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A systematic review of traffic safety culture definitions

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Abstract

Traditional road safety measures targeting driver behaviour, vehicle technology, and infrastructure have significantly reduced crashes. However, further progress requires approaches beyond these measures. A safety culture perspective offers such an approach, as culture has a significant impact on traffic safety and is not addressed by traditional interventions. Traffic Safety Culture (TSC), rooted in the broader concept of safety culture, is a relatively recent and evolving field of research, and no consensus definition has yet emerged. This study, conducted within the TRUST project, reviews proposed definitions and applications of TSC, also referred to as Road Safety Culture (RSC). A PRISMA-based systematic literature review identified 48 relevant papers, from which 25 definitions were extracted. Twelve originated from two research groups, indicating ongoing conceptual development. While three definitions were overly broad, the remaining ones included additional components of TSC. Most definitions conceptualize TSC through one to five sub-dimensions, primarily cognitive but also behavioural and motivational. Shared norms, beliefs, and attitudes recur across definitions, with 13 related sub-constructs identified. Although studies predominantly measure TSC through quantitative surveys across countries, regions, or specific road user groups, conceptual and methodological inconsistencies persist. Greater conceptual clarity and methodological standardization are needed to strengthen the application of TSC in road safety research and interventions.

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Keywords: traffic safety culture; road safety culture; definition; dimensions; social unit; measurement

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1. Introduction

Traditional road safety interventions targeting driver behaviour, technological improvements, and infrastructure have achieved significant reductions in traffic crashes (Elvik et al., 2009). However, as Nævestad et al. (2019a) emphasize, further progress requires approaches that go beyond these measures. A safety culture perspective has been proposed as one such approach, since culture represents an important risk factor not addressed by traditional interventions. Traffic Safety Culture (TSC) has therefore increasingly been positioned as a complementary perspective in road safety research, broadening the focus from structural measures to the cultural norms and expectations that shape everyday traffic behaviour. The concept originates from the broader field of safety culture research, which emerged after the Chernobyl nuclear disaster in 1986, when deficiencies in organisational safety culture were identified as a contributing factor to the accident.

In the context of road traffic, cultural explanations of behaviour appeared already in the 1990s. Zaidel (1992) discussed how cultural differences influence driving behaviour. In the 2000s, the role of cultural factors in risky driving behaviour was increasingly examined in countries such as the United States, Australia, and Canada (AAA, 2007). However, the concept of TSC gained significant visibility only in the 2010s, when researchers began to propose explicit definitions and frameworks aimed at measuring and operationalising TSC for the purpose of designing and evaluating targeted road safety interventions.

Despite the growing body of research, no single definition of TSC has become widely accepted. One reason for this conceptual ambiguity lies in the difficulty of transferring the safety culture concept from organisational settings to the heterogeneous population of road users. Safety culture research typically focuses on clearly defined groups, such as employees within organisations or professional drivers within companies (Nævestad & Bjornskau, 2012; Pietrek, 2023). By contrast, private road users often share little beyond their mode of transport and the legal framework under which they operate. Consequently, meaningful social units for analysing TSC may include families, peer groups, schools, or communities (Edwards et al., 2014). At the same time, TSC has also been examined at larger societal levels, such as nations or administrative regions, where factors such as legislation, enforcement, education, and infrastructure may shape cultural patterns of traffic behaviour (Nævestad, 2021).

This paper reviews existing definitions of TSC and related concepts, identifies recurring dimensions across definitions, and examines how the concept has been operationalised in empirical research.

2. Methods

2.1. Search strategy

A systematic literature search was conducted to identify publications defining or applying the concept of Traffic Safety Culture or closely related terms such as Road Safety Culture, Traffic Culture, and Traffic Safety Climate. The following search string was applied: (traffic OR road OR pedestrian OR cyclist OR bike OR car OR lorry OR moped OR motorcycle OR truck OR road user* OR bus OR taxi OR cab OR cyclist OR highway) AND safety AND (climate OR culture). Searches were conducted in Scopus and Web of Science, limited to titles and keywords, English language publications, and article or review article publication types. The search returned 654 records. All search hits were imported into EndNote. Duplicate records were removed automatically and then manually verified at the title and author level to identify duplicates caused by spelling inconsistencies. Additional publications were identified through reference lists and other sources.

2.2. Selection of studies

The screening process followed the PRISMA framework. Titles, abstracts, and full texts were screened for relevance to the concept of TSC. The selection process is illustrated in Fig. 1. A total of 48 papers were included in the final review. Of these, 43 originated from the systematic database search, while 5 were identified through other sources.

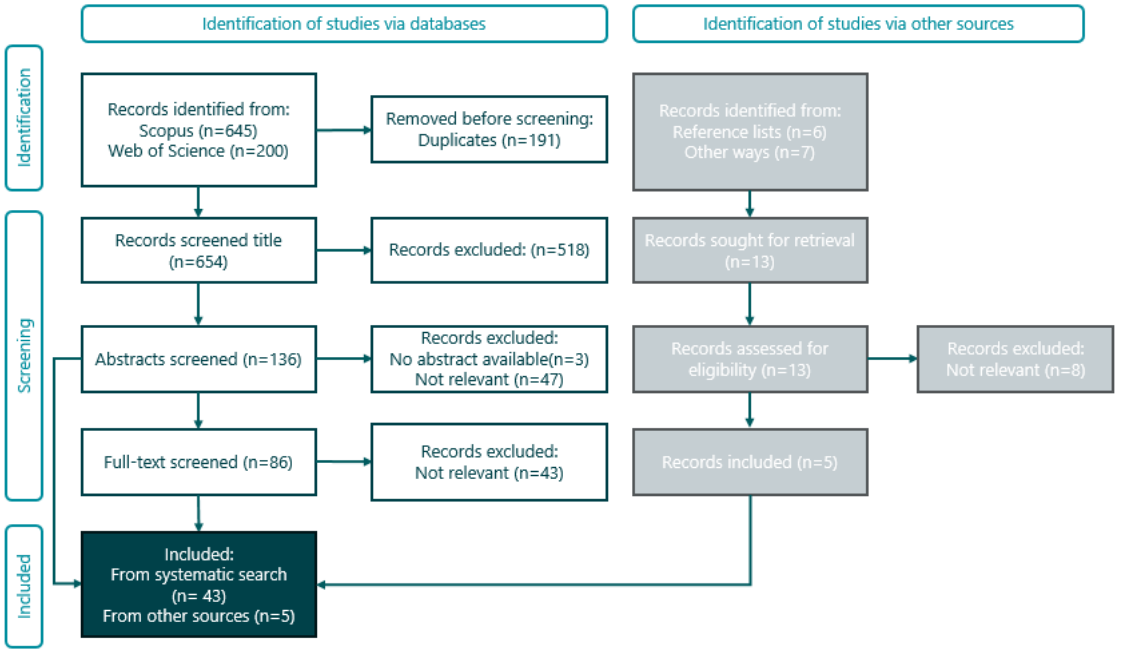

Fig. 1. PRISMA flow diagram for the literature search.

3. Definitions of Traffic Safety Culture

Across all reviewed publications, 25 definitions of TSC or Road Safety Culture (RSC) were identified, as presented in Table 1. Twelve of these definitions originated from two research groups, suggesting ongoing refinement and conceptual development of the concept. Three definitions were found to be particularly broad and descriptive without providing clear guidance for measurement or operationalisation. Most definitions conceptualise TSC through one to five sub-dimensions, typically including cognitive, behavioural, and motivational elements. There is broad agreement that TSC primarily exists in people's minds and cannot be fully captured through observation of behaviour alone. Behavioural models have been proposed to illustrate how cultural dimensions influence traffic safety outcomes. For example, Ward et al. (2020) developed a model combining elements of the Theory of Planned Behaviour and the Prototype Willingness Model to explain how cultural factors shape road user behaviour. Several definitions emphasise shared norms and expectations regarding road user behaviour. For instance, Nævestad et al. (2019b) define RSC as shared norms prescribing certain road safety behaviours and shared expectations regarding the behaviour of others. Other definitions emphasise shared beliefs and values. McDonald and Arthur (2014, cited in Coogan et al., 2014) describe TSC as a framework for understanding the attitudes, beliefs, values, and knowledge about safe driving behaviour shared within a meaningful social group.

Across all definitions, as presented in Table 2, 13 recurring sub-constructs were identified, including beliefs, values, attitudes, norms, behaviour, risk perception, assumptions, knowledge and skills, perceived control, motivation, intention, commitment, and meaning. However, the relationships between these constructs – if addressed at all – are conceptualised differently across definitions. Some authors describe these elements as components of TSC, while others treat them as outcomes or reflections of an underlying cultural system. For example, Lajunen et al. (2017) define TSC as the sum of factors influencing skills, safety attitudes, and safety behaviour, whereas Myers et al. (2014) conceptualise attitudes and beliefs as manifestations of culture.

Table 1. Definitions of Traffic Safety Culture (TSC) and Road Safety Culture (RSC) identified based on literature review, which provide information on what TSC is in the context traffic safety

Author(s)	Name of construct	Definition
Chen et al., 2012	TSC	"When immigrants came to this country, they brought with them the attitudes and perceived social norms of their countries of origin toward risky traffic behavior as pedestrians and cyclists, as well as habits and expectations of behavior when driving. These 'attitudes, beliefs, perceptions, and values that (people) share in relation to traffic safety' are broadly referred to as (traffic) safety culture." (p. 139)
Edwards et al., 2014	TSC	"TSC can be defined as the assembly of underlying assumptions, beliefs, values and attitudes shared by members of a community, which interact with a community's structures and systems to influence road safety related behaviours." (p. 300)
Lajunen et al., 2017	TSC	"the sum of all factors that affect the skills, safety attitudes, and safety behavior of road users" (p. 11)
McDonald & Arthur, 2014, cited from Coogan et al. 2014	TSC	"'The development of a new paradigm of a traffic safety culture to better understand 'the attitudes, beliefs, values, and knowledge about safe driving behavior shared within a meaningfully defined group' …" (p. 314)
Mishra & Mehran, 2022	TSC	"… is a shared belief, assumption, and perception by a group of people towards traffic safety-related matters." (p. 82)
Myers et al., 2014	n.a.	"… we suggest that the utility of this "new" understanding of culture could be improved if researchers more clearly delineated the ideological – the socially constructed abstract systems of meaning, norms, beliefs and values (which we refer to as culture) – from concrete behaviors, social relations and other properties of workplaces (e.g., organizational structures) and of society itself." (p. 26)
Nævestad, 2021	TSC (SC among nonprofessional road users)	"Thus, we may, for example, define safety culture among nonprofessional road users as, for example, shared norms, beliefs, and assumptions that provide frames of reference that guide individuals' interpretations of actions, hazards, and their identities, and which motivate and legitimize behaviors that have an impact on safety, and which are created through interaction within groups. We may hypothesize that this definition also can be applied to the national level, the community level, peer groups, and families." (p. 557)
Nævestad & Bjornskau, 2012	TSC	"… an interrelated set of perceptions of risk related to traffic safety, attitudes to traffic safety measures, and traffic safety behaviours shared by members of particular groups." (p.146)
Nævestad et al., 2019a	RSC	"… we define road safety culture (RSC) as shared patterns of behaviour, shared norms prescribing certain road safety behaviours and thus shared expectations regarding the behaviours of others." (p. 3)
Nævestad et al., 2019b	RSC	"… as shared norms prescribing certain road safety behaviours, and thus shared expectations regarding the behaviours of others."
Nævestad et al., 2022	RSC	"…shared values and attitudes signifying what is important (e.g. safety, mobility, respect, politeness), shared norms prescribing certain road safety behaviours, and thus shared patterns of behaviour and shared expectations regarding the behaviours of others." (p. 376)
National Academies, 2018	TSC	"… define traffic safety culture as the values and beliefs shared among groups of road users and stakeholders that influence their decisions to behave or act in ways that affect traffic safety." (p. 11)
Otto et al., 2016	TSC	"… the values and beliefs shared among groups of road users and stakeholders that influence their decisions to behave or act in ways that affect traffic safety." (p. 3)
Pietrek, 2023	SC at individual level	"The main objective of shaping the safety culture at the individual level is to improve the knowledge, skills and motivation of individual employees of transport companies in the area of safety behaviours." (p. 590)
Sucha et al., 2016	TSC	"A traffic safety culture is rather a multifaceted concept which defines the norms, attitudes, and opinions in relation to the issue of traffic safety at the societal level (not the individual level). In other words, it is something that is shared by the given society and influences the behaviour of its members." (p. 47)
US DOT, 2011	TSC	"… The shared values, actions, and behaviors that demonstrate a commitment to safety over competing goals and demands." (p. 6)
Ward et al., 2010	TSC	"… perceptions people have about what behaviors are normal in their peer group and their expectations for how that group reacts to violations to these behavioral norms. In terms of traffic safety, this definition applies to behaviors that either increase risk (e.g. speeding) or are protective (e.g. wearing seatbelts), as well as behaviors related to acceptance or rejection of traffic safety interventions." (p. 4f)
Ward & Özkan, 2014	TSC	"Following the discussion by Ward et al. (2014), the main aspect of TSC are values, beliefs, attitudes, perceived norms, and perceived control."
Ward et al., 2019a	TSC	"… the shared belief system of a group of people, which influences road user behaviors and stakeholder actions that impact traffic safety…" (p. 8)
Ward et al., 2019b	TSC	"…'traffic safety culture' as "the shared belief system, which influences behaviors affecting traffic safety." This definition applies to both the behavior of road users and the artifacts generated by stakeholder actions." (p. 32)
Ward et al., 2014	TSC	"… the culture that emerges in a geographical area can influence driver responses to perceptions of risk associated with system hazards and driver intentions to engage in risky behaviors. For instance, drivers in rural areas may share a belief system described as "denial of risk" that increases risk-taking behaviors such as speeding. This aspect of society that influences behavioral choices that affect traffic safety is called "traffic safety culture." (p. 42)

Table 2. Sub-constructs of definitions of Traffic Safety Culture (TSC) and Road Safety Culture (RSC) extracted from reviewed papers

Author(s) of definition	Year	Construct	Sub-dimensions: Beliefs	Values	Attitudes, Opinions	Norms	Behaviour	Percept. (of risk)	Assumptions	Knowledge-Skills	Perceived control	Motivation	Intention	Committment	Meaning	Social unit of application
Chen et al.	2012	TSC	●	●	●	●	●									" that people share"
Edwards et al.	2014	TSC	●	●	●				●							"shared by members of a community"
Lajunen et al.	2017	TSC			●		●			●						"road users"
McDonald & Arthur	2014	TSC	●	●	●					●						"shared within a meaningful defined group"
Mishra & Mehran	2022	TSC	●					●	●							"a group of people"
Myers et al.	2014	n.a.	●	●	●	●									●	n.a.
Nævestad	2021	TSC/SC of non-prof. road users	●			●			●							"among non-professional road users"
Nævestad & Bjornskau	2012	TSC			●		●	●								"shared by members of particular groups"
Nævestad et al.	2019a	RSC				●	●									n.a.
Nævestad et al.	2019b	RSC				●										n.a.
Nævestad et al.	2022	RSC		●	●	●	●									n.a.
National Academies	2018	TSC	●	●												"shared among groups of road users and stakeholders"
Otto et al.	2016	TSC	●	●												"shared among groups of road users and stakeholders"
Pietrek	2023	SC (at individ. level)								●		●				"individual employees of transport companies"
Stringer	2018	Community TSC	●	●	●		●									n.a.
Sucha et al.	2016	TSC			●	●										"shared by the given society"
US DOT	2011	TSC		●			●							●		n.a.
Ward & Özkan	2014	TSC	●	●	●	●					●					"of subgroups within society"
Ward et al.	2010	TSC				●										"people"
Ward et al.	2014	TSC	●					●					●			"drivers"
Ward et al.	2019a	TSC	●													"of a group of people"
Ward et al.	2019b	TSC	●													"of a group"

4. Measurement and Operationalisation

The reviewed studies employ a variety of methodological approaches to measure and analyse TSC. Most studies apply quantitative survey methods to measure attitudes, beliefs, values, and behaviours related to traffic safety. Surveys are typically conducted among specific groups of road users, such as car drivers, truck drivers, cyclists, or pedestrians, or across larger geographical units such as regions or countries. Quantitative analyses often employ

statistical techniques such as factor analysis, principal component analysis, structural equation modelling, multidimensional scaling, and multilevel modelling to identify latent cultural factors or examine relationships between cultural constructs and safety outcomes (Timmermans et al., 2020). Some studies adopt mixed methods approaches. For example, Nævestad et al. (2019a) combined survey data with qualitative interviews to analyse national road safety cultures.

Alternative approaches to operationalising TSC have also been proposed. Mehri et al. (2022) used a method based on the Grounded Theory, including interviews and focus groups with taxi drivers, to identify themes underlying safe and unsafe behaviours. Sujon and Dai (2021) analysed social media data using sentiment analysis to examine community attitudes towards traffic safety and enforcement. Chen et al. (2012) analysed crash data among immigrants in New York as an indicator of "safety assimilation," assuming that migrants initially retain traffic safety norms from their countries of origin. Stringer (2018) examined community-level traffic safety culture in relation to alcohol-related crashes in the United States by analysing structural indicators such as bar density, religious affiliation, and alcohol regulations. These examples illustrate the diversity of methodological approaches used to operationalise the concept of TSC.

5. Related Concepts

Two closely related concepts frequently appear in the literature: Traffic Safety Climate (TClimate) and Traffic Culture (TC). Traffic Safety Climate refers to road users' attitudes and perceptions regarding the traffic system in a specific context and time (Özkan & Lajunen, 2011; Gehlert et al., 2014). It is typically considered a surface manifestation of deeper cultural values and is therefore more sensitive to situational factors. The concept has been operationalised through the Traffic Climate Scale (TCS), which includes dimensions such as external affective demands (emotional engagement), internal requirements (individual skills and abilities), and system functionality (Gehlert et al., 2014). Studies using the TCS have found links between traffic climate perceptions and risky or prosocial driving behaviour (Üzümcüoğlu et al., 2020; Kaçan et al., 2019; Feng et al., 2021; Li et al., 2024).

TC, by contrast, refers to the broader sociotechnical system shaping traffic behaviour, including institutional structures, governance, norms, and economic conditions (Özkan & Lajunen, 2011). Leviäkangas (1998) defined it as the sum of factors influencing driver skills, attitudes, behaviour, equipment, and environment. In this conceptual hierarchy, TC represents the deeper societal layer, while Traffic Safety Climate reflects the perception-based manifestation of these cultural structures at a given point in time.

6. Conclusion

TSC has emerged as an important concept for understanding cultural influences on road user behaviour. However, the concept remains theoretically fragmented, with multiple definitions and varying approaches to operationalisation. Most definitions emphasise shared norms, beliefs, values, and attitudes within social groups, yet there is limited agreement on how these constructs relate to one another or how they should be measured. The diversity of methodological approaches further complicates cross-study comparisons. Notably, initiatives such as the TRUST project have begun to address these challenges by working towards a more coherent and operational definition of TSC, alongside advancing methodological consistency in its study. Future research should aim to establish clearer conceptual boundaries and develop more consistent methodological frameworks for studying TSC. Strengthening the theoretical and empirical foundations of the concept may improve its usefulness for designing culturally informed road safety interventions.

Building on these findings, several practical actions can be derived to improve road safety. First, the recurring emphasis on shared norms, beliefs, attitudes, and expectations suggests that awareness and communication campaigns should target not only individual behaviour but also the perceived social norms within peer groups, families, schools, and local communities, which the reviewed definitions identify as meaningful social units of TSC. Second, the cognitive, behavioural, and motivational sub-dimensions identified across definitions can be used by road safety authorities and practitioners as a structured basis for diagnostic surveys, allowing tailored interventions to be designed for specific road user groups (e.g. young drivers, professional drivers, vulnerable road users) and for specific regions

or countries. Third, given that legislation, enforcement, education, and infrastructure shape cultural patterns of traffic behaviour, policymakers are encouraged to integrate TSC indicators into national road safety strategies and monitoring frameworks, so that cultural factors are systematically considered alongside traditional engineering, enforcement, and education measures. Finally, the methodological diversity observed in the reviewed studies highlights the need for standardised TSC assessment tools that can be embedded in periodic road safety observatories, supporting the design, evaluation, and benchmarking of culturally informed interventions over time.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatgGPT-5.2 in order to improve readability and language. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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