma literature (Mayou, Malt, Green, Sterling, O'Donnell, Schnyder, Matsuoka, Holbrook, Horowitz, Baker, Craig). A fourth cluster (yellow, bottom) corresponds to the combat/veteran and exposure-treatment tradition (Keane, Resnick, Cohen, Foa). A fifth, smaller cluster (purple, lower-left) reflects the neurobiological-trauma literature (Bremner, Yehuda, Pynoos, Boscarino, Yule). Foa, Bryant, and Kessler occupy central positions within the co-citation network and are connected to multiple clusters, while Blanchard and Shalev also link the assessment and injury-related clusters.

Bibliographic Coupling Analysis

Whereas co-citation analysis captures the intellectual base, bibliographic coupling characterizes the research front: documents are linked when they share cited references, and clusters therefore reflect thematically related contemporary work. In the bibliographic-coupling map (Figure 9), author–year labels denote the documents identified as network nodes; these represent analytic (network) data rather than

sources cited to support specific claims and, unless discussed substantively in the text, are not individually listed in the References.

Five clusters are distinguishable in the document-level bibliographic coupling map (Figure 9). A first cluster (red, right) groups early and influential RTC/injury-PTSD cohort and prevalence studies (Norris 1992, Mayou 1993, Blanchard 1996, Doherty 1999, Bryant 2000, Large 2001, McMillan 2001, Kuhn 2003). A second cluster (blue, upper-left) groups documents related to cognitive models and child/adolescent trauma (Murray 2002, Ehlers 2003, Meiser-Stedman 2005, De Young 2007, Luszczynska 2009, Bui 2010, Brewin 2011, Weston 2014) that share a similar cognitive-theoretical reference base. A third cluster (yellow, center-top) is centered on studies by Ehring and colleagues concerning cognitive predictors and rumination (Ehring 2008, Doerfel 2008). A fourth cluster (purple, center-bottom) groups comorbidity, chronic-pain and injury-rehabilitation studies (Eidlitz-Markus 2000, Otis 2003, Boscarino 2006, Ablin 2008, Beck 2008, Grant 2008, Kongsted 2008), which share references related to rehabilitation-medicine and pain-psychology sources. A fifth cluster (green, lower) comprises more recent and methodologically broader studies (Stein 2002, Schneiderman 2008, Belanger 2009, Rosenthal 2013, Benfer 2018, Vasterling 2018, Alenko 2019, Shalev 2019), and shares fewer references with the earlier RTC/PTSD literature. Overall, the coupling map indicates that the early empirical and cognitive-model studies remain closely connected within the literature, whereas the more recent green cluster forms a comparatively distinct group of publications.

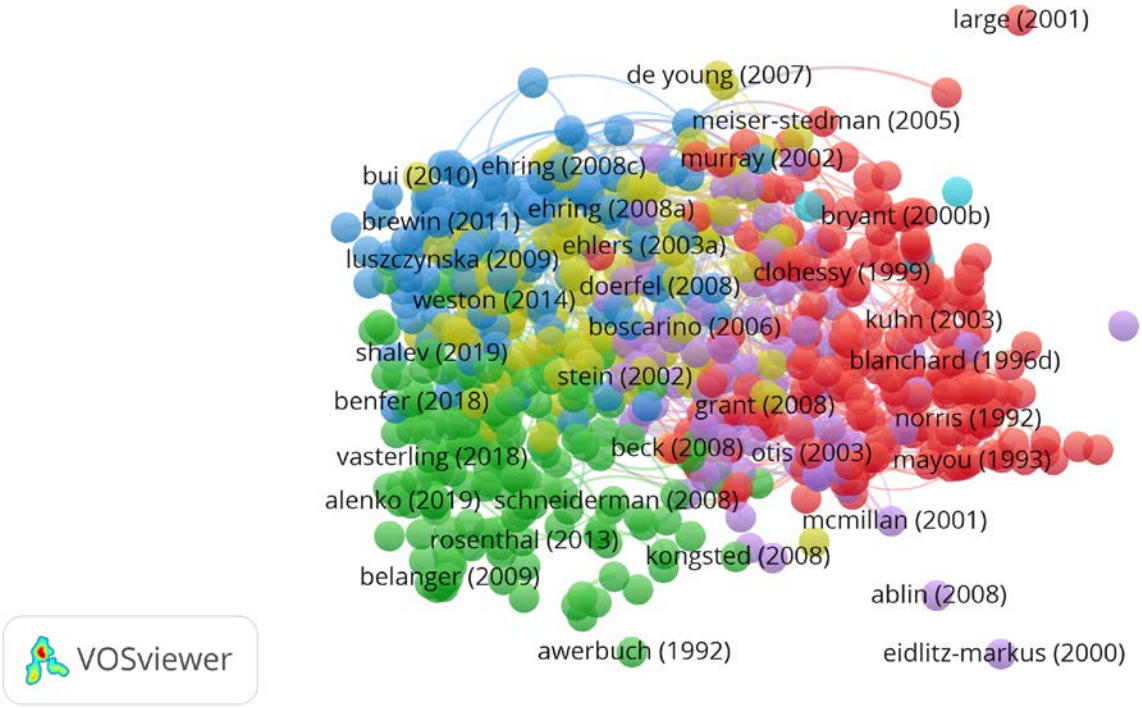


Figure 9. Bibliographic-coupling network at the document level*

*Nodes = documents meeting the minimum-coupling threshold; node size is proportional to number of citations received; edge thickness is proportional to shared-reference overlap; colors denote modularity-based clusters. Network built from the Web of Science cited-references file. Node labels denote first author and year of the items identified in the Web of Science network analysis; they are analytic data and are not individually listed in the References unless discussed in the text.

Discussion

The present results permit a compact synthesis organized around four structural findings. The literature is characterized by field fragmentation and limited cross-cluster citation exchange, a geographic mismatch between evidence and burden, weak intellectual coupling to road-safety and behavioral-transport research, and a clinical-translational agenda that is realistically constrained by the current distribution of evidence.

The convergent keyword, topic-cluster, co-citation, and coupling evidence can be read as a field that is not simply multi-topic but also structurally fragmented, with research communities that rarely cite one another across cluster boundaries. This pattern is interpreted as consistent with, rather than conclusive proof of, a fragmented research landscape. The inference is drawn from the relative density of within- versus between-cluster citation exchange and from the absence of shared reference anchors across clusters, and would be strengthened by full-text content analysis in future work. The assessment/psychometric cluster (Blanchard et al. 1996, Beck et al. 2008), the cognitive-theoretical cluster (Ehlers et al. 2003), the epidemiological-prognostic cluster (Heron-Delaney et al. 2013, Dai et al. 2018, Lin et al. 2018), the biomarker and longitudinal-predictor cluster (Delahanty et al. 2000, Heinrichs et al. 2005), and the rehabilitation / comorbidity cluster exchange references internally far more readily than across cluster boundaries. Comparable bibliometric analyses of other interdisciplinary fields caution that such structures vary: some prove less fragmented and more centralized than often assumed (Wang et al. 2023), while others mature into more cohesive domains over time (Pisarevskaya et al. 2020). This suggests that the fragmentation inferred here for the RTC–PTSD field should likewise be tested directly rather than presumed. This interpretive approach is consistent with broader bibliometric diagnostics of medium-sized research sub-fields (Donthu et al. 2021, Wan et al. 2025). Thematic evolution since 2010 has deepened specialization within clusters without proportionally strengthening cross-cluster translation.

The sharpest finding of the analysis is a structural mismatch between the geography of research production and the geography of the underlying burden. The United States, Australia, the United Kingdom, and Germany together account for the majority of literature output, while LMICs, which shoulder approximately 92% of global road-traffic deaths (World Health Organization 2023a), contribute under 10%. The Sub-Saharan Africa regional meta-analysis of Aytenew et al. (2025) estimates a pooled PTSD prevalence of 23.4% among RTC survivors in the region, comparable to some high-income estimates, although the authors themselves note that it is relatively low compared with studies conducted outside the region, yet the region's scientific footprint in the global literature is negligible. This asymmetry may limit the external validity of the field's dominant psychometric instruments (largely validated in high-income samples) and is likely to complicate the design of contextually appropriate prevention and treatment strategies; this remains a hypothesis that should be tested against direct instrument-adaptation and cross-cultural validation studies in LMIC settings rather than asserted on the basis of bibliometric geography alone (Papadakaki et al. 2024, Aytenew et al. 2025). This geographic imbalance further reinforces a deeper structural issue: the limited intellectual traffic between PTSD research and the transport-safety literatures that frame road trauma as a public-health problem. Several factors may contribute to this imbalance, including disparities in research funding, bibliographic coverage of regional journals, access to international collaborations, and competing public-health priorities within many LMICs. Although these explanations remain speculative, they are consistent with broader patterns reported in the global health and scientometric literature.

One of the principal bibliometric findings of this analysis, and one that has received relatively limited attention in the parent literatures, is the weak intellectual coupling between PTSD research and the transport-safety, human-factors, and injury-prevention literatures. This pattern is interpreted here as the trauma–transport disconnection and constitutes one of the main contributions of the present study. The co-citation and bibliographic-coupling maps contain very few references from transport engineering, road design, or traffic-policy research, while the subject-category distribution is dominated by Psychiatry, Clinical Psychology, and Neurosciences, with Transportation and Engineering largely absent.

A possible explanation for this persistent separation is that the two research traditions differ fundamentally in their primary unit of analysis. PTSD research is predominantly individual-centered, focusing on psychological symptoms, diagnosis, treatment, recovery, and long-term mental-health outcomes following trauma. In contrast, transport-safety research generally adopts a systems perspective, emphasizing infrastructure, vehicle design, traffic environments, human factors, and population-level injury prevention. Consequently, the limited intellectual coupling observed in the present study may reflect not only relatively limited cross-disciplinary interaction but also these fundamentally different research orientations. Rather than representing competing perspectives, the two traditions

should be viewed as complementary, with greater integration offering opportunities to improve both scientific understanding and policy development.

This separation is also reflected at the policy level. The Global Plan for the Decade of Action for Road Safety (United Nations 2021) emphasizes infrastructure, vehicle design, speed management, and emergency care but gives only limited attention to the long-term psychological consequences experienced by crash survivors. Similarly, recent European reviews have shown that PTSD and other mental-health outcomes remain under-addressed within post-crash care pathways (Papadakaki et al. 2024). Notably, Papadakaki et al. (2024) represent one of the few attempts to connect post-crash mental-health outcomes with road-safety policy and post-crash care pathways. Although such integrative studies remain relatively uncommon, they highlight the potential for closer interdisciplinary collaboration. As a result, long-term psychological consequences remain only partially incorporated into transport-policy frameworks, contributing to an underestimation of the societal burden of road trauma and to the limited inclusion of mental-health indicators in Safe-System performance frameworks (United Nations 2021, Papadakaki et al. 2024). Taken together, these findings suggest that better integration of long-term psychological consequences into transport-policy frameworks could support more comprehensive post-crash care while also strengthening evidence-informed transport policy.

Four implications follow directly from the bibliometric picture. First, the field relies heavily on a small number of self-report instruments (e.g., PCL, IES-R, PDS) developed and validated almost exclusively in high-income, English-speaking populations. Expanding cross-cultural and, in particular, low- and middle-income country (LMIC) validation studies is therefore a methodological priority (Aytenew et al. 2025). Second, pragmatic clinical trials conducted in LMIC road-traffic settings remain scarce. Closing this gap will require international collaborative trial networks that share harmonized protocols, outcome measures and data-sharing agreements between high- and low-income contexts (Papadakaki et al. 2024, Aytenew et al. 2025). Third, the current literature treats road-traffic injury and post-traumatic mental health as parallel but largely separate research streams. Embedding routine post-crash mental-health screening and brief early intervention within the Safe-System pillars of the UN Decade of Action for Road Safety (United Nations 2021) would help operationalize this link at the policy level. Examples of relevant mental-health indicators include routine screening rates for PTSD, depression, and anxiety among crash survivors, referral rates to mental-health services, uptake of psychological follow-up, return-to-work outcomes, and patient-reported quality-of-life measures (Papadakaki et al. 2024). Fourth, there is a marked imbalance between the field's theoretical maturity, particularly in cognitive-model and acute-predictor research and its comparatively limited output in applied translation. Greater investment in rehabilitation, return-to-work and chronic-comorbidity (pain, mTBI, depression) research would help redress this gap and enhance the field's real-world impact.

Three contributions distinguish the present study from earlier PTSD bibliometric work. It isolates the road traffic crash context as a distinct trauma domain; it combines performance analysis with layered science mapping to build a convergent picture of the field's cognitive organization; and, most consequentially, it identifies bibliometric evidence suggesting a trauma-transport disconnection as a structural feature of the field. Future work that closes this disconnection, through co-authored trials, shared outcome sets, and the integration of mental-health indicators into Safe-System performance dashboards, would represent the most consequential next step for both the literature and the populations it is meant to serve.

Several limitations should be acknowledged. First, the analysis relied solely on the Web of Science Core Collection; while WoS provides high-quality structured metadata, single-database designs underrepresent gray literature, non-English journals and regional outlets, which may have artificially amplified the geographic concentration described above. Second, the corpus was assembled with a topic-based query that, although iteratively refined, may have missed studies that describe road trauma without using the exact terms in the search string. Third, the Lotka-law was estimated using OLS regression on log-transformed productivity counts. Because OLS may bias power-law estimates, future studies should validate these findings using maximum-likelihood estimation (MLE), which is widely regarded as the standard approach for fitting power-law distributions. Fourth, the trauma-transport disconnection was diagnosed primarily through the absence of transport-engineering and human-factors categories in the

subject and co-citation networks; a more direct test would require cross-field citation-ratio analyses against a benchmark corpus. Finally, the bibliometric mapping captures structural patterns but cannot speak to the content quality of individual studies; complementary scoping or systematic reviews would be needed for that purpose.

Conclusion

Taken together, the analysis suggests that PTSD research after RTCs is intellectually mature but exhibits signs of structural fragmentation. Five themes organize the field, yet cross-fertilization between them appears limited. Scientific production is concentrated in a small group of predominantly English-speaking countries, whereas the burden of road trauma falls disproportionately on low- and middle-income countries. In addition, the bibliometric evidence indicates only limited intellectual coupling between the trauma and transport-safety literatures. Future research should prioritize cross-cultural validation of psychometric instruments in LMIC contexts, develop collaborative clinical-trial networks with shared protocols and outcome sets, and explore opportunities to better integrate mental-health indicators into Safe-System performance frameworks aligned with the UN Decade of Action for Road Safety. Strengthening collaboration between trauma research and transport-safety disciplines may represent an important step toward a more integrated evidence base for both research and policy.

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Conflict of Interest: No conflict of interest was declared.
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