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Mapping Global Road Safety Communication: A Bibliometric Analysis of Campaigns and Awareness Strategies (2000–2025)

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Abstract:

Objective: Road traffic injuries are a major global health concern, particularly in low- and middle-income countries (LMICs). While public awareness campaigns are essential for promoting safer behaviors, the research landscape remains fragmented and under-integrated. This study aimed to map the global structure of road safety communication research, identify conceptual trends, and investigate authorship, collaboration, and thematic growth patterns.

Material and Methods: A bibliometric analysis was performed on 730 Scopus-indexed documents (2000–early 2025) using Biblioshiny and VOSviewer, following bibliometric protocols. The analysis examined annual publication growth, citation impact, keyword co-occurrence, and co-authorship networks. Thematic maps, multiple correspondence analysis (MCA), and co-citation analyses were employed to explore conceptual clusters and structural progression.

Results: The findings revealed consistent growth in global publication output, predominantly from high-income countries. Three core thematic clusters emerged: public health and injury prevention, demographic and psychological profiling, and behavior-based intervention options. Collaboration networks were concentrated in Australia, the United States, and Europe, while LMIC participation remained sparse and episodic. Although digital media and emotion-based messaging are gaining attention, they remain insufficiently explored. Key gaps persist in theoretical integration, campaign evaluation rigor, and geographic inclusivity.

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Conclusion: Road safety communication research is expanding, but it remains thematically fragmented and regionally imbalanced. Future studies should prioritize interdisciplinary frameworks, leverage digital and culturally attuned strategies, and establish equitable research collaborations, especially involving underrepresented regions.

Keywords: behavior change, bibliometric analysis, public awareness, road safety, social marketing

Introduction

Road traffic injuries continue to be one of the primary causes of preventable death and disability around the world. According to the World Health Organization, road crashes kill roughly 1.19 million people per year, with millions more suffering nonfatal injuries[1]. In response, governments, non-governmental organizations, and health groups have launched public awareness campaigns and communication initiatives to encourage safer behavior.

Over the last two decades, road safety campaigns have shifted from typical public service announcements to comprehensive interventions based on behavioral science, social marketing, and health communication. The rapid rise of digital and social media has further amplified campaign reach and influence, shaping risk perception and behavioral intentions[2–4].

Despite the increasing volume and diversity of studies, the research landscape remains methodologically scattered and thematically siloed. Contributions cover transportation engineering, psychology, public health, communication, and policy studies, yet cross-disciplinary integration and theoretical coherence remain limited. Syntheses of global research trends, thematic evolutions, and patterns of scholarly collaboration are rare—particularly from the standpoint of low- and middle-income countries (LMICs)[5,6].

To address these gaps, this study uses bibliometric analysis and science mapping methodologies, drawing on Scopus-indexed publications from 2000 to early 2025. It explores global publication trends, influential contributors, thematic trajectories, and patterns of institutional and geographic collaboration[7–9].

Special focus is placed on regional inclusivity and the Global South perspective, as current literature is disproportionately shaped by high-income countries. A more balanced, context-sensitive mapping may reveal pathways for equitable knowledge production and culturally attuned interventions[10].

Research questions

1. What are the publication and citation trends in road safety communication research?

2. Who are the most influential authors, journals, and institutions?

3. What are the dominant themes and conceptual structures in the literature?

4. What does the collaboration landscape reveal about knowledge development?

5. What research gaps and opportunities exist for future interdisciplinary studies?

Material and Methods

This study used bibliometric and science mapping tools to examine the global landscape of road safety communication research, with a particular emphasis on campaigns, awareness initiatives, and social marketing strategies. The analysis followed structured bibliometric protocols as outlined by Donthu et al. (2020)[11], and was

conducted using data from the Scopus database processed through Biblioshiny (from the Bibliometrix R package) and VOSviewer[7–9].

Data source and search strategy

Scopus was chosen for its extensive multidisciplinary coverage and reliable information[12–14]. A Boolean search string was developed to ensure relevance across communication, public health, and transportation sectors. The following terms were queried in the title, abstract, and keyword fields: ("road safety" OR "traffic safety" OR "driving safety") AND ("campaign" OR "awareness program" OR "social marketing").

The search was executed in March 2025 and yielded 730 English-language publications between 1958 and early 2025. While early 2025 publications may not yet have accumulated significant citation counts due to a natural citation lag, their inclusion ensures that the dataset reflects the most recent conceptual developments and publication trends. As the analysis emphasizes thematic mapping, author networks, and conceptual structure—not citation ranking alone—these newer articles contribute valuable insight into emerging research directions. Only the final versions of peer-reviewed journal articles, conference proceedings, and review papers in English were included. Records with incomplete metadata or non-standard formats were excluded to maintain analytical consistency. The final search string is (TITLE-ABS-KEY ("road safety" OR "traffic safety" OR "driving safety") AND TITLE-ABS-KEY ("campaign" OR "awareness program" OR "social marketing")) AND (LIMIT-TO (PUBSTAGE, "final")) AND (LIMIT-TO (SRCTYPE, "j") OR LIMIT-TO (SRCTYPE, "p")) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "cp") OR LIMIT-TO (DOCTYPE, "re")). A PRISMA-style diagram was prepared to illustrate the inclusion process. Figure 1 presents a PRISMA-style flowchart detailing the screening and selection process of Scopus-indexed publications for inclusion in the bibliometric analysis[15]. The chart illustrates the total records identified, screening stages, eligibility criteria, and final document inclusion count, ensuring methodological transparency.

Data cleaning and preparation

The dataset was exported in CSV format and cleaned using Microsoft Excel. This involved eliminating duplicates, standardizing author names and institutional affiliations, and consolidating synonymous terms. Manual harmonization techniques were applied, with additional reference to ORCID identifiers where available.

Biblioshiny produced descriptive indicators (publication and citation trends, top authors, journals), keyword co-occurrence patterns, thematic maps, and co-authorship networks[8,9]. Thematic structures were classified using a centrality-density matrix into motor, niche, emerging, and basic themes[12].

VOSviewer was used to create network visualizations of keywords, authors, and co-citation links[9]. Three major conceptual clusters were identified through co-word analysis: (1) public health and injury prevention, (2) demographic and psychological profiling, and (3) behavioral research and prevention strategies.

Given the authors' Southeast Asian institutional context, particular emphasis was placed on identifying geographic disparities, knowledge silos, and collaboration asymmetries impacting low- and middle-income countries (LMICs)[10,13].

Descriptive bibliometric results

This section summarizes publication trends, citation performance, key sources, and major contributors based on 730 Scopus-indexed documents analyzed using Biblioshiny and VOSviewer[7,9].

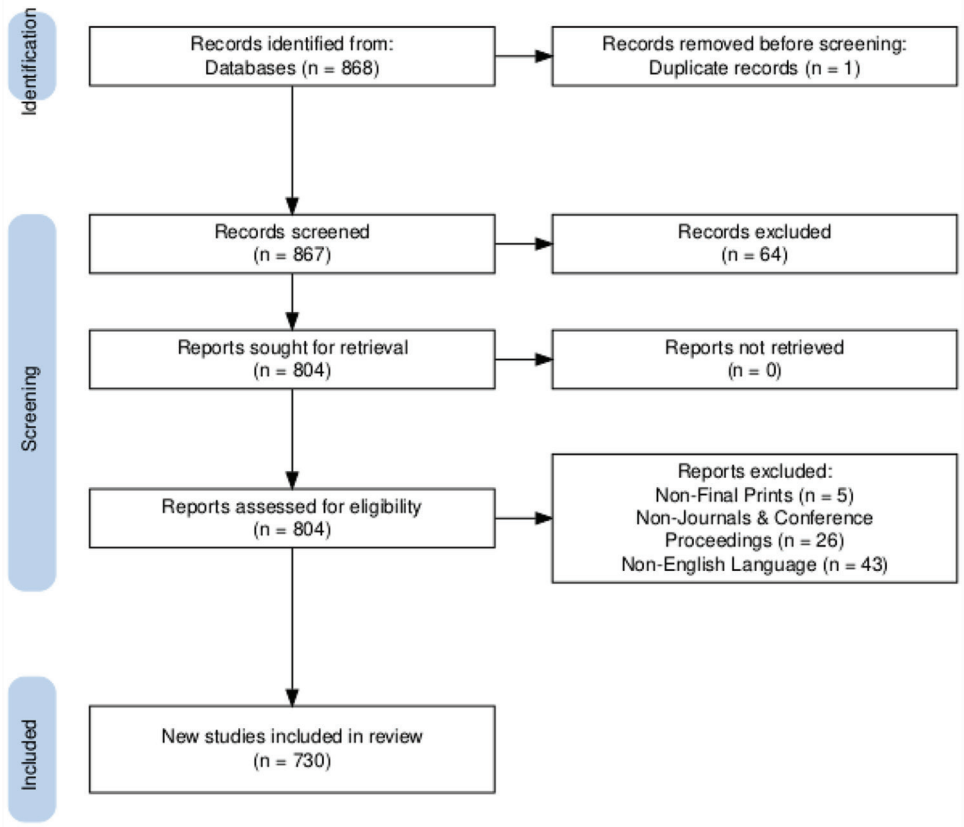

Figure 1 PRISMA-style flowchart (source: researchers' findings)

Annual scientific production and citation trends

Global research on road safety communication increased dramatically during the early 2000s, indicating a move towards behavior-based safety campaigns. Figure 2, Annual Citation Trends (2000–2025), shows a marked increase in scholarly attention to road safety communication after 2015, reflecting growing global interest in behavioral and communication-based safety strategies[12,16].

Most relevant sources

Top journals reflect the field's interdisciplinary nature. *Accident Analysis and Prevention* leads with 66 publications, followed by *Transportation Research Part F* (36), *Traffic Injury Prevention* (32), *Journal of Safety Research* (27), and *Transportation Research Record* (19). These avenues connect engineering, psychology, public health, and communication[17].

Most cited documents

Highly cited studies, shown in Table 1 (globally) and Table 2 (locally), contribute to the intellectual foundation of the field. Ulleberg and Rundmo (2003) had the most citations (682) for their research on personality and risk perception[4]. Other notable works include Philip et al. (2005) on driver fatigue and Zaza et al. (2001) on child safety interventions[13,14]. Within the dataset, Phillips, Ulleberg and Vaa (2011) had the highest local citation count, followed by Hoekstra and Wegman (2011)[18,19].

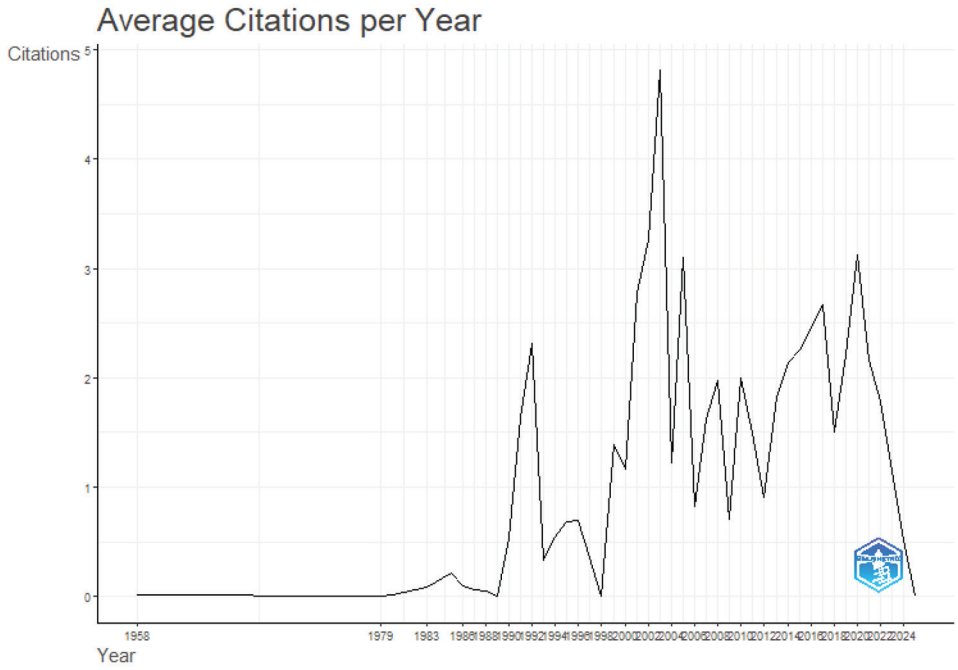

Figure 2 Annual citation per year (source: researchers' findings, biblioshiny)

Table 1 The most globally cited documents

Rank	Author & year (journal)	Total citatons	DOI
1	Ulleberg & Rundmo (2003), Safety Science	682	10.1016/S0925-7535(01)00077-7
2	Philip et al. (2005), Accident Analysis & Prevention	302	10.1016/j.aap.2004.07.007
3	Ulleberg (2001), Transp. Res. Part F	232	10.1016/S1369-8478(01)00029-8
4	Engelmann et al. (2006), Atmospheric Measrement Tech.	221	10.5194/amt-9-1767-2016
5	Zaza et al. (2002), American Journal of Preentive Medicine	218	10.1016/S0749-3797(01)00377-4

Table 2 The most locally cited documents

Rank	Author & year (journal)	Local citations	Global citations
1	Phillips et al. (2011), Accident Analysis & Prevention	33	156
2	Hoekstra & Wegman (2011), IATSS Research	23	85
3	Ulleberg & Rundmo (2003), Safety Science	21	682
4	I. Lewis et al. (2007), Transp. Res. Part F	17	114
5	Tay & Watson (2002), Health Marketing Quarterly	16	82

IATSS=International Association of Traffic and Safety Sciences

Author and institutional contributions

Ulleberg, Lewis, Tay, and Watson are frequent contributors, recognized for incorporating psychology and communication theories into campaign research[4,20,21]. European, Australian, and American institutions dominate, with Australian experts leading the way in campaign evaluation and psychological profiling.

Language and document types

All of the documents are in English. The dataset comprises journal publications, conference papers, and review articles. Journal papers constitute the main body of knowledge, but conferences frequently present regional or preliminary results.

Summary of descriptive findings

The literature reflects a maturing, interdisciplinary field grounded in behavioral science and public health. However, representation remains skewed toward high-income countries, with minimal participation from LMICs[5,13]. The citation structure highlights a few seminal works, while author and journal concentration suggest the field's intellectual anchors are relatively stable.

Thematic and conceptual structure

This section examines the conceptual progression of road safety communication research utilizing co-word analysis, thematic mapping, and factorial analysis with Biblioshiny and VOSviewer[7–9].

Keyword clusters and conceptual domains

Co-word analysis showed three major thematic clusters that influence the conceptual framework of road safety communication studies. The first cluster, "Public Health and Injury Prevention," includes terms like traffic accidents, law enforcement, education, and epidemiology. It represents institutional and policy-driven initiatives for preventing injuries through safety education and enforcement measures[17,22].

The second cluster, "Demographics and Risk Profiling," focuses on terms such as male, adolescent, psychology, and risk behavior. This topic underlines how responses to safety messages vary by demographic and psychological segment, emphasizing the necessity of audience targeting in campaign design[4,19,23].

The third cluster, "Behavioral Research and Prevention Strategies," covers topics like accident prevention, behavioral research, and risk perception. It reflects theoretical methods of understanding and modifying road safety behavior[21,24,25].

Figure 3, Co-word Network Visualization, reveals three dominant conceptual clusters: (1) public health and injury prevention, (2) demographic and psychological profiling, and (3) behavior-based intervention strategies. These clusters represent the structural backbone of road safety communication research.

Thematic map (biblioshiny)

Thematic map (Table 3), developed with Biblioshiny, divides the conceptual structure of the field into four quadrants based on centrality and density measurements[8]. Motor topics, such as road safety and accident prevention, are both central and well-developed, demonstrating their importance in the literature. Niche topics such as motorbikes and behavioral research are more specialized and internally rich, but they are less linked to broader conversations. Emerging or decreasing themes, such as texting and driving and public policy, indicate areas of growing interest or fading importance that warrant additional examination in road safety communication—a trend also evident in other digital health fields. Meanwhile, human factors, psychology, and education appear to be fundamental themes—central to the subject but underdeveloped in depth.

This mapping emphasizes the need to better integrate developing topics like mobile risks and digital media within the broader research landscape[3,26,27].

Factorial analysis and conceptual integration

Multiple Correspondence Analysis (MCA) supports the three-cluster structure by demonstrating conceptual parallels between psychological qualities (e.g., attitudes, risk perception) and behaviors (e.g., compliance, speeding)[4,19]. Figure 4, factorial map from MCA, illustrates conceptual associations between key psychological and behavioral variables in road safety campaigns, including constructs such as risk perception, attitudes, compliance, and speeding. These correlations underscore the significance of matching audience profiling to messaging methods[23,25].

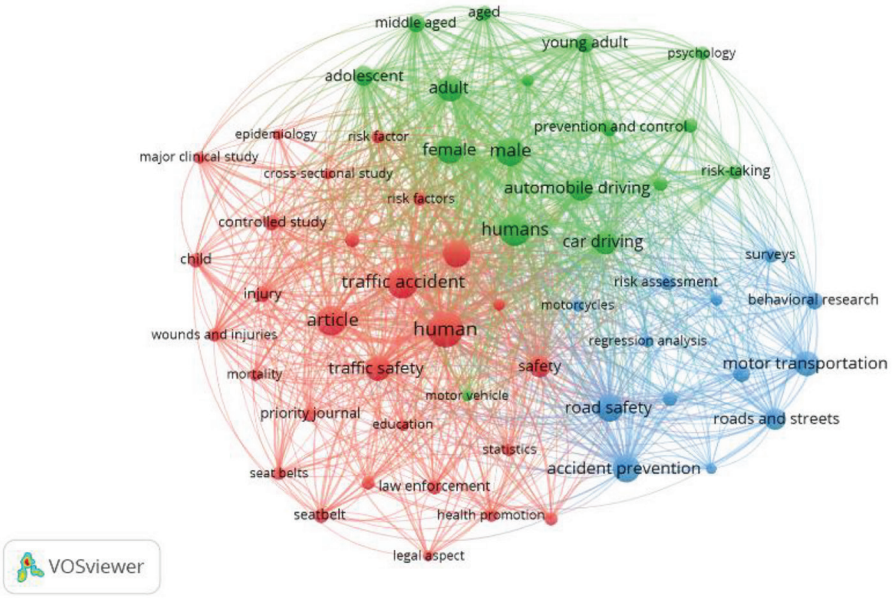

Figure 3 Network visualization of co-word analysis (source: researchers' findings, VOSviewer)

Table 3 Thematic classification

Quadrant	Characteristics	Example themes
Motor Themes	High centrality & density; well-developed and important	Road safety, accident prevention
Niche Themes	High density but low centrality; specialized and isolated	Behavioral research, motorcycles
Emerging or Declining	Low centrality & density; underdeveloped or fading	Texting and driving, public policy
Basic Themes	High centrality but low density; general and transversal	Human factors, psychology, education

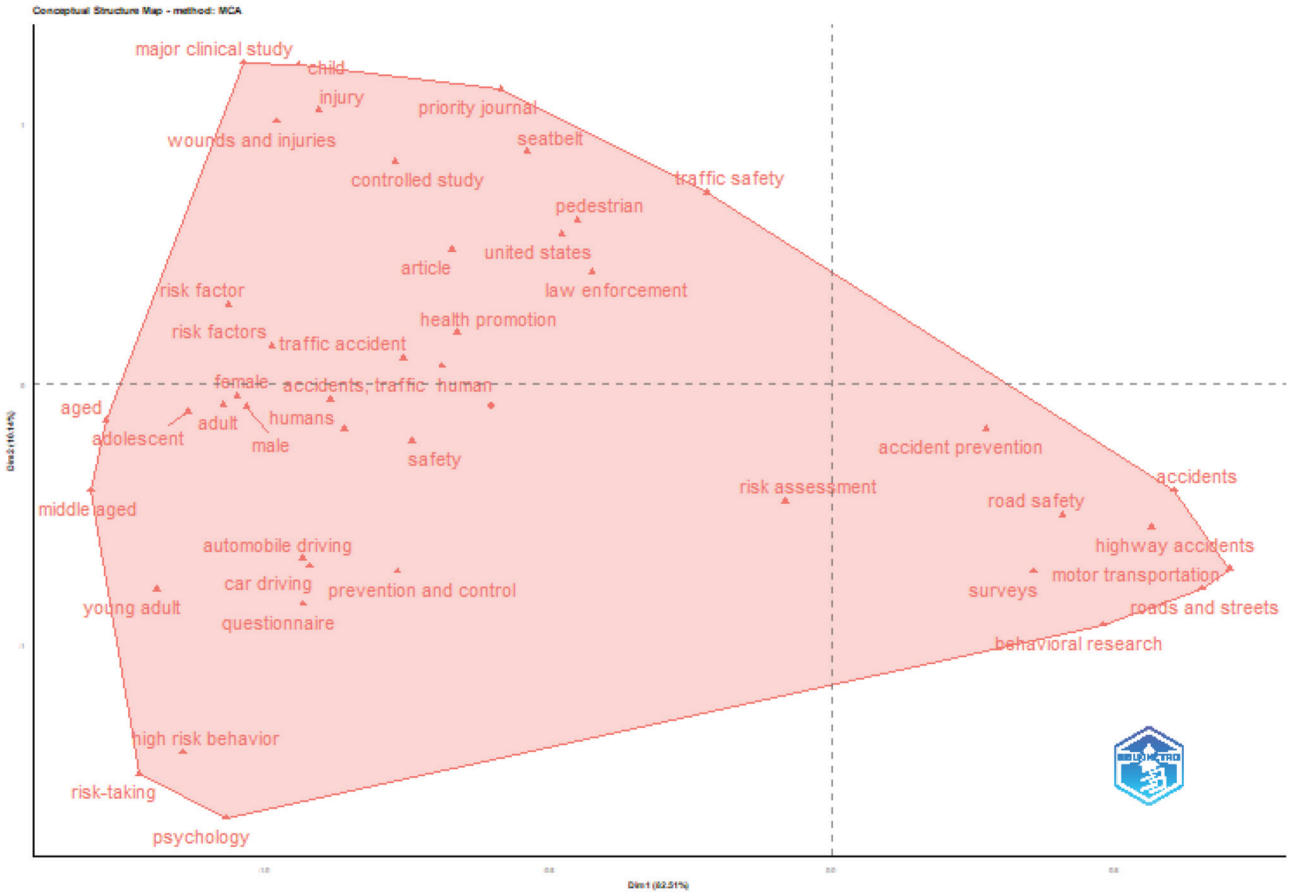

Figure 4 Factorial map (MCA visualization) (source: researchers' findings, VOSviewer)

Centrality of key concepts

Network metrics show *road safety* and *accident prevention* as central, while *psychology* and *law enforcement* bridge conceptual domains. Although less central, *behavioral research* and *message framing* are emerging as growing areas of inquiry[18,21,28].

Synthesis of thematic insights

The field is structured around three stable domains—public health, behavioral science, and demographic profiling—but newer areas like *texting while driving*, *emotion-driven messaging*, and *digital risk communication* are gaining traction[3,26,29]. Although research increasingly focuses on audience targeting and emotional appeal, theory integration and LMIC representation remain limited[5,13].

Social and collaboration structure

This section examines how co-authorship and international collaboration patterns influence road safety communication research, using Scopus data and Biblioshiny visualizations[7].

Author collaboration networks

Author networks show moderate collaboration, with a few major personalities connecting otherwise disparate clusters. Tay R stands out as a significant connection,

allowing international collaboration in public health and psychological safety research[21]. Lewis I and Watson B are two more notable authors who have written extensively about persuasive messages and behavior change[23,25,30].

Despite these hubs, many researchers work alone or with small national teams. This restricts knowledge sharing across disciplines and regions, hampering theoretical integration and various viewpoints[17].

International collaboration patterns

Australia is a leader in international collaborations (Table 4), frequently partnering with Canada, the United Kingdom, and the United States. These connections often focus on campaign evaluation and behavior-oriented interventions[14]. However, most partnerships are one-time collaborations rather than sustained research alliances.

While countries such as the United States and Australia show broad engagement, links to Global South countries remain minimal. Collaborations with Indonesia, Thailand, and Bangladesh, for example, are uncommon and frequently limited to isolated incidents[5,31].

Implications for collaboration equity

The collaborative landscape has growth potential, but it also reflects a continuing inequality. High-income nations dominate research production and networks, but low- and middle-income countries (LMICs), despite having larger road injury burdens, are underrepresented[6,10,13].

Addressing this gap necessitates deliberate efforts to establish equitable collaborations. These should include shared funding, co-authorship, and collaborative subject design with a focus on regional relevance[32]. Engaging communication scholars in health and transportation partnerships can improve campaign design and message efficacy, particularly in LMIC contexts where local risk views, such as those in Nepal, provide useful insights[33].

A more inclusive global research ecosystem will improve not only theoretical diversity but also the cultural appropriateness and practical impact of road safety interventions[12].

Discussion

This study presents a comprehensive bibliometric analysis of road safety communication research from 2000 to early 2025. It demonstrates a developing but unevenly distributed field organized into three major thematic areas and a fractured collaborative network, like recent domain-specific bibliometric reviews in public health, which applied similar methodologies in other health-related fields. The findings have implications for theoretical integration, methodological progress, and global research equity[7].

A growing but fragmented field

Publication growth since the early 2000s demonstrates growing interest in communication-based therapies[12,14]. However, author and thematic networks remain fractured. The majority of cooperation occurs at the national or regional level, with Australia functioning as a crucial hub[21]. Disciplinary silos exist, restricting comprehensive, theory-driven interventions that address the behavioral and cultural complexities of road safety issues[17].

Thematic clusters and integration gaps

Three consistent conceptual clusters dominate the field: (1) public health and policy, (2) demographic and psychological profiling, and (3) behavioral research. These domains are mostly separated. For example, psychological profiling is infrequently used in ad design, and communication studies frequently overlook audience-specific behavioral insights[4,19]. Seminal research on personality, message framing, and perception is extensively acknowledged but not consistently used in practice[23,25,29,33].

Better integration of communication and behavioral science frameworks, such as the Extended Parallel Process Model (EPPM) and Theory of Planned Behavior (TPB), may improve campaign precision and efficacy[32]. Although the EPPM and TPB are well-established in health communication and behavioral safety research, these theoretical frameworks were not explicitly prominent in the keyword co-occurrence network or title-abstract keyword analysis within the dataset. Their relative absence suggests a notable theoretical gap in road safety campaign literature indexed in Scopus, despite their frequent mention in policy or psychology domains. This highlights a missed opportunity for more theory-driven interventions and points to the need for stronger integration of behavioral models into communication campaign design and evaluation.

Research gaps and emerging trends

A number of gaps exist. Research on digital platforms like Instagram, TikTok, and YouTube is limited, despite their importance for youth-targeted campaigns[3,34,35]. Recent studies have investigated the impact of anti-texting PSAs on attention and recollection[29,30,33,36]. Research also focuses on descriptive or cross-sectional designs, leaving causal and long-term campaign effects unexplored[24].

Geographic disparities are significant. The majority of contributions come from high-income nations, while LMICs, which have the greatest road injury rates, are underrepresented in authorship and thematic material[5,6,13].

Methodological opportunities

Mixed-methods research that combines behavioral analytics and qualitative insights might help researchers better assess the impact of campaigns. New tools like social media analytics, AI sentiment tracking, and mobile apps provide real-time feedback for campaign evaluation, particularly among younger digitally active audiences[2,36,37].

This study identifies essential pathways to improve road safety communication research and practice. Although the area has grown, there are still obstacles in disciplinary integration, regional inclusion, and theory-driven evaluation. Future research objectives and policy development aim to be guided by the following consequences.

Implications for practice and policy

Campaigns should be planned collaboratively with communication, psychology, and public health professionals. Message targeting should take into account demographic and psychographic segmentation[23,25]. Emotional techniques such as fear, empathy, and humor must be theoretically grounded and culturally appropriate[20,29]. Cross-sector collaboration is critical for long-term impact, particularly in LMICs[6,13]. Aligning communication initiatives with global frameworks like the UN Decade of Action for Road Safety (2021-2030) can improve coherence and financing opportunities[10].

Campaign designers must use demographic and psychographic profiling to segment their audiences[4,19,38]. Tailoring messaging to local customs and media habits can raise campaign relevance and impact. To avoid backfire effects, emotional appeals (fear, empathy, and humor) should be properly worded with efficacy cues[25,30,33].

Collaborative campaign design that includes researchers, media professionals, and community leaders improves both cultural fit and public trust[32]. Feedback loops and participative approaches should be integrated into campaign strategy and implementation.

Policymakers must consider communication as an essential component of road safety policy. Investments are needed not only in infrastructure and enforcement, but also in message testing, campaign evaluation, and capacity-building[13,17]. LMICs, in particular, need funding support to develop context-specific communication strategies[6].

To eliminate global gaps in research production and influence, funding structures should encourage co-authorship, inclusive partnerships, and regional knowledge hubs[5,31].

Implications for researchers and future research priorities

Researchers should combine behavior change models (e.g., TPB, EPPM, and COM-B) with strategic communication frameworks, including narrative persuasion, message framing, and social marketing[4,25]. Future bibliometric or content-driven studies could further explore how often and how deeply TPB, EPPM, and similar frameworks are operationalized in campaign literature, particularly in emerging digital formats. A targeted analysis using full-text or abstract scanning may uncover hidden conceptual adoption that keyword mapping alone does not reveal. Mixed-methods approaches that incorporate behavioral data and audience insights might help explain why and how individual campaigns perform[23,29]. More experimental and longitudinal studies are needed to assess the long-term impact of communication treatments[24].

Despite their widespread use, digital platforms are largely untapped. Future studies should investigate how social media material, particularly influencer-driven campaigns, influences safety perceptions, norms, and behaviors[3,39].

Future studies should also evaluate the success of digital campaigns across platforms, including audience engagement and behavioral effects[3,34,39]. Emotion-driven messaging needs further exploration using well-established theoretical models to understand its persuasive impact[25,33]. Studies must also be culturally sensitive and inclusive, especially in low- and middle-income countries where context-specific strategies are critical[6,13].

Investigating how safety messages are retained and reinforced over time is essential to improving long-term campaign effectiveness[24]. Finally, applying AI, ICT tools, and big data analytics can enable real-time monitoring and optimization of communication strategies, as shown in successful health awareness efforts[2,40].

Conclusion

As road injuries continue to claim over a million lives annually, strategic communication must be fully integrated into public health and safety interventions. This study maps the global structure of road safety communication research and identifies critical thematic clusters, knowledge gaps, and collaboration imbalances. To transition from awareness-raising to measurable, long-term behavioral change, future campaigns must prioritize theoretical precision, digital innovation, and inclusive, cross-sectoral collaboration. Integrating behavior change theories, leveraging emerging digital tools, and engaging underrepresented regions are essential for impactful, equitable progress. Building a more interconnected and culturally responsive research ecosystem will enhance the effectiveness and reach of road safety campaigns—enabling communication to become a life-saving public health mechanism on a global scale[5,6,10].

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