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High-Risk Drivers and Road-Safety Governance in Italy: A Behavioural and Policy Perspective

Anna Pettini¹, Teresa Nobile², Ester Macri³

Abstract

This study uses an integrated analysis of survey data from 1,060 participants to examine driver attitudes and behaviours regarding road safety in Italy. Cluster analysis identified distinct driver profiles and significant geographical disparities. A high-risk subgroup (25% of respondents) was found, characterized by high self-confidence and low responsibility; younger age emerged as a key correlate. The misalignment between perceived and actual safety highlights the need for evidence-based policies. The study advocates an integrated approach combining targeted education, data-driven enforcement, and strategic infrastructure investment to advance Vision Zero goals.

Keywords: road safety governance, driver responsibility, public administration, Vision Zero, cluster analysis, policy design.

Key Messages:

- Road safety in Italy requires a multi-level governance approach that integrates behavioural insights with public administration strategies.
- The identification of a high-risk driver group accounting for 25% of the sample provides public administrators with an evidence-based mandate to shift from universal to segmented policy enforcement and educational strategies.
- Discrepancies between subjective perceptions of safety and objective accident data highlight the need for evidence-based policies that are tailored to regional contexts.
- The effectiveness of road safety policies depends on the capacity of governance to coordinate education, law enforcement and infrastructure investments across different administrative levels (national, regional and local).
- This study demonstrates how behavioural science can inform public administration by offering a practical framework for developing more effective, context-sensitive road safety policies.

1. Introduction

Road safety is a globally important challenge. It directly impacts human life and health, and plays a central role in developing a sustainable mobility system. The United Nations has emphasised this by including road safety in the Sustainable Development Goals (SDGs) and setting the ambitious target of halving the number of road traffic fatalities by 2030 (UN, 2015; 2024). However, achieving this goal will require a radical shift in road safety strategies, transcending traditional approaches to embrace innovative, systemic models capable of addressing the complexity of the involved factors, including behavioural and governance-related dimensions.

In this context, the Safe System approach represents a significant shift in thinking. Rather than viewing road traffic accidents as an inevitable cost of mobility, the Safe System is founded on the idea that every road death can be prevented. It involves designing transport systems that tolerate human error, mitigate

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its consequences, and protect road users through redundant safety mechanisms and infrastructure (Edvardsson Björnberg et al., 2022). Its four foundational principles, recognising human error as inevitable, protecting the human body within its biomechanical tolerance limits, sharing responsibility between system users and designers, and creating a 'forgiving' road environment, provide a robust basis for developing transformative policies (Edvardsson Björnberg et al., 2022). The European Union has been a driving force in advancing road safety policy, launching the Road Safety Action Programme in 2001 and subsequent policies aimed at achieving zero road deaths by 2050 (European Commission, 2001; 2020).

However, recent assessments, such as the European Commission's 2022 report on Advanced Driver Assistance Systems (ADAS) and the NHTSA's 2023 report, emphasise the importance of combining technological advances with systemic and coordinated policy efforts at the level of public administration.

A notable example of the practical application of the Safe System approach is the Vision Zero movement, launched in Sweden in the 1990s with the aim of eliminating all road traffic fatalities and serious injuries. The experiences of countries such as Sweden and the Netherlands demonstrate that Vision Zero is a realistic goal: a combination of infrastructural improvements, educational initiatives, and enforcement policies has resulted in a decrease in road traffic accidents (OECD, 2022; ITF, 2020). Nevertheless, the success of Vision Zero hinges not only on structural changes, but also on fostering a robust road safety culture. Studies such as those by Starkey and Isler (2016) and Scott-Parker et al. (2015) emphasise the crucial role of attitudes, personality traits, and executive functions in shaping safe driving behaviours.

As discussed in the literature (Ward et al., 2010; Nordfjærn et al., 2014), the concept of road safety culture provides a useful framework for understanding the influence of perceptions, attitudes and behaviours on road user safety. It shapes the way risks are perceived and managed, playing a crucial role in determining the effectiveness of public policies. International studies, including those conducted in Norway and Sweden, have demonstrated the importance of a shared road safety culture in reducing risky behaviours and promoting responsible attitudes (European Transport Safety Council, 2023; Nordfjærn et al., 2014). Furthermore, the pandemic has emphasised the dynamic nature of driving behaviours. While lockdown measures led to reduced traffic volumes, they also resulted in an increased risk of accidents due to higher average speeds (Katrakazas et al., 2020; Briefing, 2020).

There are significant shortcomings in road safety culture in Italy. Despite adopting the National Road Safety Plan 2030 (Piano Nazionale per la Sicurezza Stradale 2030, or PNSS 2030), which is inspired by the principles of the Safe System approach, the country continues to record accident rates that are higher than the European average. Regional disparities, inconsistent interventions, and risky behaviours such as mobile phone use while driving and speeding remain persistent challenges (ISTAT, 2022; WHO, 2015). Furthermore, scholarly literature shows that many Italian drivers, particularly young men, tend to overestimate their abilities and underestimate risks, thereby increasing the likelihood of accidents (Machin & Sankey, 2008; Deery, 1999; Jones, 2013).

Economic studies demonstrate that the social costs of road traffic accidents are substantial. In high-income countries, these costs amount to as much as 6% of GDP, whereas the global average is around 2.7% (Wijnen & Stipdonk, 2016; Papadakaki et al., 2017). These costs include healthcare expenditure, lost productivity and human suffering, highlighting the need for interventions that align with the principles of the Safe System approach. Educational programmes such as the Goals for Driver Education (GDE) matrix show that interventions focusing on risk awareness and self-assessment can significantly improve driving behaviour and reduce accident rates (Hatakka et al., 2002; Engström et al., 2003).

Finally, European initiatives such as EuroRAP and EuroNCAP aim to align infrastructure and vehicle safety standards with the Vision Zero philosophy. However, achieving consistent implementation across regions remains a significant challenge, as highlighted in strategic reports from the European Commission (Threlfall, 2003; European Commission, 2010, 2023). The Italian experience demonstrates

that technical and infrastructural advances alone will not be enough to achieve long-term road safety goals without a broader cultural shift.

Against this backdrop, the present study seeks to analyse the key behavioural factors that influence road safety in Italy, paying particular attention to drivers' attitudes, perceptions, and sense of responsibility. Using data from a survey of 1,060 representative participants, we conducted a cluster analysis to identify distinct, homogeneous groups of drivers based on their risk profiles. Unlike principal component analysis (PCA), this data-driven technique uncovers natural typologies within the population, providing a more nuanced understanding of driver segmentation (Hair et al., 2019; Magidson & Vermunt, 2002). Identifying these clusters provides a robust basis for exploring road user behaviour and perceptions, identifying risk profiles, and examining regional differences. The primary objective is to provide an empirical basis for developing targeted public policies that integrate education, enforcement and infrastructure investment.

From a public administration perspective, the evidence generated by this study allows governmental bodies to translate the EU's Safe System vision into context-specific interventions. By examining the intersection between behavioural risk profiles and Italy's multi-level administrative architecture — encompassing municipal police forces, regional transport departments, and the Ministry of Infrastructure — we demonstrate that governance capacity plays a crucial role in shaping road safety outcomes, rather than individual behaviour alone. This approach directly responds to calls in the literature on public administration for more sophisticated, evidence-based policy instruments that can navigate complex socio-behavioural landscapes (Bianchi et al., 2021; Howlett, 2019).

The remainder of this article is structured as follows: Section 2 provides the theoretical context for the analysis by reviewing the relevant literature. Section 3 describes the data collected and the methodology employed for the cluster analysis. Section 4 presents the results of the analysis and compares them with data from the Italian National Institute of Statistics (ISTAT). Section 5 discusses the study's implications and limitations, while Section 6 concludes by offering targeted policy recommendations for public administration.

2. Background Literature

The discourse surrounding road safety has evolved significantly, shifting from a focus solely on individual driver behaviour to a broader systemic perspective that recognises the critical role of public administration and governance. This shift is exemplified by frameworks such as the GDE-5SOC (Goals for Driver Education – 5 Stages of Competence) matrix, which was developed by Hatakka, Keskinen, Glad, Gregersen and Hernetkoski in 2002. Although initially centred on driver education, the framework offers a fundamental understanding of driving behaviour that is essential for designing public policies. It categorises the fundamental components of driving behaviour within a hierarchical model, in which drivers' actions adapt depending on circumstances and psychological processes, across operational, tactical, and strategic levels.

Laapotti et al. (2006) further elaborated on these theories, identifying three levels of driving behaviour: operational (fundamental vehicle handling skills), tactical (real-time traffic management and risk perception) and strategic (broader decisions such as trip planning and assessment of personal and environmental conditions). This hierarchical understanding is crucial for public administrators when designing interventions, as it highlights that effective road safety policies must address not only basic skills, but also cognitive processes and strategic choices that are influenced by personal, social and cultural factors.

Peräaho et al. (2003) built upon this model by introducing a fourth level: 'Life Goals and Competencies for Living'. This links driving behaviour to an individual's broader life choices and values. This resulted in the GDE matrix, a two-dimensional instrument that integrates behavioural levels with educational content. The GDE matrix emphasises technical knowledge, risk factor management and self-assessment

(Keskinen & Hernetkoski, 2011). From a public administration standpoint, the GDE matrix highlights the importance of a comprehensive training approach that goes beyond technical skills to encompass risk awareness and self-assessment capabilities. Integrating cognitive and value-based perspectives is essential for mitigating risky behaviours and improving road safety, informing public education campaigns and driver licensing reforms.

However, the effectiveness of such behavioural interventions is inextricably linked to robust governance structures and effective policy implementation. As Elvik (2021) highlights, there is a strong statistical relationship between the level of democracy and government effectiveness, and road safety outcomes, suggesting that public perceptions of policy enforcement significantly influence fatality rates. In the context of road safety governance, the concept of 'responsibilisation' demonstrates how governments encourage non-state actors to share responsibility for road safety, shifting the focus away from individual blame (Elvik, 2021). This involves a collaborative governance approach in which policy support and voluntary action are encouraged.

The implementation of road safety policies in a multi-level context, such as in Italy, engages directly with core public administration concepts. Specifically, the success of the Vision Zero approach depends on local and regional governments' administrative capacity to coordinate complex interventions (Bianchi et al., 2021). Furthermore, the effectiveness of enforcement strategies is often mediated by street-level bureaucracy: the police officers and administrative staff who translate policy into action (Lipsky, 2010). The fragmentation of authority across the national (Ministry of Infrastructure), regional (Transport Departments) and local (Municipal Police) levels presents a classic multi-level governance challenge. Aligning goals and sharing data are critical for achieving policy coherence in such a context (Howlett, 2019). By focusing on behavioural segmentation, this study provides these administrative actors with a practical tool to help them avoid the 'one-size-fits-all' trap, thereby contributing to the literature on policy targeting and implementation fidelity.

Effective road safety management is essential for turning policy intentions into reductions in fatalities and serious injuries (Loughborough University, n.d.). This involves strengthening road safety management, improving data collection, prioritising the safety of vulnerable road users, and improving road infrastructure (UNESCAP, n.d.). Public administration plays a pivotal role in orchestrating these efforts, including constructing and enforcing traffic rules and regulations, ensuring adequate driver training, and providing public education (UNECE, n.d.). Implementing interventions focusing on human behaviour, road infrastructure and vehicle safety requires a coordinated, multi-sectoral approach, which is often led by local and national government agencies (Goel, 2024; FHWA, n.d.). Therefore, understanding driver behaviour must be considered in the context of the administrative capacity required to design, implement and enforce policies that will lead to sustainable improvements in road safety. This study aims to contribute to this understanding by examining behavioural factors through the lens of public policy and governance in Italy.

3. Research Design

This study examines the perceptions, attitudes and behaviours of Italian drivers, including the shared norms and values that influence road safety. The term 'road safety culture' was chosen to explore not only observable behaviours, but also the cognitive, emotional and normative factors that underlie them. Previous studies (e.g. Ward et al., 2010; Nordfjærn et al., 2014) have shown that road safety culture is a vital component in enhancing the efficacy of public road safety policies when interpreted in this manner. The questionnaire, fully reported in Appendix A, was designed to analyse factors influencing driving behaviour and perceptions of risk and responsibility, both of which are key topics in road safety culture literature.

The questionnaire was developed through a multi-stage process. First, a literature review was conducted to identify key variables such as risk perception (Deery, 1999), sensation seeking (Zuckerman, 1979; Finn & Bragg, 1986) and the role of individual and collective responsibility

(Hatakka et al., 2002; Ward et al., 2010). The second phase involved conducting an exploratory focus group with university students (aged 20–28) to provide qualitative insights for refining the thematic areas and validating the questionnaire items, in line with similar studies (Twisk & Stacey, 2007). Finally, the questionnaire was administered using the CAWI (Computer-Assisted Web Interviewing) method to ensure rapid, representative data collection.

In collaboration with the Demetra panel, a sample of 1,060 participants was selected and validated using ISTAT statistics. The sample was distributed proportionally according to the gender, age, geographical area and educational level of the Italian population. Eleven of the fifteen attitudinal items are direct adaptations of the well-established Driving Behaviour Questionnaire (DBQ), ensuring conceptual continuity with international research. Four items were drafted specifically to capture enforcement mechanisms relating to Italy’s points-based licence and speed camera system. Preliminary reliability checks yielded Cronbach’s α values ranging from .50 to .69 across the three short subscales (Violations, Errors, and Lapses), and McDonald’s ω values ranging from .73 to .84 (.72 for the 11-item DBQ core). These values are considered acceptable for exploratory public policy instruments with fewer than five items per factor (Cortina, 1993). Finally, regional differences were tested using one-way ANOVA followed by Tukey HSD. A binary logistic model incorporating age and gender was also estimated to examine the effect of demographics on the high-risk driver (HRD) profile (details in Appendix B).

4. Profiling the Italian Driver: A Quantitative Snapshot for Public Administration

This section presents the empirical basis of our study, offering a quantitative profile of the Italian driving population. The data, collected from a representative sample of 1,060 participants, serves as both a descriptive backdrop and a crucial diagnostic tool for public administration. Understanding the demographic composition, attitudes and perceptions of citizens is the first step towards designing evidence-based policies. While the sample mirrors the Italian population in terms of gender and geographical distribution, it does show a slight over-representation of individuals with higher educational attainment. This is a common feature of online surveys and has been accounted for in the subsequent analysis.

TABLE 1. MEANS AND STANDARD DEVIATIONS FOR THE LIKERT SCALE ITEMS INCLUDED IN THE QUESTIONNAIRE.

N	Item	Mean (M)	Standard Deviation (SD)
D1	Drivers should not consume alcohol before driving, not even in minimal amounts	4.26	1.104
D2	It is important to be more cautious when driving with passengers than when driving alone	3.92	1.281
D3	I feel safe when driving	3.64	1.176
D4	When driving, I feel in full control	3.53	1.119
D5	It is very unlikely that I will be involved in a serious accident because I am a very cautious driver	3.14	1.157
D6	Driving is a way to relax	2.83	1.297
D7	If possible, I prefer to avoid driving	2.77	1.489
D8	I have very few minutes to reach my destination	2.76	1.138
D9	Having control of the vehicle while driving gives me a sense of power	2.69	1.237

D10	When driving, I am afraid of getting into an accident	2.61	1.297
D11	Speed cameras do not allow drivers to relax because they force them to slow down abruptly	2.40	1.283
D12	Driving at night is more enjoyable than driving during the day	2.23	1.250
D13	On roads that are driven daily, one can drive almost automatically	2.19	1.155
D15	In heavy traffic, truly skilled drivers can find a way to bypass queues	1.89	1.145
D16	If you are a good driver, you can use a mobile phone while driving without major problems	1.47	0.987

Table 1 provides a detailed overview of the mean responses to the key attitudinal questions. From a public administration perspective, these descriptive statistics are not just numbers, but also indicators of public sentiment and potential obstacles to policy implementation. For example, the near-unanimous agreement that drink-driving is unacceptable (D1: $M = 4.26$) suggests that public awareness campaigns on this issue have largely succeeded and that stringent enforcement would be widely supported. Conversely, ambivalent and highly variable responses regarding avoiding driving (D7: $M = 2.77$, $SD = 1.49$) and fear of accidents (D10: $M = 2.61$, $SD = 1.29$) reveal a fragmented public. This signals to policymakers that a one-size-fits-all approach to promoting alternative mobility or raising risk awareness is unlikely to succeed. This indicates the need for market segmentation-style approaches in public communication, a topic that we will explore through cluster analysis in the next section.

Furthermore, the data reveals a critical disconnect between a strong sense of social responsibility in certain areas (e.g. protecting passengers, D2: $M = 3.92$) and a potential 'optimism bias' concerning personal risk (D5: $M = 3.14$). Drivers feel safe and in control, yet their perception of the likelihood of a serious accident is neutral. This is a classic challenge for public administration: how to translate a general pro-social attitude into consistent, safe behaviour, especially when individuals do not perceive themselves as being at risk. While the strong rejection of obvious rule-breaking (e.g. using a mobile phone while driving; D16: $M = 1.47$) is encouraging, the more nuanced attitudes towards 'automatic driving' on familiar routes (D13: $M = 2.19$) suggest that risk perception is highly contextual. This clearly mandates public policies that proactively shape situational awareness, rather than merely punishing deviance.

In summary, this initial data description provides a comprehensive picture of the Italian driver. While it confirms the existence of a solid foundation of safety-conscious norms, it also highlights significant pockets of heterogeneity and cognitive biases that pose direct challenges to effective governance. The following sections will further dissect this complexity, moving from an aggregate description to identifying specific, policy-relevant target groups.

5. From Data to Governance: Identifying Policy-Relevant Segments and High-Risk Profiles

This section shifts focus from descriptive analysis to strategic segmentation. Statistical techniques are employed to identify meaningful patterns in the data that can inform public administration directly. The aim is to transform raw data into actionable intelligence for policymakers. First, we construct two key indices, Self-Confidence and Responsibility, which serve as proxies for underlying behavioural dispositions. We then use these indices to conduct a regional analysis, revealing territorial disparities that challenge the concept of centralised governance. Finally, we use cluster analysis to identify distinct driver typologies, resulting in the definition of a 'high-risk driver' profile representing a priority target for policy intervention.

5.1. Constructing Policy-Relevant Indices: Self-Confidence and Responsibility

In order to move beyond single-item analysis, we constructed two composite indices based on theoretical and empirical literature. Driving Self-Confidence and Driving Responsibility. These indices represent two fundamental dimensions of driver psychology that can be influenced by different types of policy levers, and are not merely statistical artefacts.

The Self-Confidence Index aggregates items related to perceived control, safety, and driving pleasure. While high scores on this index may indicate competent and experienced drivers, they can also signal overconfidence, which is a known precursor to risk-taking (Deery, 1999). From a policy perspective, this group may be less receptive to traditional fear-based awareness campaigns and may require more nuanced interventions that challenge their self-perception.

The Responsibility Index combines items related to rule adherence, concern for others, and rejection of risky behaviours. This index captures the degree to which drivers have internalised pro-social norms. It directly measures the prevailing 'road safety culture' (Ward et al., 2010) and serves as a key performance indicator for educational and normative interventions.

A one-way ANOVA confirms that a driver's macro-area of residence significantly impacts both indices (Self-Confidence: $F(4, 1056) = 8.5, p < .001$; Responsibility: $F(4, 1056) = 6.2, p < .001$), providing statistical validation for a territorially differentiated approach to governance.

5.2. Territorial Heterogeneity as a Governance Challenge: A Regional Analysis

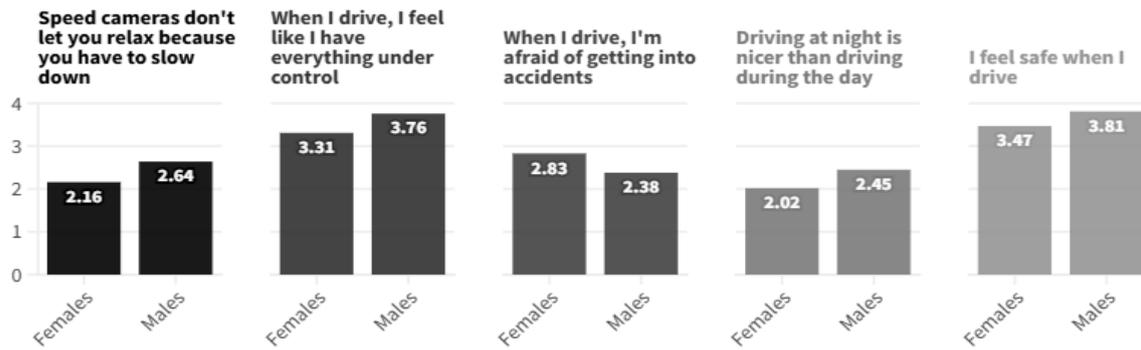
Analysing the geographical distribution of these two indices reveals a complex map of attitudes that defies simplistic north–south dichotomies and poses a significant challenge to Italy's multi-level governance system.

Self-confidence is highest in regions such as Trentino-Alto Adige, Sicily and Campania. The high levels of self-confidence in Trentino-Alto Adige may be linked to higher driving education standards, reflecting a successful policy outcome. However, the similarly high levels of self-confidence in Sicily and Campania, which have different socioeconomic and infrastructural contexts, suggest an alternative underlying cause: a cultural overconfidence disconnected from objective conditions (Agliari et al., 2015). This finding is important for public administration because the same behavioural indicator (high confidence) can have different policy implications depending on the context. In one case, it may need to be sustained, while in another it may need to be challenged.

The Responsibility Index shows a different pattern. Regions such as Basilicata, Tuscany and Emilia-Romagna have the highest scores, indicating a stronger civic culture and adherence to norms. The lower scores in Calabria, Campania and Sicily, despite their inhabitants' high self-confidence, point to a critical disconnect. This presents the most challenging scenario for public administration: regions where drivers are confident but less responsible, which could lead to higher actual risk despite individual perceptions. This highlights the need for a nuanced approach to policy design, with enforcement and educational strategies tailored to address this behavioural disparity.

Figure 1 (Gender Differences in Driving Perceptions and Attitudes) illustrates this further, revealing that men generally report higher self-confidence and lower anxiety, while women exhibit the opposite. This demographic segmentation is important for public communication campaigns, suggesting that messages targeting men should focus on the social consequences of risky driving, whereas those targeting women should emphasise empowerment and skill development.

FIGURE 1. GENDER DIFFERENCES IN DRIVING PERCEPTIONS AND ATTITUDES



5.3. Cluster Analysis: Identifying Policy-Relevant Driver Segments

To identify specific target groups for policy intervention and move beyond aggregate regional trends, we performed a cluster analysis. From a public administration perspective, this technique is particularly valuable as it enables the identification of distinct population segments, allowing for the design of targeted policy interventions rather than one-size-fits-all approaches (Bianchi et al., 2021). Such segmentation is essential for improving the efficiency and effectiveness of policies in complex governance systems.

Geographic Analysis of the Driving Self-Confidence Index

The regional distribution of the Self-Confidence Index, which is based on self-reported perceptions of control, assurance and skill while driving, reveals significant variations across Italy. Regions such as Trentino-Alto Adige, Sicily, and Campania have the highest average values, with an index score exceeding 3.18 out of 5. This suggests that respondents in these regions tend to report a greater sense of confidence while driving, reflecting a stronger belief in their ability to manage traffic situations, respond to hazards and maintain control in stressful situations. In Trentino-Alto Adige, this elevated self-confidence could be attributed to higher driving education standards or a culturally embedded sense of individual competence commonly observed in regions influenced by Northern Europe (Özkan et al., 2006; Autonome Provinz Bozen-Südtirol, 2024). In contrast, in southern regions such as Sicily and Campania, this pattern may be attributed to distinct social dynamics. These could stem from overconfidence being a culturally accepted attitude or a response to infrastructural issues, such as lax enforcement or greater exposure to informal driving behaviours (Agliari et al., 2015). Regions such as Marche and Sardinia also have high levels of self-confidence, which supports the idea that geographical and socio-cultural factors influence how individuals perceive their own driving behaviour. Conversely, lower levels of self-confidence were found in regions such as Tuscany and Umbria. Taken together, these findings suggest that regional variation in self-confidence while driving cannot be explained solely by structural factors, such as the quality of infrastructure or the prevalence of accidents. Rather, it reflects a complex interplay of individual psychology, cultural norms and social context. Understanding these dynamics is crucial for designing effective, regionally targeted road safety interventions, particularly when considering how subjective perceptions may influence risk-taking behaviour, adherence to traffic laws and receptiveness to public health messaging. Further research could explore how these perceptions evolve and interact with other attitudes, such as trust in institutions, normative beliefs and perceived invulnerability.

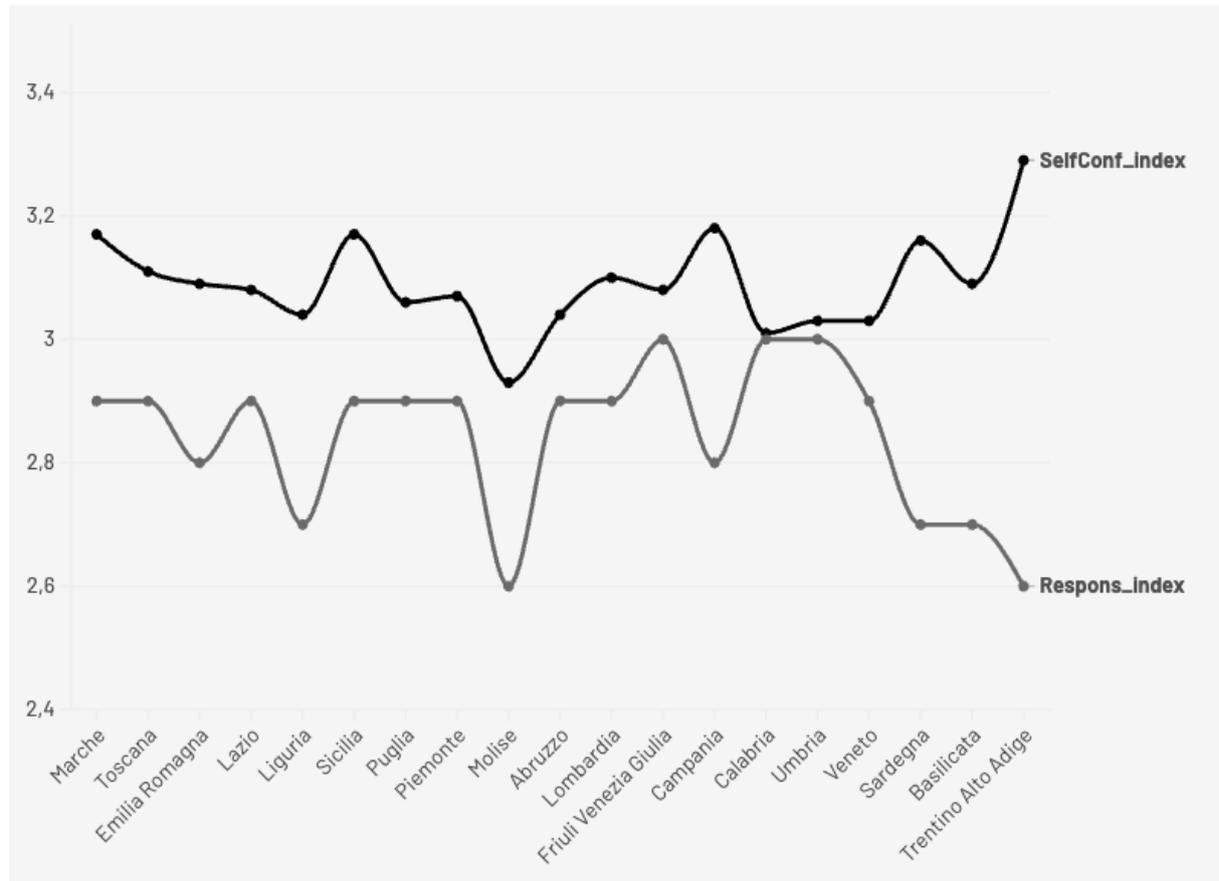
5.3 Geographic Analysis of the Driving Responsibility Index

The Responsibility Index was developed to measure adherence to traffic regulations, sense of duty towards others and internalisation of accountability while driving. Notable variations are also evident across Italian regions. Rather than reflecting personal efficacy alone, the index indicates a tendency to follow the rules and an awareness of the social implications of one's driving behaviour. Regions such as Basilicata, Tuscany, and Emilia-Romagna tend to score higher on this measure, suggesting a more normative approach to driving in which individual actions are considered in terms of their social implications. Regions such as Tuscany and Emilia-Romagna are characterised by well-developed civic infrastructure and strong regional identities associated with civic participation. Their high responsibility scores could suggest a cultural emphasis on compliance, shared spaces, and trust in institutional traffic governance. Basilicata's position is particularly interesting, combining relatively low road traffic volumes with a strong attitudinal orientation towards responsibility. This may reflect a local emphasis on moral or ethical values in driving, or it could be a residual effect of more rural and less competitive driving environments. Conversely, lower levels of responsibility were observed in regions such as Calabria, Campania and Sicily. Despite exhibiting relatively high levels of self-confidence, these regions tend to score lower on the Responsibility Index. This suggests a potential discrepancy between confidence and accountability in driving behaviour. In such contexts, internalising traffic rules may be less common, potentially due to reduced enforcement, informal driving norms or a lower perceived legitimacy of institutions. The discrepancy between perceived control and responsibility towards others could significantly impact risky behaviour, particularly in densely populated or high-traffic urban areas where mutual regulation is essential. Overall, regional variations in responsibility suggest that traffic behaviour cannot be fully understood without considering deeper socio-cultural factors. This highlights the need for a more nuanced, place-based approach to traffic psychology that considers responsibility as both a cognitive or moral disposition and a social construct shaped by regional histories, educational systems and collective driver expectations. Further qualitative and longitudinal research could shed light on how such perceptions change in response to interventions, infrastructural changes or generational turnover.

Joint interpretation of the two indices

The combined regional distribution of the Self-Confidence and Responsibility indices reveals the intricate relationship between drivers' perceptions of their abilities and their accountability towards other road users. Together, the two indices provide a more nuanced understanding of regional driving cultures and potential risk profiles. Regions such as Trentino-Alto Adige, Sicily and Campania have high self-confidence scores, indicating that drivers in these areas consider themselves to be highly competent drivers. However, when these scores are considered alongside responsibility scores, a more intricate picture emerges. For example, while Trentino-Alto Adige has a relatively high responsibility score, indicating a balanced driving attitude, Sicily and Campania have lower responsibility levels. This combination of high self-confidence and lower responsibility could indicate overconfidence and lead to riskier driving behaviours. Conversely, regions such as Tuscany and Umbria have lower self-confidence levels and higher responsibility scores. This suggests a more cautious approach to driving, where drivers are more aware of their limitations and considerate of traffic norms and the safety of others. This could indicate a driving culture that prioritises communal safety over individual assertiveness. The central regions, including Emilia-Romagna and Lazio, tend to cluster around moderate values for both indices, reflecting a balanced perception of driving competence and responsibility. This equilibrium may be due to thorough driver education programmes and consistent traffic regulation enforcement, fostering an environment that values skill and accountability. These regional disparities emphasise the importance of tailoring road safety interventions to specific cultural and psychological profiles. An understanding of how self-confidence and responsibility are distributed can inform targeted educational campaigns and policy measures aimed at enhancing road safety in different regions.

FIGURE 2: JOINT INTERPRETATION OF THE TWO INDICES



Comparison with ISTAT Data

Comparing the findings with the most recent ISTAT data on road accidents reveals significant variations in accident rates across Italy. These rates range from 522.1 in Liguria to 154 in Calabria. Alongside Liguria, the regions of Tuscany and Emilia-Romagna have the highest rates, while Calabria, Molise and Basilicata have the lowest. Conversely, Calabria, Molise and Basilicata have the lowest rates. The road accident mortality rate shows a narrower range than the accident rate. It ranges from 3.8 in Liguria to 8.5 in Basilicata. Geographical differences are smaller still, with a slight increase in the north-east and central regions compared to the north-west and south. A more pronounced divergence emerges when examining the rate of injuries resulting from road accidents: Molise records the lowest rate (206.9), while Liguria records the highest (638.3). In order to investigate whether a systematic relationship exists between psychological perceptions of driving behaviour and official statistics on road safety, we conducted a regional-level analysis combining subjective indices with objective data from ISTAT (2022). We aimed to explore the extent to which self-perceived dimensions, such as confidence and responsibility while driving, align with—or differ from—actual traffic incident data.

We also aimed to identify typologies of Italian regions based on the joint distribution of our two indices and key official indicators from the 2022 ISTAT dataset. The variables selected to capture the perceived and actual dimensions of road safety were the number of road traffic accidents, the number of fatalities and the number of injured individuals per 100,000 inhabitants. These five variables were selected to capture perceived and actual dimensions of road safety and to reveal regional profiles using a data-driven approach. The resulting clusters describe these profiles and can be used as a practical tool for targeting multi-level governance. They help identify where specific combinations of behavioural attitudes and objective risks require differentiated policy responses from national, regional, or local authorities. To prevent the clustering algorithm from being unduly influenced by differences in the measurement scales of the variables, all five indicators were standardised using z-scores. This process

rescales each variable so that it has a mean of zero and a standard deviation of one, enabling meaningful comparisons and distance computations across different units of measurement. We then applied the K-means clustering algorithm, a widely used unsupervised learning technique that partitions a dataset into non-overlapping clusters by minimising intra-cluster variance. The algorithm begins with an initial set of k centroids and then assigns each observation to the nearest centroid based on the Euclidean distance in multidimensional space. The centroids are then updated iteratively until convergence is reached. To determine the optimal number of clusters, we employed two complementary heuristics: the elbow method and the silhouette score. The elbow method evaluates the total within-cluster sum of squares (inertia) as a function of the number of clusters, identifying the point at which adding more clusters results in only marginal improvements in fit. In contrast, the silhouette score measures the average separation between clusters by comparing within-cluster cohesion to between-cluster separation. Both methods independently indicated that a three-cluster solution was optimal, suggesting a tripartite structure in the combined psychological and road safety data. The resulting cluster solution reveals three qualitatively distinct regional profiles. Cluster 0 comprises regions such as Tuscany, Liguria, and Emilia-Romagna. These regions are characterised by high psychological index scores and elevated traffic incident and injury rates. These characteristics suggest regions with confident drivers who adhere to social norms and who are exposed to high levels of traffic, possibly due to dense urban environments, high tourism levels or high vehicle circulation. Cluster 1 comprises regions with intermediate or low levels of psychological and objective indicators. These areas may represent environments that are more balanced and less traffic-intensive, where both the perceived and actual road risk are moderate. Cluster 2 comprises regions with relatively low self-confidence and sense of responsibility scores, as well as lower traffic incident, injury, and fatality rates. This configuration may reflect rural or less motorised areas, where reduced traffic volume mitigates objective risk despite drivers having a lower perceived sense of readiness or normative alignment. Overall, the clustering approach reveals significant, spatially differentiated relationships between self-perception and road safety outcomes across Italy. While some regions demonstrate congruence between subjective and objective dimensions, others exhibit discrepancy: high confidence without corresponding safety, or low confidence despite favourable accident rates. These findings emphasise the importance of considering psychological and structural factors when designing regionally specific road safety interventions and suggest that behavioural indicators should be interpreted in the context of broader territorial dynamics.

TABLE 2. Regional results, ISTAT data and clusters

Region	SelfConf index	Respons index	Sample size	Incidents * 100k	Deaths * 100k	Injured * 100k	Cluster
Marche	3,17	2,9	28	333.6	6.1	448.9	0
Toscana	3,11	2,9	55	413.2	6.2	527.9	0
Emilia Romagna	3,09	2,8	100	376.8	7.0	489.7	0
Lazio	3,08	2,9	109	355.0	5.9	469.3	0
Liguria	3,04	2,7	27	522.1	3.8	638.3	0
Sicilia	3,17	2,9	61	216.8	4.7	315.5	1
Puglia	3,06	2,9	60	237.4	5.8	364.4	1
Piemonte	3,07	2,9	75	238.9	5.7	320.0	1
Molise	2,93	2,6	8	151.9	4.8	206.9	1
Abruzzo	3,04	2,9	16	221.9	4.6	312.3	1

Lombardia	3,10	2,9	158	289.4	4.0	381.1	1
Friuli Venezia Giulia	3,08	3,0	22	273.6	6.2	344.0	1
Campania	3,18	2,8	81	175.1	4.1	249.7	1
Calabria	3,01	3,0	30	154.0	4.0	241.8	1
Umbria	3,03	3,0	8	262.9	5.7	359.1	1
Veneto	3,03	2,9	57	273.0	6.6	356.9	1
Sardegna	3,16	2,7	30	209.5	6.3	288.2	2
Basilicata	3,09	2,7	14	169.6	8.5	251.4	2
Trentino Alto Adige	3,29	2,6	6	290.5	6.1	380.7	2

5.4. The High-Risk Driver Profile: A Priority for Administrative Action

Our analysis revealed a significant 'High-Risk Driver' (HRD) subgroup, accounting for 25% of the sample. These individuals are characterised by a dangerous combination of high self-confidence and low responsibility. This profile is a major concern for the public sector, as this group is most likely to engage in risky behaviour and contribute to accident rates. Key findings regarding the HRD profile include:

Age as a predictor: Even when controlling for confidence and responsibility, younger age remains a significant positive predictor of the HRD profile (OR = 1.01 per year, $p = .018$). This emphasises the importance of age-specific interventions, particularly those targeting young male drivers who are frequently over-represented in accident statistics.

Gender Distribution: Although gender itself was not an independent predictor, males were over-represented within the HRD group (153 males versus 107 females). This suggests that, although confidence and responsibility are the primary drivers of risk, gender may moderate these factors. Therefore, gender-sensitive approaches are required in public awareness campaigns.

Geographical concentration: The South and Islands region had the highest number of HRDs (87), followed by the Northwest (74). This geographical concentration provides clear directives for regional and local administrative bodies to prioritise resources and tailor interventions to these specific areas. It suggests that local cultural norms, enforcement practices or infrastructural conditions may contribute to this high-risk profile being prevalent in these areas.

Identifying the HRD profile provides public administration with a clear mandate. Rather than making generic calls for road safety, it identifies a specific, measurable segment of the population that requires urgent, tailored policy attention. This precision enables public resources to be allocated more efficiently and interventions to be designed that are more likely to reduce accidents and fatalities. The challenge for governance is to translate this empirical insight into coordinated action across the multi-level administrative structure, from national policy frameworks to local enforcement and educational initiatives.

6. Discussion: From Behavioural Insights to Road Safety Governance in Italy

The findings of this study offer a vital link between the analysis of driver behaviour at a micro level and the challenges of public administration and governance at a macro level in the Italian context.

Integrating behavioural data with official crash statistics illuminates the complex interplay between individual attitudes, regional disparities and the multi-level governance framework responsible for road safety. Identifying distinct driver clusters, including a significant 'high-risk' segment accounting for 25% of the sample, provides public managers and policymakers with actionable intelligence, enabling them to move beyond generic safety campaigns to implement targeted, data-driven interventions.

This paper's key contribution to the field of public administration lies in its operationalisation of the Safe System paradigm within Italy's specific administrative architecture. Our results reveal that a one-size-fits-all approach to road safety is bound to be ineffective. The regional clusters we identified, ranging from areas with high confidence and high incident rates (e.g. Tuscany and Liguria) to areas with low confidence and low incident rates, underscore the necessity of tailoring policy instruments to local socio-cultural and infrastructural contexts. This aligns with the broader literature on policy design, which emphasises the need for context-sensitive and evidence-based approaches to complex societal problems (Howlett, 2019).

From a governance perspective, our findings highlight three primary levers for administrative action, each corresponding to specific competencies within Italy's multi-level system.

Policy Targeting and Administrative Capacity in Educational Interventions

The prevalence of high-risk driving, particularly among younger demographics, highlights the need for more sophisticated educational programmes. Regional and municipal authorities can use our cluster profiles to design communication campaigns that address the specific attitudes and perceptions of local populations. For example, in regions where overconfidence is prevalent, campaigns could aim to reduce the glamour associated with risky driving and encourage realistic self-assessment, in line with the GDE framework (Hatakka et al., 2002).

Street-Level Bureaucracy and Segmented Enforcement Strategies

The discrepancy between perceived safety and actual accident rates in certain areas highlights a significant governance issue. National bodies, such as the Ministry of Infrastructure, can use this data to allocate resources more effectively and prioritise infrastructure improvements in areas where a false sense of security may be contributing to higher incident rates. Furthermore, coordinated enforcement strategies between national (Polizia Stradale) and local (Polizia Municipale) police forces are essential. Our findings can inform targeted enforcement efforts against specific behaviours (e.g. speeding and distracted driving) that are prevalent among certain groups of drivers.

Overcoming Multi-Level Governance Challenges through Collaborative Frameworks

The fragmented responsibilities for road safety governance across different levels of the Italian government make stronger collaborative mechanisms necessary. Our research provides a shared evidence base around which different administrative actors can align their efforts. This supports the call in public administration literature for collaborative governance models to address 'wicked problems' such as road safety, where behavioural, social and technical factors are deeply intertwined (Bianchi, Nasi & Rivenbark, 2021).

In essence, this study demonstrates how behavioural science can inform public administration by providing an empirical foundation for a more nuanced and effective approach to road safety governance. By shifting the focus from individual blame to systemic analysis, we provide public managers with a practical roadmap for designing and implementing policies that are both evidence-based and administratively feasible within a complex, multi-level governance system.

7. Limitations and Future Research

As with any survey-based research, this study has methodological limitations relating to the administration of the questionnaire. The survey was conducted using CAWI (Computer-Assisted Web Interviewing), a widely used method in professional polling and social research thanks to its efficiency and scalability. It enables responses to be collected rapidly from many participants while optimising resources. However, as with all online surveys, there is a potential limitation in terms of sample coverage, as individuals with lower digital literacy or restricted internet access may be underrepresented. Nevertheless, the sample was carefully structured in accordance with survey methodology best practice to ensure broad and balanced representativeness. While it is important to acknowledge the study's limitations, it is crucial to emphasise that they do not undermine the valuable insights that the findings provide for future research. One way to overcome these limitations would be to conduct additional studies with a more diverse sample using data collection tools that combine CAWI with traditional methods such as face-to-face or telephone interviews. Furthermore, targeted thematic studies could facilitate a more profound exploration of regional differences in road safety habits and perceptions, considering the potential for substantial variations attributable to cultural, economic and infrastructural factors. Selecting a concise, governance-focused scale instead of a longer psychometric instrument reflects the recent trend in public administration research to prioritise policy relevance over measurement accuracy when operationalising behavioural constructs (George & Pandey, 2017). Future research could replicate the study using the full DBQ in order to test the robustness of our governance-specific findings in an external context.

8. Concluding Remarks: Towards an Integrated Governance of Road Safety

This study aimed to reveal the behavioural foundations of road safety in Italy and, in doing so, to provide public administration with a clear, actionable framework. Our analysis confirms that human factors, particularly the interplay between driver confidence and responsibility, are key to understanding road risk. However, our main contribution is to place these behavioural insights in a broader governance context, showing that effective road safety management involves designing smarter, more adaptive public policies, not just changing individual behaviours.

Identifying a substantial 'high-risk' driver segment and significant regional variations in attitudes and accident rates highlights the limitations of a centralised, uniform approach. We therefore advocate a paradigm shift towards a more decentralised, data-driven model of road safety governance. This model should be based on the principles of the Safe System but adapted to the specific administrative and cultural realities of Italy.

Our findings offer a clear path forward for Italian public administration at all levels. For national policymakers, this study provides a compelling case for the strategic allocation of resources and the promotion of inter-agency coordination. For regional and local administrators, our cluster analysis is a powerful tool for identifying local issues and designing targeted solutions, such as bespoke educational campaigns and focused enforcement efforts. By providing a detailed, evidence-based understanding of who is at risk, where and why, we enable public managers to implement policies that can save lives, moving beyond mere rhetoric.

Ultimately, this research strongly advocates the integration of behavioural science into public administration. The challenge of achieving Vision Zero lies as much in governance as in engineering or education. Embracing the complexity of human behaviour and using data to inform policy enables public institutions to manage road safety more effectively, thus fulfilling their core mission of protecting citizens and enhancing societal well-being. Future research should continue to explore the causal links

between specific governance arrangements and road safety outcomes, thereby strengthening the evidence base for a new generation of public policies.

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APPENDIX A: The Questionnaire

Section 1: Socio-Demographic Questions

1.1 Year of birth:

1.2 Gender:

- Male
- Female
- Prefer not to answer

1.3 Municipality of residence:

1.4 Province of residence:

1.5 Region of residence:

1.6 Highest level of education attained:

- No formal education
- Primary school diploma
- Lower secondary school diploma
- Upper secondary school diploma
- University degree
- Postgraduate degree

1.7 Employment status:

- Employed
- Unemployed
- Seeking employment
- Student
- Retired
- Homemaker

1.8 Do you have minor children?

- Yes
- No

Section 2: Driving Habits

2.1 Do you have a driving license?

- Yes, and I drive
- Yes, but I do not drive
- No

(If the answer is "No," proceed to Section 3)

Only if 2.1 is "Yes, and I drive" or "Yes, but I do not drive"

2.1.1 How long have you had your driving license?

- Less than one year
- Between one and five years

- Between six and ten years
- More than ten years
- More than twenty years
- More than thirty years

2.1.2 How often do you drive?

- Every day for more than two hours
- Every day for less than two hours
- Several times a week
- About once a week
- Rarely
- Never

2.1.3 Do you drive on highways?

- Every day
- Often
- Rarely
- Never

Section 3

3.1 Please indicate your level of agreement with the following statements (Scale 1-5, with anchors at the extremes):

1 = Strongly disagree

5 = Strongly agree

3.1.1 I have only a few minutes to reach my destinations.

3.1.2 I feel safe when driving.

3.1.3 When driving, I feel I have everything under control.

3.1.4 If possible, I prefer to avoid driving.

3.1.5 When driving, I am afraid of having an accident.

3.1.6 Driving is a way to relax.

3.1.7 Having control of the vehicle while driving gives me a sense of power.

3.1.8 It is important to be more cautious when driving with passengers than when driving alone.

3.1.9 It is very unlikely that I will have a serious accident because I am very careful when driving.

3.1.10 When there is heavy traffic, a skilled driver can always find a way to bypass the queue.

3.1.11 Driving at night is more enjoyable than driving during the day.

3.1.12 On roads I travel daily, I can drive almost automatically.

3.1.13 A driver should not consume alcohol in any amount before driving.

3.1.14 If one is a skilled driver, they can use a phone while driving without major issues.

3.1.15 Speed cameras prevent relaxation while driving because they require sudden deceleration.

3.2 Which of the following statements best reflects your opinion? (7-point semantic differential scale with opposing statements at each extreme):

- It is always right to follow the rules.
- If a rule does not make sense, it is right to disregard it.

3.3 Which of the following statements best reflects your opinion? (7-point semantic differential scale with opposing statements at each extreme):

- People can be trusted.
- In general, it is better not to trust others.

Appendix B

Binary-logit: Predictors of High-Risk Driver (HRD)

Predictor	Odds Ratio	<i>p</i> -value
Intercept	0.59	.020
Male (vs female)	0.99	.920
Age (per year)	1.01	.018

(*Self-Confidence* \geq median & *Responsibility* \leq median – $N = 274$, 25 %)

One-way ANOVA by macro-area ($N \approx 1\ 060$)

Index	F (4, 1056)	<i>p</i> -value
Self-Confidence	8.5	< .001
Responsibility	6.2	< .001

Tukey-HSD (*significant pairs only*): Self-Confidence: North-East > Centre ($p < .05$).

Responsibility: South + Islands < North-West ($p < .05$)