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Beyond Infrastructure: How Age, Gender, and Behavioral Norms Shape Road Safety in Iraq

Haydar Raheem Hmoud[1]

Abstract

Road safety is a critical concern worldwide, directly influencing public health, economic stability, and overall quality of life. As the number of vehicles on the road continues to rise, the quality of infrastructure—roads, bridges, signage, and traffic control systems—plays a pivotal role in determining safety outcomes. This study investigates how age and gender influence road safety perceptions, behaviors, and experiences among 1,490 respondents in Iraq. Females constituted 56.5% of participants, with a majority (40.9%) aged 18–25, reflecting Iraq's youthful demographics. Findings reveal significant age and gender disparities: middle-aged respondents (46–55 years) perceived roads as less safe than younger groups, contrasting with trends in high-income countries. Gender differences emerged, with females rating roads as safer (159 vs. 100 males) and males reporting more risky behaviors (e.g., phone use while driving: 22 males vs. 7 females). Seatbelt non-use was unexpectedly rare among males (0 cases vs. 36 females), suggesting cultural or reporting biases. Factor analysis identified three key components: (1) satisfaction with road safety infrastructure and efforts, (2) personal safety compliance (e.g., seatbelt use), and (3) a paradoxical link between high-risk perception and risky behaviors, possibly due to risk normalization. The study highlights the need for targeted interventions, such as awareness campaigns and stricter enforcement, to address these disparities and improve road safety in Iraq. It is vital for policymakers, municipal planners, and the public to understand the complex relationship between road safety and the quality of infrastructure to create a safer road environment and minimize the catastrophic impact of traffic-related accidents.

Keywords: *Road Safety, Infrastructure, Factor Analysis, Risky Behavior, Awareness Campaign.*

Introduction

With the increase in traffic accidents, road safety is one of the major global public health problems. Proper care of roads could also reduce the number of traffic accidents, as it would lead to improving sightlines, unblocking traffic lanes all around and putting in place a safe environment for pedestrians or cyclists. (Ghaffar et al. 2020) "The issue lies in poor road conditions, signages not being put out as they should, mending wrong or narrow road and that results in dangerous traffic environments; more chances of traffic accidents slapped on top with injury or even death," says Owsinski, Chapter-22 (2022). It is equally important to adhere this clause with care. (Blanco et al., 2023; Haydar, 2020).

Road safety is still a major concern in Iraq, a nation dealing with many infrastructure, governance, and socioeconomic issues. Iraq has one of the highest rates of traffic accidents in the Middle East, according to studies (Ibrahim et al., 2019). Road traffic injuries are one of the country's leading causes of death for young people, contributing significantly to overall mortality, according to a World Health Organization report from 2021. Iraq's emergency response systems frequently fall short of providing prompt and sufficient care, which exacerbates the issue. According to research by Mahdi et al. (2020), thousands of accident victims do not receive the necessary medical care, which exacerbates the effects of these incidents. The Iraqi Injury Surveillance System Annual Report for 2022 provides statistics for traffic accidents and other injury types within Iraq. Traffic accidents were responsible for 4,945 (40.1%) of 12,334 total fatal events and involved 72.9% males and 27.1% females. On the other hand, there were 49,106 non-fatal traffic accident-related injuries, which were 38% of all non-fatal injuries for the year that totaled 129,074. Males were the majority among those who were injured (78.7%), while 21.3%

[1] University of Baghdad, Email: haydar.r@kmc.uobaghdad.edu.iq, ORCID: https://orcid.org/0000-0002-4194-8178

of all traffic accident-related instances involved females. Young people were predominantly hit were those 20-29 and also included high numbers from the 0-9 and 10-19 groups. (Khwaif, 2022).

Contributing Factors

Several factors are accountable for the high road traffic injury incidence rate in Iraq. The deplorable condition of road infrastructure, exacerbated by prolonged conflict and neglect, is one major factor (Abed et. al., 2023; Haydar et. al., 2024; Haydar et. al., 2025). Poor road conditions, bad signage, and no traffic management system are issues that severely impact road safety, according to Al-Azzawi et al. (2020). Recklessness and disregard for traffic rules are also linked to cultural factors and are major agents for the high incidence of accidents (Abed et al., 2023). Furthermore, an increased rate of vehicle ownership, especially within cities, is responsible for more congested roads and increased risk. Zubairi et al. (2022), from a survey, highlight the relationship between increased numbers of vehicles on roads and increased accident frequencies, pointing out that most drivers are not well-educated regarding road safety measures

Government Initiatives and Road Safety Measures

A number of initiatives have been undertaken by the government of Iraq to enhance road safety. The Ministry of Interior launched a national road safety strategy for curbing traffic casualties by 30% within five years from 2018 (Ministry of Interior, 2018). Nevertheless, the impact of these measures remains questionable due to insufficient funding and failure to conduct public awareness campaigns. A study by Jassim et al. (2021) shows that while road safety measures, including speed humps and better signs, have been installed within a few cities, many cities are still missing basic safety facilities. Additionally, traffic law enforcement is weak, which dilutes efforts to curb reckless driving.

Public Awareness and Education

The government of Iraq has made various attempts to enhance road safety. The Ministry of Interior launched a national road safety strategy for decreasing traffic casualties by 30% within half a decade starting from 2018 (Ministry of Interior, 2018). The efficiency of the measures taken, however, is questionable due to limited funding and their inability to implement public awareness programs. Research conducted by Jassim et al. (2021) shows that road safety facilities such as speed humps and better signs have been installed across a number of cities, while many cities are devoid of vital safety facilities. On top of that, traffic law enforcement continues to be weak, and that undermines efforts to curb reckless driving.

Aims of the study

The current study aimed to assess factors contributing in roads safety and to compare the current situation of safety with previous achievements to better understanding the progress in enhancement the safety of roads.

Methodology

Research Design

This study employed a quantitative research design using a structured questionnaire to assess road safety perceptions and behaviors among drivers in Iraq. The questionnaire was developed to gather data on various aspects of road safety, including factors contributing to traffic accidents, awareness of traffic laws, quality of roads, and drivers' self-reported behaviors.

Data Analysis

The collected data were analyzed using Excel spreadsheets and statistical software (SPSS V.28). Descriptive statistics were employed to summarize demographic information and responses to specific questions. Inferential statistical methods, such as chi-square tests, were used to explore relationships between variables, with a p-value of less than 0.05 considered statistically significant. Additionally, factor analysis (principal component analysis with varimax rotation) was conducted to identify latent constructs and reduce data dimensionality, ensuring key road safety factors were accurately captured. The analysis helped uncover underlying patterns in drivers' perceptions and behaviors. Qualitative data from open-ended questions were analyzed using thematic analysis to identify common themes and insights regarding drivers' perceptions of road safety.

Ethical Considerations

This study adhered to ethical guidelines, ensuring the anonymity and confidentiality of participants' responses. Ethical approval was obtained from the Institutional Review Board (IRB) prior to the commencement of data collection. Participants were informed that their participation was voluntary and that they could withdraw at any time without penalty.

Results

Participant Demographics

The study surveyed 1,490 participants to assess road safety perceptions in Iraq. Key demographic characteristics are summarized in Table 1.

Table 1. Demographic Profile of Survey Participants

Question	Answer	Frequency	Percent,%
Gender	Female	842	56.5
	Male	648	43.5
Age	>56	74	5.0
	18-25	609	40.9
	26-35	276	18.5
	36-45	114	7.7
	46-55	417	28.0
primary role	Driver	621	41.7
	Government official	385	25.8
	Pedestrian	432	29.0
	Road construction worker	39	2.6
	Student	13	0.9
How long have you been driving/using road	Less than 1 year	160	10.7
	1-5 years	391	26.2
	5-10 years	135	9.1
	> 10 years	804	54.0
Where do you primarily travel?	Urban areas	974	65.4
	Rural areas	11	0.7
	Both	505	33.9

Road Safety Perceptions and Behaviors

The study examined participants' perceptions of road safety conditions and their self-reported behaviors. As shown in Tables 2 and 3, the results reveal significant concerns about road safety alongside notable patterns in compliance and attitudes.

Table 2. Road Safety Perceptions and Infrastructure Evaluation

Question	**Response**	**Frequency**	**Percent (%)**
Overall road safety rating	Unsafe	270	18.1
	Neutral	772	51.8
	Safe	259	17.4
	Very Safe	189	12.7
Satisfaction with road safety efforts	Very dissatisfied	138	9.3
	Dissatisfied	619	41.5
	Neutral	403	27
	Satisfied	264	17.7

	Very Satisfied	66	4.4
Road infrastructure quality	Very Poor	211	14.2
	Poor	606	40.7
	Fair	654	43.9
	Good	19	1.3
Traffic law enforcement effectiveness	Very Ineffective	31	2.1
	Ineffective	224	15
	Neutral	638	42.8
	Effective	294	19.7
	Very Effective	303	20.3

Table 3. Self-Reported Road Safety Behaviors

Question	Response	Frequency	Percent (%)
Traffic rule compliance frequency	Never	17	1.1
	Rarely	78	5.2
	Sometimes	278	18.7
	Frequently	487	32.7
	Very Frequently	630	42.3
Mobile phone use while driving	Never	566	38
	Calls/Texts	164	11
	Navigation	691	46.4
	Frequently	69	4.6
Seatbelt usage frequency	Never	36	2.4
	Rarely	81	5.4
	Sometimes	255	17.1
	Frequently	291	19.5
	Very Frequently	827	55.5

Age-Specific Analysis of Road Safety Perceptions and Behaviors

The following tables (4 and 5) present age-stratified analyses of road safety perceptions and behaviors, revealing significant variations across different demographic groups.

Table 4. Age Group Differences in Safety Perceptions

Safety Evaluation	18-25, N (%)	26-35, N (%)	36-45, N (%)	46-55, N (%)	>56, N (%)	P-value	
	Road Safety Rating						
Unsafe	61 (4.1)	73 (4.9)	13 (0.9)	76 (5.1)	47 (3.2)		
Neutral	385 (25.8)	147 (9.9)	101 (6.8)	129 (8.7)	10 (0.7)	< .001	
Safe	121 (8.1)	25 (1.7)	0 (0)	113 (7.6)	0 (0)		
Very Safe	42 (2.8)	31 (2.1)	0 (0)	99 (6.6)	17 (1.1)		
	Accident Frequency						
Never	0 (0)	2 (0.1)	0 (0)	10 (0.7)	0 (0)		
Rarely	144 (9.7)	29 (1.9)	0 (0)	58 (3.9)	8 (0.5)		

Sometimes	355 (23.8)	167 (11.2)	101 (6.8)	280 (18.8)	38 (2.6)	< 0.001	
Frequently	83 (5.6)	77 (5.2)	13 (0.9)	59 (4)	15 (1)		
Very Frequently	27 (1.8)	1 (0.1)	0 (0)	10 (0.7)	13 (0.9)		
	Satisfaction with Safety Efforts						
Very dissatisfied	13 (0.9)	29 (1.9)	0 (0)	80 (5.4)	16 (1.1)		
Dissatisfied	267 (17.9)	103 (6.9)	65 (4.4)	156 (10.5)	28 (1.9)		
Neutral	197 (13.2)	67 (4.5)	26 (1.7)	110 (7.4)	3 (0.2)	< 0.001	
Satisfied	131 (8.8)	62 (4.2)	13 (0.9)	31 (2.1)	27 (1.8)		
Very Satisfied	1 (0.1)	15 (1)	10 (0.7)	40 (2.7)	0 (0)		

Table 5. Age Group Differences in Safety Behaviors

Safety Behavior	**18-25, N (%)**	**26-35, N (%)**	**36-45, N (%)**	**46-55, N (%)**	**>56, N (%)**	**P-value**
	Traffic Rule Compliance					
Never	0 (0)	17 (1.1)	0 (0)	0 (0)	0 (0)	
Rarely	26 (1.7)	10 (0.7)	0 (0)	41 (2.8)	1 (0.1)	
Sometimes	99 (6.6)	47 (3.2)	26 (1.7)	80 (5.4)	26 (1.7)	< 0.001
Frequently	248 (16.6)	94 (6.3)	62 (4.2)	65 (4.4)	18 (1.2)	
Very Frequently	236 (15.8)	108 (7.2)	26 (1.7)	231 (15.5)	29 (1.9)	
	Mobile Phone Use While Driving					
Frequently	26 (1.7)	25 (1.7)	0 (0)	18 (1.2)	0 (0)	
Calls/Texts	53 (3.6)	33 (2.2)	26 (1.7)	49 (3.3)	3 (0.2)	< 0.001
Navigation	267 (17.9)	117 (7.9)	36 (2.4)	216 (14.5)	55 (3.7)	
Never	263 (17.7)	101 (6.8)	52 (3.5)	134 (9)	16 (1.1)	
	Seatbelt Usage					
Never	13 (0.9)	10 (0.7)	0 (0)	13 (0.9)	0 (0)	
Rarely	41 (2.8)	1 (0.1)	13 (0.9)	13 (0.9)	13 (0.9)	
Sometimes	80 (5.4)	88 (5.9)	0 (0)	66 (4.4)	21 (1.4)	< 0.001
Frequently	102 (6.8)	37 (2.5)	49 (3.3)	101 (6.8)	2 (0.1)	
Very Frequently	373 (25)	140 (9.4)	52 (3.5)	224 (15)	38 (2.6)	

Gender Differences in Road Safety Perceptions and Behaviors

The analysis reveals statistically significant differences between male and female respondents across all measured aspects of road safety. Tables 6 and 7 present these gender-based comparisons, with all results showing high statistical significance ($p < 0.001$) unless otherwise noted.

Table 6. Gender Differences in Safety Perceptions and Evaluations

Question	**Response**	**Female**	**Male**	**P-value**
Overall road safety rating	Unsafe	143 (9.6)	127 (8.5)	0.02
	Neutral	419 (28.1)	353 (23.7)	
	Safe	159 (10.7)	100 (6.7)	
	Very Safe	121 (8.1)	68 (4.6)	
Accident frequency	Never	10 (0.7)	2 (0.1)	0.001
	Rarely	118 (7.9)	121 (8.1)	
	Sometimes	527 (35.4)	414 (27.8)	
	Frequently	163 (10.9)	84 (5.6)	
	Very Frequently	24 (1.6)	27 (1.8)	
Traffic rule compliance	Never	10 (0.7)	7 (0.5)	<0.001

	Rarely	26 (1.7)	52 (3.5)	
	Sometimes	131 (8.8)	147 (9.9)	
	Frequently	222 (14.9)	265 (17.8)	
	Very Frequently	453 (30.4)	177 (11.9)	

Table 7. Gender Differences in Safety Behaviors and Awareness

Question	Response	Female	Male	P-value
Mobile phone use	Frequently	47 (3.2)	22 (1.5)	0.001
	calls/texts	42 (2.8)	122 (8.2)	
	Navigation	365 (24.5)	326 (21.9)	
	Never	388 (26)	178 (11.9)	
Seatbelt usage	Never	36 (2.4)	0 (0)	0.001
	Rarely	53 (3.6)	28 (1.9)	
	Sometimes	113 (7.6)	142 (9.5)	
	Frequently	136 (9.1)	155 (10.4)	
	Very Frequently	504 (33.8)	323 (21.7)	
Drunk driving awareness	No	1 (0.1)	26 (1.7)	0.001
	Yes	841 (56.4)	622 (41.7)	

Factor Analysis Results

The factor analysis was conducted to identify underlying dimensions in the road safety perception data, with the following key findings (Table 8 and Table 9):

Component 1: Satisfaction with Road Safety Infrastructure and Efforts

Component 2: Personal Safety Compliance

Component 3: Risk Perception and Behavior

Table 8. Factor Analysis Adequacy Tests

Measure	Value	Interpretation
Kaiser-Meyer-Olkin (KMO)	0.6	Adequate for the test (acceptable >0.5)
Bartlett's Test χ^2	1211.612	$p < 0.001$
Degrees of Freedom	45	-

Table 9. Variance Explained by Extracted Factors

Factor	Eigenvalue	Variance %	Cumulative %	Rotated Eigenvalue	Rotated % Variance
1*	1.903	19.03%	19.03%	1.898	18.98%
2**	1.536	15.36%	34.38%	1.488	14.88%
3***	1.092	10.92%	45.30%	1.144	11.44%

*: Satisfaction with Road Safety Infrastructure and Efforts

**: Personal Safety Compliance

***: Risk Perception and Behavior

Discussion

This study examined how age and gender influence road safety perceptions, behaviors, and experiences among 1,490 respondents in Iraq. Females represented 56.5% of participants while the other 43.5% were males. Majority of participants were under the (18-25 years) age group (40.9%) while only 5% of participants aged more than 56 years. The overrepresentation of young respondents (18–25 years) and underrepresentation of older adults (>56 years), especially among females, reflects Iraq's youthful population structure (World Bank, 2023). The gender disparity in older age groups may stem from cultural norms limiting women's mobility (Al-Madani & Al-Janahi, 2012), though further qualitative research is needed to explore this. The strong association between age and primary road roles (e.g., students in 18–25 vs. government officials in 46–55; $\chi^2 = 587.46$, $p < 0.001$) mirrors global trends where age correlates with occupational and travel patterns (WHO, 2021).

Middle-aged respondents (46–55 years) rated roads as significantly less safe than younger groups ($\chi^2 = 366.69$, $p < 0.001$). This contrasts with studies in high-income countries, where younger drivers often perceive higher risks (Şimşekoğlu, 2015). The discrepancy may reflect Iraq's unique context: older adults' cumulative exposure to hazardous infrastructure (e.g., potholes, poor lighting) may heighten risk awareness. Gender differences in safety ratings ($\chi^2 = 9.80$, $p = 0.020$) align with prior work suggesting women are more risk-averse (Turner & McClure, 2003). Females in this study were more likely to rate roads as "Safe" (159 vs. 100 males), possibly due to differing travel patterns (e.g., more urban trips; $\chi^2 = 104.62$, $p < 0.001$).

Male respondents reported higher rates of risky behaviors, such as frequent phone use while driving (22 vs. 7 females; $\chi^2 = 104.72$, $p < 0.001$). This supports cross-cultural findings that men engage in more distracted driving (Gauld et al., 2014). Notably, seatbelt non-use was rare among males (0 cases vs. 36 females), contradicting studies elsewhere (Al-Matawah et al., 2019). This anomaly warrants investigation—potentially reflecting reporting bias or cultural specificity.

Respondents across age groups rated road quality as "Poor" (606/1,490), with the youngest (18–25) most critical ($\chi^2 = 100.62$, $p < 0.001$). This aligns with World Bank (2023) reports on Iraq's deteriorating infrastructure. However, perceptions of enforcement were polarized: while 46–55-year-olds viewed it as "Very Effective" (102/417), younger groups deemed it "Ineffective" ($\chi^2 = 160.27$, $p < 0.001$). Such disparities may reflect generational differences in trust in authorities (Haghani et al., 2022).

Additionally, factor test was conducted to simplify and identify patterns of the data. Before conducting factor test, adequacy to perform the test was investigated by KMO measure (0.6) and significant Bartlett's test ($p < 0.001$) indicating the data is suitable for factor analysis where three components were extracted. First component (satisfaction with road safety infrastructure and efforts) links infrastructure quality, enforcement effectiveness, and trust in safety efforts where a strong correlation were achieved (0.766-0.789) suggesting that they are central to public perception which aligns with studies showing that infrastructure improvements boost trust in safety systems (Haydar, 2025; WHO, 2022). Second component (personal safety compliance) reflects individual-level safety behavior such as seatbelt-use and rule-following. High internal consistency which achieved for seatbelt use (0.793) and rule-following (0.697) indicate these behaviors cluster together, matching the theory of planned behavior (Ajzen, 1991) which are comparable to Florent Varet et al. (2021), where habitual safety practices (e.g., seatbelt use) were linked to broader compliance. Finally, the third component (risk perception and behavior) captures a paradoxical pattern: individuals who perceive roads as unsafe (negative safety rating -0.69) yet engage in risky behaviors (phone use while driving 0.67). Such achievements could be explained as normalization of risk due to frequent exposure to accidents/near-misses, overconfidence because drivers may believe they can manage risks (e.g. using phones "safely") or, recognizing general danger but underestimating personal vulnerability. Some targeted interventions may help in addressing this mismatch, such as: campaigns linking perceived risk to personal consequences (e.g., "You think roads are unsafe—why add to the danger?"), enforcement of distracted driving laws paired with awareness of near-miss causality or, training programs to recalibrate risk assessment (e.g., highlighting how phone use amplifies existing hazards).

Conclusion

The survey reveals deep-rooted challenges in Iraq's road safety landscape, with significant concerns surrounding infrastructure quality, law enforcement effectiveness, and public adherence to traffic regulations. While awareness of critical dangers—such as drunk driving—is remarkably high (98.2%), actual behavioral compliance varies considerably across different age groups, suggesting a

gap between knowledge and practice. Younger respondents (18-25 years old), who make up the largest demographic in the survey (40.9%), exhibited neutral or negative perceptions of road safety, with many reporting frequent accidents or near-misses. This group was also less likely to strictly follow traffic rules, indicating a need for targeted education and stricter enforcement to instill safer driving habits. Older age groups (46-55 and >56 years), while more experienced in road usage, were highly critical of current safety measures, with many expressing dissatisfaction with enforcement and infrastructure. Their responses suggest long-standing systemic issues that have not been adequately addressed over time.

The findings underscore an urgent need for comprehensive reforms, including: infrastructure upgrades – Given that 54.9% of respondents rated roads as "Poor" or "Very Poor," investments in better road design, maintenance, and safety features (such as clear signage, pedestrian crossings, and lighting) are essential, stricter law enforcement – With only 40% believing traffic laws are effectively enforced, stronger penalties, increased police presence, and automated monitoring (e.g., speed cameras) could improve compliance, and public awareness campaigns – Since younger drivers show lower rule adherence despite high awareness, tailored programs—such as school-based road safety education, social media campaigns, and defensive driving courses—could bridge the gap between knowledge and behavior.

Without immediate action, Iraq's road safety crisis will likely persist, leading to continued high accident rates, economic losses, and preventable fatalities. A multi-faceted approach combining policy changes, infrastructure investment, and behavioral interventions is crucial for meaningful progress.

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