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# Investigating the Effect of Safety Attitude, Safety Behavior and Safety Culture on Safety Performance Among Drivers in Saudi Arabia

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***Abstract:*** This study investigates the influence of safety behavior, safety attitude, and safety culture on overall safety performance among drivers in Saudi Arabia, focusing on gender, age, and driving experience. Data was collected in 2019 (559 participants) and 2024 (1,190 participants) using quantitative and qualitative methods. Advanced statistical tools like ANOVA, T-tests, Pearson correlation, and Structural Equation Modeling (SEM) analyzed relationships between safety factors and driving performance. Results revealed safety behavior had the most significant impact on safety performance. Significant differences in safety attitude were found between genders, with females showing higher attitudes, though safety performance was similar. Age and driving experience were key determinants: drivers aged 26-30 in 2024 had the highest safety performance, while those 18-25 had the lowest in both years. Drivers with over 21 years of experience showed superior safety performance, emphasizing the positive impact of experience. The study highlights the need for better driver education, stricter traffic regulation enforcement, and promoting safety culture to improve driving performance, offering insights into how safety behaviors, attitudes, age, and experience affect driving and reduce traffic incidents in Saudi Arabia.

***Keywords:*** Safety performance, Safety behavior, Safety culture, Driving experience, Gender differences

## I. INTRODUCTION

Many car accidents in Saudi Arabia result from neglecting traffic rules, poor driving behavior, performance, and negative attitudes. Despite government control measures, the number of road accidents remains high, causing severe economic and social impacts. This issue underscores the need for deeper research into road safety and the factors influencing driver behavior and performance.

This research aims to explore all aspects of road safety in Saudi Arabia, focusing on the relationship between safety performance, attitude, culture, and behavior among drivers. By examining these factors, we can understand why certain drivers are more prone to accidents and how these tendencies can be mitigated through better education and awareness campaigns. The study will evaluate the effectiveness of current measures, including traffic regulations and safety awareness programs, to identify areas for improvement.

Conducted for the Industrial Engineering department at King Abdulaziz University in Jeddah, Saudi Arabia, this study aims to evaluate and compare safety behavior, culture, attitudes, and performance between male and female drivers across different age groups over the past two years. A survey will gather data, which will be analyzed using statistical software to identify key factors impacting safety

  

performance. By identifying these factors, the study aims to provide insights to help reduce road accidents and enhance driver safety in Saudi Arabia.

*Background*

Wrong behaviors, contemporary culture, and irresponsible drivers contribute to dangerous phenomena on Saudi roads. Drivers often face accidents due to others' carelessness, such as using mobile phones, not maintaining proper safety distance, and unnecessary use of high beams. These actions cause confusion and potential collisions. This study evaluates the effects of safety culture, attitudes, and behaviors on driving performance, focusing on differences between men and women since women began driving in Saudi Arabia. By examining these factors, the research aims to uncover the causes of unsafe driving and identify patterns to reduce accidents and improve road safety.

*Problem Statement*

On a yearly basis, everyday people get killed or harmed due to the lack of safety in driving. Saudi Arabia is one of the countries that has a huge number of car accidents. Between 2019 and 2020, the number of violations committed in Saudi Arabia has increased by almost 40% [36]. Among these violations is the Violation Speed Ticket. Despite the existence of the camera on the roads, its percentage has increased by 34% [36], which is considered one of the main factors that affect the safety performance without mentioning other factors such as, safety attitude, and safety culture in driving. Moreover, our government allowed females to drive in 2020, and this caused so many safety mistakes, because of their lack of experience in driving, unlike males who have been driving in Saudi Arabia since the first time a car arrived in the country.

Moreover, there are differences between males and females in their safety attitudes and safety behaviors. It was found that males are often willing to take the risk or act unsafely just to drive as they desire and also in similar cases, they are willing to take the risk and do an irrational action more than females just to reach their driving destination. According to some studies, gender and age are having a huge impact on the performance of the overall safety in roads. In terms of the age of the driver, in some studies it was found that the probability of the occurrence of an accident decreased as long as the age increased in which means that there is a reverse relation between age and driving safely. In addition, most people do not care about the safety culture in driving, and they are not bound by them, because of their lack of knowledge and education of its importance in protecting them from cars accidents. Furthermore, driving schools bear a heavy responsibility in this aspect, either by giving some people driving license while they do not pass the exam or they have health ills it, or their weak role in traffic safety awareness.

*Objective*

The main aim of this study is to assess the safety culture among vehicle drivers in Saudi Arabia, focusing on how differences in gender and driving experience impact safety performance. By examining safety behavior, attitudes, and culture, this study aims to understand the factors influencing road safety.

*Sub-Objectives:*

1. Analyze the differences in safety performance among five distinct age groups of drivers.
2. Evaluate how varying levels of driving experience impact safety performance

3. Compare safety performance between male and female drivers
4. Investigate the direct and indirect relationships between safety behavior, safety culture, safety attitudes, and their collective impact on safety performance.
5. Identify the primary safety factors contributing to road accidents based on safety behavior, culture, and attitudes.
6. Assess the effectiveness of existing educational programs in driving schools and social media on raising awareness of traffic safety rules among drivers.

*Importance*

This study examines drivers' behavior, attitudes, and culture to identify key safety factors to reduce road accidents in Saudi Arabia. It aims to address the root causes of unsafe driving, raise awareness, and provide insights for targeted strategies. The research offers data-driven guidance for policymakers to improve regulations, safety campaigns, and educational programs, with a focus on gender and age differences, to tailor effective interventions for a safer driving environment.

## II. LITERATURE REVIEW

This study aims to draw insights from international research on driver safety to understand Saudi Arabia's safety performance. By comparing methodologies and results from different countries, we seek to identify effective techniques for evaluating safety behaviors between male and female drivers. This global perspective will help us uncover key safety factors applicable to improving local transportation systems.

*Safety in Transportation*

Achieving transportation safety requires proactive measures. For example, enforcing speed limits significantly reduces accidents. Compliance with safety regulations varies, with some drivers prioritizing personal convenience over safety. Effective transportation safety involves collaboration between drivers, government agencies, and law enforcement.

*Safety Behavior*

Modern transportation systems present new safety challenges. Unsafe driving behaviors such as speeding and tailgating are major causes of accidents. Teenage drivers, in particular, exhibit higher risk behaviors. Understanding and mitigating these behaviors is essential for improving road safety.

*Safety Attitude*

Attitudes toward safety directly influence driving behavior. Promoting positive safety attitudes through education and enforcement can reduce accidents. Both subjective (self-reported) and objective (observable) data are crucial for understanding and improving safety attitudes.

*Safety Culture*

Safety culture encompasses the collective practices and beliefs regarding transportation safety. Strong safety cultures, supported by compliance with regulations and positive safety perceptions, reduce accident rates. Evaluating safety culture through both subjective perceptions and objective indicators provides a comprehensive understanding of its impact.

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*Safety Performance*

Accident rates and safety indicators like seatbelt usage and compliance with traffic laws measure safety performance. Behavioral measures are critical for assessing safety performance and developing effective interventions to reduce accidents.

*Individual Differences*

- Gender: Men are more likely to engage in risky driving behaviors, while women tend to be more cautious. Gender-specific interventions may be necessary.
- Age: Younger drivers are more prone to risky behaviors, while older drivers may experience declines in abilities. Age-appropriate education and interventions are essential.
- Experience: More experienced drivers exhibit better judgment and situational awareness, leading to safer driving. Novice drivers are more likely to make errors and have higher accident rates.

Understanding these individual differences helps tailor safety measures to specific demographics, enhancing overall road safety.

## III. METHODOLOGY

To achieve the study's main objective of understanding the impact of safety culture and behavior on driving performance, data were collected in two phases: 2019 and 2024. This longitudinal design facilitates the assessment of changes in safety behaviors, attitudes, and culture, particularly following the societal shift that allowed women to drive in Saudi Arabia. A comparative analysis between male and female drivers will reveal how these safety factors differ by gender and over time. Data were gathered using a structured questionnaire focused on various aspects of driving safety, enabling a comprehensive evaluation of the evolution of safety culture and performance across different demographics from 2019 to 2024.

*Design*

This study evaluates three key safety factors influencing driver performance: safety attitude, safety behavior, and safety culture. Data collection occurred in two periods—2019 and 2024—allowing analysis of how these factors evolved with social changes, notably the inclusion of women drivers. By examining male and female driver data, the study highlights the impact of safety culture and behavior across genders and time.

A structured questionnaire, manually distributed for better engagement, ensured culturally relevant questions tailored to Saudi Arabia. The survey reached diverse participants through driving schools, universities, and public spaces like malls. This design enables a thorough comparison of safety behaviors, attitudes, and culture over time, reflecting the changing dynamics of Saudi Arabia's driving culture, especially with the growing participation of female drivers.

*Data Collection*

  

Data was collected using a structured questionnaire distributed in two phases: 2019 and 2024. The survey targeted participants from women's and men's driving schools in Jeddah, Riyadh, and Dammam, as well as students and instructors at universities, ensuring diverse demographics.

The questionnaire, adapted from previous studies for Saudi Arabia's unique driving context, consisted of five sections, featuring multiple-choice and rating scale questions. The first section collected demographic information, including age, gender, nationality, education level, and driving experience. The second section assessed safety behaviors, focusing on risky practices like mobile phone use, speeding, and seatbelt neglect. The third section evaluated safety attitudes through various driving scenario responses.

The fourth section examined safety culture, addressing vehicle maintenance, insurance, and reactions to accidents. The final section measured safety performance by asking participants to report traffic violations over the past two years. This comprehensive data offers insights into how safety behaviors, attitudes, and culture influenced driving performance across the two periods.

*Sample Size*

The sample size for this study aimed to capture a representative population of Saudi drivers in 2019 and 2024. In 2019, 559 participants were surveyed, comprising 250 females (44.72%) and 309 males (55.28%). Among them, 533 (95.35%) were Saudi nationals, while 26 (4.65%) were non-Saudi residents. Most participants held valid driving licenses, with responses from those without licenses excluded. Participants were sourced from driving schools, universities, and public spaces to ensure diverse representation.

By 2024, the sample size grew significantly to 1,190 participants, driven by improved access after COVID-19 restrictions. This included 623 females (52.35%) and 567 males (47.65%), reflecting the rising number of female drivers post-legalization. Of the 2024 participants, 1,101 (92.52%) were Saudi nationals, and 89 (7.48%) were non-Saudis, with valid licenses also prioritized. The increase in sample size from 2019 to 2024 indicates a recovery in data collection and a broader demographic inclusion, particularly of female drivers. This robust sample facilitates a thorough analysis of changes in safety behaviors, attitudes, and culture over time.

*Methodological Framework for Evaluating Safety Performance*

The study evaluated safety performance among male and female drivers in Saudi Arabia through seven key methods:

- Descriptive Analysis: Analyzed trends and distributions in key variables.
- Reliability Test: Ensured data consistency and validity.
- Pearson Correlation and ANOVA: Examined relationships between safety factors (attitudes, behaviors, culture) and performance.
- Independent Sample T-tests: Identified differences in performance by gender.
- ANOVA and Post Hoc Tests: Assessed age-related performance differences.
- ANOVA and Post Hoc Analysis: Evaluated the impact of driving experience on performance.
- Structural Equation Model (SEM): Analyzed relationships between safety factors and performance across 2019 and 2024.

These methods provide a robust framework for understanding safety dynamics in Saudi Arabia.

  

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The study utilized structured methodology, starting with a questionnaire designed to assess key safety factors: attitudes, behaviors, and culture. Data collection occurred in two phases, 2019 and 2024, enabling temporal comparison. Sample size and demographics were carefully chosen to represent male and female drivers from diverse backgrounds. A range of statistical methods—descriptive analysis, reliability tests, Pearson correlation, ANOVA, and Structural Equation Modeling (SEM)—were employed to rigorously analyze the data and explore relationships between safety factors and performance. These methodologies aim to reveal insights into safety performance differences by gender, age, and driving experience, enhancing the understanding of road safety in Saudi Arabia.

## IV. DATA ANALYSIS AND DISCUSSION

This section analyzes data from 559 participants in 2019 and 1,190 in 2024. Incomplete responses and those from individuals without a driving license were excluded. SPSS v.28 was used for data analysis due to its robust capabilities. Cronbach's alpha assessed the questionnaire's reliability, with values above 0.7 indicating acceptable consistency in measuring safety factors [17]. Linear regression examined the predictive relationships between safety factors (attitude, behavior, culture) and driving performance, identifying which had the most significant impact [18]. ANOVA partitioned variability to determine the influence of factors like gender, age, and experience on driving performance. Post hoc tests explored significant group differences, controlling the error rate [19].

A T-test identified significant differences in safety performance, attitudes, and behaviors between male and female drivers [20]. AMOS, an advanced SEM tool, modeled complex relationships between safety attitudes, behaviors, and performance, providing a comprehensive understanding of their impact on safety performance [21]. Pearson's correlation coefficient measured the strength and direction of relationships between continuous variables like safety behavior, safety culture, and driving performance, with values close to +1 or -1 indicating strong relationships [22].

### *Reliability Test*

The questionnaire's reliability for 2019 and 2024 was assessed using Cronbach's Alpha. The overall Alpha for the combined dataset (1,749 items) was 0.781, indicating acceptable internal consistency. Alpha values for individual sections ranged from 0.746 (Safety Culture) to 0.805 (Safety Performance), suggesting the questionnaire reliably measured safety factors, as values above 0.7 are considered acceptable [17]. Detailed reliability results are in Table 4.1.

Table 4.1 Reliability test

| **Dimensions** | **No. of items** | **Cronbach's Alpha** |
|---|---|---|
| Safety Behaviour | 20 | 0.798 |
| Safety Attitude | 15 | 0.776 |
| Safety Culture | 10 | 0.746 |
| Safety Performance | 9 | 0.805 |
| Overall | 54 | 0.781 |

### *Descriptive Analysis for Participant's Gender*

In 2019, the sample had 250 females (44.72%) and 309 males (55.28%), offering insights into gender-related safety performance. By 2024, the sample shifted to 623 females (52.35%) and 567 males

  

(47.65%), reflecting increased female participation following legal changes. Combined, the total sample had 873 females (50.00%) and 876 males (50.00%), providing a balanced basis for examining gender differences in safety behavior and performance, giving a comprehensive view of male and female driving experiences in Saudi Arabia.

*Descriptive Analysis for Participant's Age*

In 2019, the majority of participants were aged 18-25, totaling 324. The 26-30 and 31-45 age groups each had 96 participants, the 46-60 group had 41, and the 60-and-above group had 2 participants. By 2024, the age distribution broadened. The 31-45 group became the largest with 509 participants. The 26-30 group had 283, the 46-60 group grew to 252, the 18-25 group decreased to 86, and the 60-and-above group increased to 60 participants. Combining both years, the 31-45 age group had the highest representation with 605 participants. The 18-25 group had 410, the 26-30 group had 379, the 46-60 group had 293, and the 60-and-above group had 62 participants, showing substantial growth across most age groups.

*Descriptive Analysis for Participant's Education Level*

In 2019, most participants held a Bachelor's degree (375), followed by High school graduates (119) and those with higher education degrees (65). By 2024, Bachelor's degree holders increased to 659, High school graduates to 202, and higher education degrees to 329. Combined, there were 1,034 Bachelor's degree holders, 321 High school graduates, and 394 with higher education degrees, showing a trend towards a more educated driving population.

*Descriptive Analysis for Participant's Driving Experience*

In 2019, the largest group had 6-10 years of driving experience (183 participants), followed by 3-5 years (172), 0-2 years (84), 11-20 years (68), and over 21 years (52). By 2024, the largest group shifted to those with 11-20 years of experience (298). This was followed by over 21 years (347), 6-10 years (225), 3-5 years (256), and 0-2 years (64). Overall, there was a clear increase in drivers with over 10 years of experience in 2024, compared to a majority with 3-10 years in 2019, highlighting a trend towards more experienced drivers in the sample.

*Descriptive Analysis for Participant's Background*

In 2019, there were 533 locals and 26 residents among participants. By 2024, locals increased to 1,101 and residents to 89. Overall, the study included 1,634 locals and 115 residents across both years, enhancing the diversity and comprehensiveness of the data on driving behaviors and safety performance.

*The Impact of Safety Behavior, Attitude and Culture on Safety Performance*

For the 2019 data, an ANOVA test evaluated safety performance based on Safety Behavior, Safety Attitude, and Safety Culture. The model was significant, $F(3,557) = 35.52$, $p < 0.001$. Safety behavior had the highest effect on safety performance (Beta = -0.69, $p < 0.01$). Safety culture and safety attitude had the least effect, with non-significant p-values > 0.05, as shown in tables 4.2 and 4.3.

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Table 4.2 ANOVA results for 2019

| Model | Sum of Squares | df | Mean square | F | Sig. |
|---|---|---|---|---|---|
| Regression | 58.595 | 3 | 19.532 | 35.522 | .000a |
| Residual | 304.618 | 554 | .550 | | |
| Total | 363.213 | 557 | | | |

a. Dependent Variable: Safety Performance
b. Predictors: (Constant), Safety Behavior, Safety Attitude, Safety Culture

Table 4.3 Coefficients results for 2019

Coefficients

| | Unstandardized Coefficients | | Standard Coefficients | | |
|---|---|---|---|---|---|
| Model | B | Std. Error | Beta | t | Sig. |
| (Constant) | 4.360 | .307 | | 14.209 | .000 |
| Safety Behaviour | -.697 | .092 | -.367 | -7.596 | .000 |
| Safety Attitude | -.102 | .079 | -.074 | -1.301 | .194 |
| Safety Culture | .040 | .058 | .034 | .701 | .484 |

a. Dependent Variable: Safety Performance

For the 2024 data, an ANOVA test evaluated safety performance based on Safety Behavior, Safety Attitude, and Safety Culture. The model was significant, $F(3,1186) = 42.85$, $p < 0.001$. All factors significantly impacted safety performance: safety behavior (Beta = -0.358, p = 0.000), safety attitude (Beta = -0.627, p = 0.000), and safety culture (Beta = 0.459, p = 0.000), as shown in tables 4.4 and 4.5.

Table 4.4 ANOVA results for 2024

| ANOVA | | | | | |
|---|---|---|---|---|---|
| **Model** | Sum of Squares | df | Mean square | F | Sig. |
| **Regression** | 220.841 | 3 | 73.614 | 42.851 | .000a |
| **Residual** | 2037.452 | 1186 | 1.718 | | |
| **Total** | 2258.293 | 1189 | | | |

**a. Dependent Variable: Safety Performance**
**b. Predictors: (Constant), Safety Behaviour, Safety Attitude, Safety Culture**

Table 4.5 Coefficients results for 2024

Coefficients

| | Unstandardized Coefficients | | Standard Coefficients | | |
|---|---|---|---|---|---|
| Model | B | Std. Error | Beta | t | Sig. |
| (Constant) | 4.169 | .259 | | 16.103 | .000 |
| Safety Behaviour | -.358 | .067 | -.191 | -5.342 | .000 |
| Safety Attitude | -.627 | .101 | -.308 | -6.232 | .000 |
| Safety Culture | .459 | .089 | .235 | 5.166 | .000 |

a. Dependent Variable: Safety Performance

The ANOVA test evaluated safety performance based on safety behavior, safety attitude, and safety culture in 2019 and 2024, with both models significant ($p < 0.001$). In 2019, safety behavior had the highest effect on safety performance (Beta = -0.69, $p < 0.01$). In 2024, all factors significantly impacted safety performance, with safety behavior (Beta = -0.358, p = 0.000), safety attitude (Beta = -0.627, p = 0.000), and safety culture (Beta = 0.459, p = 0.000), as shown in tables 4.2, 4.3, 4.4, and 4.5.

A study in Amman, Jordan, found a significant direct relationship between driving behavior and accident exposure, indicating that behavior greatly impacts safety performance [18]. In Malaysia, research showed that while gender influences drivers' attitudes toward safety, attitudes themselves do not significantly affect safety performance [19]. At the University of Iowa, a study suggested that

  

changing driving culture could enhance safety, but concluded that safety culture has limited influence on performance, and cultural change is challenging [20].

*Pearson Correlation Between Safety Behavior, Attitude, Culture and Performance*

For 2019 data Pearson correlation was conducted to see the relationship between safety behavior, safety attitude, safety culture and safety performance. The results were that all of the factors were significantly correlated, means that there is a relationship between all the four factors. Findings showed that safety performance has a significant negative relationship with safety behavior, safety attitude and safety culture. The rest of the factors are significantly positively correlated with each other. The results are shown in table 4.6.

Table 4.6 Pearson Correlation for 2019

**Correlations**

| | | Safety Behaviour | Safety Attitude | Safety Culture | Safety Performance |
|---|---|---|---|---|---|
| **Safety Behaviour** | Pearson Correlation | 1 | .591** | .347** | -.398** |
| | Sig. (2-tailed) | | .000 | .000 | .000 |
| | N | 558 | 558 | 558 | 558 |
| **Safety Attitude** | Pearson Correlation | .591** | 1 | .608** | -.270** |
| | Sig. (2-tailed) | .000 | | .000 | .000 |
| | N | 558 | 559 | 559 | 559 |
| **Safety Culture** | Pearson Correlation | .347** | .608** | 1 | -.138** |
| | Sig. (2-tailed) | .000 | .000 | | .001 |
| | N | 558 | 559 | 559 | 559 |
| **Safety Performance** | Pearson Correlation | -.398** | -.270** | -.138** | -.398** |
| | Sig. (2-tailed) | .000 | .000 | .001 | .000 |
| | N | 558 | 559 | 559 | 558 |

Pearson correlation was conducted to see the relationship between safety behavior, safety attitude, safety culture and safety performance. The results were that all of the factors were significantly correlated, means that there is a relationship between all the four factors. Findings showed that safety performance has a significant negative relationship with safety behavior, safety attitude and safety culture. The rest of the factors are significantly positively correlated with each other. The results are shown in table 4.4.

Table 4.7 Pearson Correlation for 2024

**Correlations**

| | | Safety Behaviour | Safety Attitude | Safety Culture | Safety Performance |
|---|---|---|---|---|---|
| **Safety Behaviour** | Pearson Correlation | 1 | .633** | .540** | -.259** |
| | Sig. (2-tailed) | | .000 | .000 | .000 |
| | N | 1190 | 1190 | 1190 | 1190 |
| **Safety Attitude** | Pearson Correlation | .633** | 1 | .794** | -.243** |
| | Sig. (2-tailed) | .000 | | .000 | .000 |

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| | | | | | |
|---|---|---|---|---|---|
| | N | 1190 | 1190 | 1190 | 1190 |
| **Safety Culture** | Pearson Correlation | .540** | .794** | 1 | -.113** |
| | Sig. (2-tailed) | .000 | .000 | | .000 |
| | N | 1190 | 1190 | 1190 | 1190 |
| **Safety Performance** | Pearson Correlation | -.259** | -.243** | -.113** | 1 |
| | Sig. (2-tailed) | .000 | .000 | .000 | |
| | N | 1190 | 1190 | 1190 | 1190 |

In both years, the results showed that all of the factors were significantly correlated, means that there is a relationship between all the four factors. In both years, findings showed that safety performance has a significant negative relationship with safety behavior, safety attitude and safety culture. The results are shown in tables 4.6, 4.7.

*Discussion*

A study was taken place in Norway, about how employee individual behavior is related to safety performance and safety of the workplace. The study also indicates that safety behavior is related to safety culture, and both are good indicators for the safety level in workplace. This also confirms this study results in which all safety factors have a relationship in between each other. [22]

*Significance Difference Between Male and Female in Safety Behavior, Safety Attitude, Safety Culture and Safety Performance*

Independent Sample test was conducted to see if there is significance difference between Male and Female in safety behavior, safety attitude, safety culture and safety performance or there is no significance difference between them.

For 2019 The first comparison was between male and female in the safety behavior. It was significant in Levene's Test for Equality of Variances= 7.793, p=.0045 which means that equal variances not assumed. Findings showed that sig (2-tailed) p=.000 which means there is a significance difference between male and female in safety behavior. Results showed that females (M=4.08, SD=0.37) have high safety behavior as compared to males (M=3.81, SD=0.42).

And the second comparison was between male and female in safety attitude. And it was not significant in the Levene's Test for Equality of Variances = 1.747, p=.187 which means equal variances assumed. Findings showed that sig (2-tailed) p= .000 which means there is a significance difference between male and female in safety attitude. Results showed that females (M=4.16, SD=0.55) have high safety attitude as compared to males (M=3.86, SD=0.57).

The third comparison was also between males and females but in safety culture. It was not significant in Levene's Test for Equality of Variances = .000 p=.992 which means that equal variances assumed. Findings showed that sig (2-tailed) p= 0.045 which means there is a significance difference between male and female in safety culture. Results showed that females (M=4.18, SD=0.71) have high safety attitude as compared to males (M=4.06, SD=0.66).

The last comparison was between males and females in the safety performance, and it was the sig in Levene's Test for Equality of Variances = 55.42 p=.000 which means that equal variances not assumed. Findings showed that sig (2-tailed) p=.000 which means there is a significance difference between

  

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male and female in safety performance. Results showed that males (M=1.52, SD=0.94) and females (M=1.19, SD=0.55) almost have same level of safety performance as compared to females

Table 4.8 Independent Samples Test for two samples Males and Females for 2019

| | | **Levene's Test for Equality of Variances** | | **t-test for Equality of Means** | | |
|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) |
| **Safety Behaviour** | Equal Variances Assumed | 7.793 | .005 | -7.946 | 556 | .000 |
| | Equal Variances not Assumed | | | -8.056 | 551.7 | .000 |
| **Safety Attitude** | Equal Variances Assumed | 1.747 | .187 | -6.108 | 557 | .000 |
| | Equal Variances not Assumed | | | -6.141 | 542.8 | .000 |
| **Safety Culture** | Equal Variances Assumed | .000 | .992 | -2.011 | 557 | .045 |
| | Equal Variances not Assumed | | | -1.994 | 514 | .047 |
| **Safety Performance** | Equal Variances Assumed | 55.42 | .000 | 4.879 | 557 | .000 |
| | Equal Variances not Assumed | | .005 | 5.139 | 510.4 | .000 |

For 2024 the first comparison was between male and female in the safety behavior. It was not significant in Levene's Test for Equality of Variances = .117, p=.732 which means that equal variances assumed. Findings showed that sig (2-tailed) p=.585 which means there is no significance difference between male and female in safety behavior.

And the second comparison was between male and female in safety attitude. And it was not significant in the Levene's Test for Equality of Variances = 1.427, p=.233 which means equal variances assumed. Findings showed that sig (2-tailed) p=.094 which means there is no significance difference between male and female in safety attitude.

The third comparison was also between males and females but in safety culture. It was not significant in Levene's Test for Equality of Variances = .274 p=.601 which means that equal variances assumed. Findings showed that sig (2-tailed) p=.011 which means there is a significance difference between male and female in safety culture. Results showed that males (M=4.31, SD=.71) have high safety culture as compared to females (M=4.20, SD=.69).

The last comparison was between males and females in the safety performance, and it was the sig in Levene's Test for Equality of Variances = 7.96 p=.005 which means that equal variances not assumed. Findings showed that sig (2-tailed) p=.000 which means there is a significance difference between male and female in safety performance. Results showed that males (M=2.19, SD=1.43) have high safety performance as compared to females (M=1.86, SD=1.31).

Table 4.9 Independent Samples Test for two samples Males and Females for 2024

| | | **Levene's Test for Equality of Variances** | | **t-test for Equality of Means** | | |
|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) |
| **Safety Behaviour** | Equal Variances Assumed | .117 | .732 | -.546 | 1188 | .585 |
| | Equal Variances not Assumed | | | -.545 | 1171.7 | .586 |

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| | | | | | | |
|---|---|---|---|---|---|---|
| **Safety Attitude** | Equal Variances Assumed | 1.427 | .233 | 1.675 | 1188 | .094 |
| | Equal Variances not Assumed | | | 1.668 | 1145.5 | .096 |
| **Safety Culture** | Equal Variances Assumed | .274 | .601 | 2.534 | 1188 | .011 |
| | Equal Variances not Assumed | | | 2.529 | 1167.0 | .012 |
| **Safety Performance** | Equal Variances Assumed | 7.967 | .005 | 4.163 | 1188 | .000 |
| | Equal Variances not Assumed | | | 4.146 | 1150.2 | .000 |

*Discussion*

A study was found, and it was about investigating how the type of human gender (male, female) is affecting the safety attitudes of driving in the roads and it was consisting of 1458 male participants and 1229 female participants. For those who filled out several scales their percentage was 54.4 and aim of these scales was to assess issues related to roads, perception of what the accident leaves behind, as well as their dangers and threats for this kind of risk. The main thing in this study is to find what is the role of gender in effecting the road safety factors and in what period of their life is the peak of this effect. In matter of fact there is no agreement on gender difference, meaning that there is no gender-related effects in driving skills that can cause a traffic accident. In that study, they found gender differences in road safety factors ("negative attitude toward traffic rules and risky driving"; and "tolerance toward speeding") and in driver behavior ("errors in inattentive driving" and "driving violations"), and in safety culture These results are the same for all drivers who came from nine different countries. And the result obtained after analysis and research were a very important result in the realization roads hazard. The results indicated that women's awareness of the dangers while driving is the same as men's awareness of the dangers while driving alike, and there is no difference between them in that.[23]

*Effects of Age on The Safety Performance*

The study uses Post hoc analysis to examine sample statistical discrepancies, identified by the statistical values themselves. This method determines which age levels have the highest and lowest safety performance. The five age levels are 18-25, 26-30, 31-40, 41-60, and over 60 years. The analysis shows a significant difference between these levels in 2019, with a P value of 0.000, less than 0.05.

In 2019, as shown in Table 4.11, the comparison begins with the 18-25 years' level. There is a significant difference between the 18-25 and 31-45 years' levels (p=0.024) and between the 18-25 and 46-60 years' levels (p=0.001), both less than 0.05. However, there are no significant differences between the 18-25 and 26-30 years' levels, nor between the 18-25 and over 60 years' levels. The 26-30 years' level shows no significant differences with any other levels. For the 31-45 years' level, there is a significant difference with the 18-25 years' level, but none with other levels. These details highlight the significant differences among the age levels.

Table 4.10 ANOVA table of the age for 2019

| | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** |
|---|---|---|---|---|---|
| **Between Groups** | 2.466 | 4 | 0.617 | 5.989 | 0.000 |
| **Within Groups** | 360.890 | 554 | 0.651 | | |
| **Total** | 363.356 | 558 | | | |

Table 4.11 Multiple Comparisons among age levels for 2019

| **Ages level** | **Age** | **Mean Difference (I-J)** | **Std. Error** | **Sig.** |
|---|---|---|---|---|
| **18-25 years** | 26-30 years | -.12258 | .04314 | .091 |
| | 31-45 years | -.18098* | .05373 | .024 |

  

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| | | | | |
|---|---|---|---|---|
| | 46-60 years | -.29667* | .06932 | .001 |
| | +60 years | -.43833 | .22990 | .459 |
| **26-30 years** | 18- 25 years | .12258 | .04314 | .091 |
| | 31-45 years | -.05841 | .04474 | .790 |
| | 46-60 years | -.17409 | .06261 | .104 |
| | +60 years | -.31576 | .22797 | .751 |
| **31-45 years** | 18- 25 years | -.18098* | .05373 | .024 |
| | 26-30 years | -.05841 | .04474 | .790 |
| | 46-60 years | -.11569 | .07033 | .609 |
| | +60 years | -.25735 | .23020 | .870 |
| **46-60 years** | 18- 25 years | -.29667* | .06932 | .001 |
| | 26-30 years | -.17409 | .06261 | .104 |
| | 31-45 years | .11569 | .07033 | .609 |
| | +60 years | -.14167 | .23433 | .985 |
| **+60 years** | 18- 25 years | -.43833 | .22990 | .459 |
| | 26-30 years | -.31576 | .22797 | .751 |
| | 31-45 years | .25735 | .23020 | .870 |
| | 46-60 years | .14167 | .23433 | .985 |

In 2019, Descriptive Table 4.12 shows that safety performance gradually increases from the 18-25 years' level to the over 60 years' level. Thus, the over 60 years' level has the highest safety performance, while the 18-25 years' level has the lowest.

Table 4.12 Descriptive analysis for age levels for 2019

| Age | N | Mean | Std. Deviation | Std. Error |
|---|---|---|---|---|
| 18-25 years | 324 | 1.4367 | 0.2569 | 0.0435 |
| 26-30 years | 96 | 1.5592 | 0.3354 | 0.0987 |
| 31-45 years | 96 | 1.6176 | 0.3386 | 0.0866 |
| 46-60 years | 41 | 1.7333 | 0.3211 | 0.0517 |
| +60 years | 2 | 1.8750 | 0.1767 | 0.0000 |
| Total | 559 | 1.6443 | 0.28581 | 0.0561 |

For 2024 the P value of all levels is .000 which is less than 0.05, so there is a significant difference between these levels.

Table 4.13 ANOVA table of the age for 2024

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| **Between Groups** | 95.646 | 4 | 23.911 | 13.102 | .000 |
| **Within Groups** | 2162.647 | 1185 | 1.825 | | |
| **Total** | 2258.293 | 1189 | | | |

Table 4.14 shows that in 2019, the 18-25 years level significantly differs from the 26-30 years level (p=0.000) but not from other levels. The 26-30 years level significantly differs from all other levels: 18-25 (p=0.000), 31-45 (p=0.000), 46-60 (p=0.000), and over 60 years (p=0.002). The 31-45 years level significantly differs from the 26-30 years level (p=0.000) but not from other levels. Similarly, the 46-60 years level significantly differs from the 26-30 years level (p=0.000) but not from other levels. The over 60 years level significantly differs from the 26-30 years level (p=0.002) but not from other levels.

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Table 4.14 Multiple Comparisons among age levels for 2024

| Ages level | Age | Mean Difference (I-J) | Std. Error | Sig. |
|---|---|---|---|---|
| **18-25 years** | 26-30 years | -.72771* | .16634 | .000 |
| | 31-45 years | -.08373 | .15750 | .984 |
| | 46-60 years | -.05879 | .16871 | .997 |
| | +60 years | -.01434 | .22724 | 1.000 |
| **26-30 years** | 18- 25 years | .72771* | .16634 | .000 |
| | 31-45 years | .64398* | .10017 | .000 |
| | 46-60 years | .66892* | .11701 | .000 |
| | +60 years | .71337* | .19200 | .002 |
| **31-45 years** | 18- 25 years | .08373 | .15750 | .984 |
| | 26-30 years | -.64398* | .10017 | .000 |
| | 46-60 years | .02494 | .10406 | .999 |
| | +60 years | .06938 | .18440 | .996 |
| **46-60 years** | 18- 25 years | .05879 | .16871 | .997 |
| | 26-30 years | -.66892* | .11701 | .000 |
| | 31-45 years | -.02494 | .10406 | .999 |
| | +60 years | .04444 | .19406 | .999 |
| **+60 years** | 18- 25 years | .01434 | .22724 | 1.000 |
| | 26-30 years | -.71337* | .19200 | .002 |
| | 31-45 years | -.06938 | .18440 | .996 |
| | 46-60 years | -.04444 | .19406 | .999 |

Descriptive table 4.15 shows that safety performance is gradually increasing from more than 18-25 years' level to 26-30 years levels, so the 26-30 years' level has the highest safety performance, and the 18-25-year level has the lowest safety performance.

Table 4.15 Descriptive analysis for age levels for 2024

| Age | N | Mean | Std. Deviation | Std. Error |
|---|---|---|---|---|
| **18-25 years** | 86 | 1.8023 | 1.37044 | .14778 |
| **26-30 years** | 283 | 2.5300 | 1.59620 | .09488 |
| **31-45 years** | 509 | 1.8661 | 1.24182 | .05504 |
| **46-60 years** | 252 | 1.8811 | 1.24032 | .07813 |
| **+60 years** | 60 | 1.8967 | 1.39602 | .18023 |
| **Total** | 1190 | 2.0244 | 1.37816 | .03995 |

*Discussion*

The results from 2019 and 2024 show that age significantly affects driving safety performance (P-values = 0.000). ANOVA confirms substantial differences across age groups in both years, though the differences varied. In 2019, the 18-25 years group had the lowest safety performance, while the over 60 group had the highest. Post hoc analysis showed significant differences between the 18-25 group and the 31-45 (Sig. = 0.024) and 46-60 (Sig. = 0.001) groups, but not with the 26-30 or over 60 groups. Safety performance improved with age, peaking among drivers over 60 [25, 28].

By 2024, the 26-30 years group showed the highest performance, overtaking older age groups. Post hoc analysis confirmed significant differences between the 26-30 group and other age groups, including 18-25 (Sig. = 0.000) and 31-45 (Sig. = 0.000). This shift may reflect targeted safety campaigns or quicker adaptation to vehicle safety technology among younger adults [27, 29].

  

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Despite improvements in the 26-30 group, the 18-25 group still had the lowest performance in both years, consistent with research showing younger drivers' higher risk-taking behaviors [28]. This indicates a need for focused interventions, such as enhanced driver education and stricter traffic rule enforcement for young drivers.

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*Effects of Driving Experience on The Safety Performance*

The study uses Post hoc analysis to examine sample statistical discrepancies, indicated by the statistical values themselves. This method identifies the highest and lowest safety performance levels among five driving experience levels: 0-2 years, 3-5 years, 6-10 years, 11-20 years, and over 21 years. In 2019, the P value for all levels was 0.000, indicating significant differences between these levels.

Table 4.16 ANOVA table of the Driving Experience for 2019

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 7.352 | 4 | 1.838 | 2.860 | .0230 |
| Within Groups | 356.004 | 554 | .643 | | |
| Total | 363.356 | 558 | | | |

In 2019, as shown in Table 4.17, the 0-2 years level shows no significant differences with other levels. The 3-5 years level significantly differs from the 6-10 years level (p=0.02) but not from other levels. Similarly, the 6-10 years level significantly differs from the 3-5 years level (p=0.02) but not from other levels. The 11-20 years level shows no significant differences with any levels, and the same applies to the over 21 years level, as their significance is greater than 0.05.

Table 4.17 Multiple Comparisons among Driving Experience levels for 2019

| Ages level | Age | Mean Difference (I-J) | Std. Error | Sig. |
|---|---|---|---|---|
| 0-2 years | 3-5 years | .15393 | .10671 | .600 |
| | 6-10 years | -.10636 | .10565 | .852 |
| | 11-20 years | -.07213 | .13077 | .982 |
| | + 21 years | -.13095 | .14145 | .887 |
| 3-5 years | 0-2 years | -.15393 | .10671 | .600 |
| | 6-10 years | -.26029* | .08513 | .020 |
| | 11-20 years | -.22606 | .11483 | .283 |
| | + 21 years | -.28488 | .12686 | .165 |
| 6-10 years | 0-2 years | .10636 | .10565 | .852 |
| | 3-5 years | .26029* | .08513 | .020 |
| | 11-20 years | .03423 | .11385 | .998 |
| | + 21 years | -.02459 | .12597 | 1.000 |
| 11-20 years | 0-2 years | .07213 | .13077 | .982 |
| | 3-5 years | .22606 | .11483 | .283 |
| | 6-10 years | -.03423 | .11385 | .998 |
| | + 21 years | -.05882 | .14768 | .995 |
| +21 years | 0-2 years | .13095 | .14145 | .887 |
| | 3-5 years | .28488 | .12686 | .165 |
| | 6-10 years | .02459 | .12597 | 1.000 |
| | 11-20 years | .05882 | .14768 | .995 |

  

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For 2019 descriptive table 4.18 shows that safety performance is gradually increasing from more than 0-2 years' level to more than 21 years' level, so the more than 21 years' level has the highest safety performance and the 3-5 years' level has the lowest safety performance.

Table 4.18 Descriptive analysis for Driving Experience levels for 2019

| Age | N | Mean | Std. Deviation | Std. Error |
|---|---|---|---|---|
| **0-2 years** | 84 | 1.3690 | .81816 | .08927 |
| **3-5 years** | 172 | 1.2151 | .58759 | .04480 |
| **6-10 years** | 183 | 1.4754 | .91879 | .06792 |
| **11-20 years** | 68 | 1.4412 | .79892 | .09688 |
| **+ 21 years** | 52 | 1.5000 | .93934 | .13026 |
| **Total** | 559 | 1.3775 | .80695 | .03413 |

For 2024 the P value of all levels is 0.000 which is less than 0.05, so there is a significant difference between these levels.

Table 4.19 ANOVA table of the Driving Experience for 2024

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 100.034 | 4 | 25.008 | 13.731 | .000 |
| Within Groups | 2158.260 | 1185 | 1.821 | | |
| Total | 2258.293 | 1189 | | | |

The comparison shown in Table 4.20 reveals the following for 2019. The 0-2 years level significantly differs from the 6-10 years (p=0.000), 11-20 years (p=0.000), and over 21 years levels (p=0.000), but not from the 3-5 years level, as its significance is higher than 0.05. The 3-5 years level shows significant differences with the 6-10 years level (p=0.000) and over 21 years level (p=0.02) but not with other levels due to higher significance. The 6-10 years level significantly differs from the 0-2 years (p=0.000), 3-5 years (p=0.000), and 11-20 years levels (p=0.003), but not from the over 21 years level, which has a significance greater than 0.05. The 11-20 years level significantly differs from the 0-2 years (p=0.000) and 6-10 years (p=0.003) levels, but not from other levels. Finally, the over 21 years level significantly differs from the 0-2 years (p=0.000) and 3-5 years (p=0.02) levels, but not from other levels due to higher significance.

Table 4.20 Multiple Comparisons among Driving Experience levels for 2024

| Ages level | Age | Mean Difference (I-J) | Std. Error | Sig. |
|---|---|---|---|---|
| 0-2 years | 3-5 years | -.63893* | .18914 | .007 |
| | 6-10 years | -1.25501* | .19064 | .000 |
| | 11-20 years | -.82703* | .18587 | .000 |
| | + 21 years | -.97055* | .18359 | .000 |
| 3-5 years | 0-2 years | .63893* | .18914 | .007 |
| | 6-10 years | -.61607* | .12328 | .000 |
| | 11-20 years | -.18810 | .11578 | .482 |
| | + 21 years | -.33162* | .11209 | .026 |
| 6-10 years | 0-2 years | 1.25501* | .19064 | .000 |
| | 3-5 years | .61607* | .12328 | .000 |
| | 11-20 years | .42798* | .11822 | .003 |
| | + 21 years | .28445 | .11460 | .095 |
| 11-20 years | 0-2 years | .82703* | .18587 | .000 |
| | 3-5 years | .18810 | .11578 | .482 |
| | 6-10 years | -.42798* | .11822 | .003 |
| | + 21 years | -.14352 | .10649 | .661 |

  

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| | | | | |
|---|---|---|---|---|
| +21 years | 0-2 years | .97055* | .18359 | .000 |
| | 3-5 years | .33162* | .11209 | .026 |
| | 6-10 years | -.28445 | .11460 | .095 |
| | 11-20 years | .14352 | .10649 | .661 |

For 2024 descriptive table 4.21 shows that safety performance is gradually increasing from more than 0-2 years' level to more than 21 years' level, so the more than 21 years' level has the highest safety performance and the 3-5 years' level has the lowest safety performance.

Table 4.21 Descriptive analysis for Driving Experience levels for 2024

| Age | N | Mean | Std. Deviation | Std. Error |
|---|---|---|---|---|
| 0-2 years | 64 | 1.1563 | .59678 | .07460 |
| 3-5 years | 249 | 1.7952 | 1.24524 | .07891 |
| 6-10 years | 231 | 2.4113 | 1.57139 | .10339 |
| 11-20 years | 299 | 1.9833 | 1.27563 | .07377 |
| + 21 years | 347 | 2.1268 | 1.42076 | .07627 |
| Total | 1190 | 2.0244 | 1.37816 | .03995 |

*Discussion*

The analysis of 2019 and 2024 data highlights a significant relationship between driving experience and safety performance, aligning with prior studies that show experienced drivers tend to perform better due to improved judgment and adherence to traffic regulations [25]. In 2019, safety performance improved with experience, but significant differences among drivers with over 10 years of experience were limited, suggesting diminishing returns of experience on safety performance [11]. In contrast, the 2024 data revealed sharper distinctions, particularly between less experienced drivers (0-2 years) and those with over 10 years, indicating that recent safety interventions or technology adoption have more significantly impacted experienced drivers [27]. Both years emphasize that younger and less experienced drivers exhibit lower safety performance, consistent with research indicating novice drivers are prone to risky behaviors [9]. The improvement in safety performance among experienced drivers from 2019 to 2024 may reflect advancements in driver education and stricter traffic regulation enforcement.

*Comparison Between Driving Experience and Age Effects*

Both driving experience and age significantly affect safety performance, as shown in the 2019 and 2024 data, though their impacts differ. In 2019, drivers with over 21 years of experience had the highest safety performance, while those with 3-5 years had the lowest. This trend persisted in 2024, with experienced drivers continuing to perform better, aligning with research linking greater experience to improved judgment and risk assessment [25]. In contrast, younger drivers (18-25 years) consistently showed the lowest safety performance. However, by 2024, drivers aged 26-30 outperformed older groups, achieving the highest safety performance. This shift may result from targeted safety interventions or better adaptation to modern vehicle technologies [28]. Ultimately, while experience leads to steady improvements in safety performance, age effects show more variability, with younger adults (26-30 years) demonstrating significant improvement, potentially reflecting changes in driving culture or increased safety awareness.

*Discussion*

  

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Previous studies emphasize the importance of driving experience in enhancing skills, with naiveté linked to a higher accident risk. Inexperienced drivers are more likely to be involved in road mishaps, while experience leads to improved mechanical knowledge and skills, measured by miles driven or time since licensing. Significant differences exist in visual techniques, with experienced drivers demonstrating greater capability [23]. A study of young Saudi drivers found a positive attitude toward traffic safety; nearly 90% viewed it as their personal responsibility, and 95% cited their driving behavior as a key factor in road traffic accidents (RTAs). Most participants reported receiving traffic citations (Mean = 1.82) and being involved in accidents (Mean to blame = 1.23, Mean not to blame = 1.51), highlighting the impact of age on safety performance [24].

*Structure Equation Model (SEM)*

The SEM (Structural Equation Model) was created using SPSS AMOS software to examine the direct effects of Safety Culture, Safety Behavior, and Safety Attitude on Safety Performance. All three sections were assessed as mediators for their indirect relationships with performance. One section demonstrated significant indirect effects, with its standard deviation surpassing those of the other sections. The direct effects remained consistent across all models, unaffected by the mediators. Figure 4.1 illustrates the first model, with Safety Behavior acting as the mediator for Safety Performance.

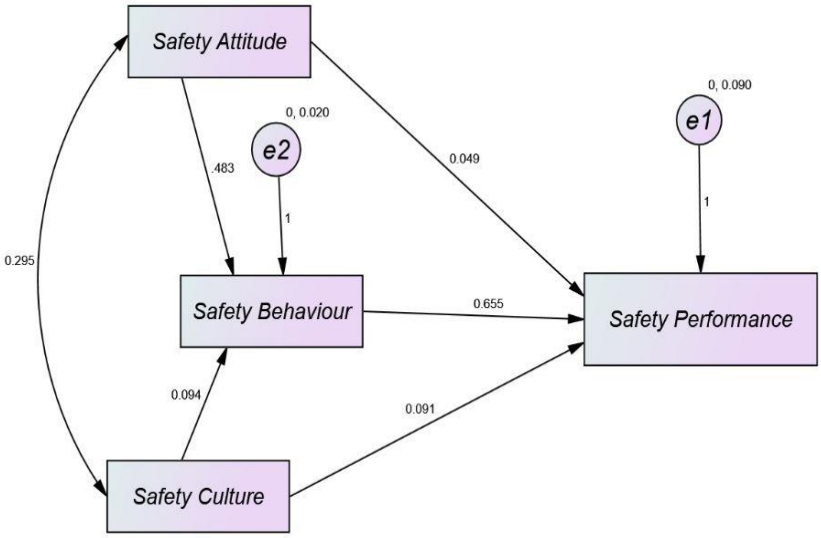


Figure 4.1 Structure Equation Model When Safety Behavior is Mediator

This model figure 4.2 is the second model to check the indirect results and compare it with the other models to check which one of them comes with significant result.

  

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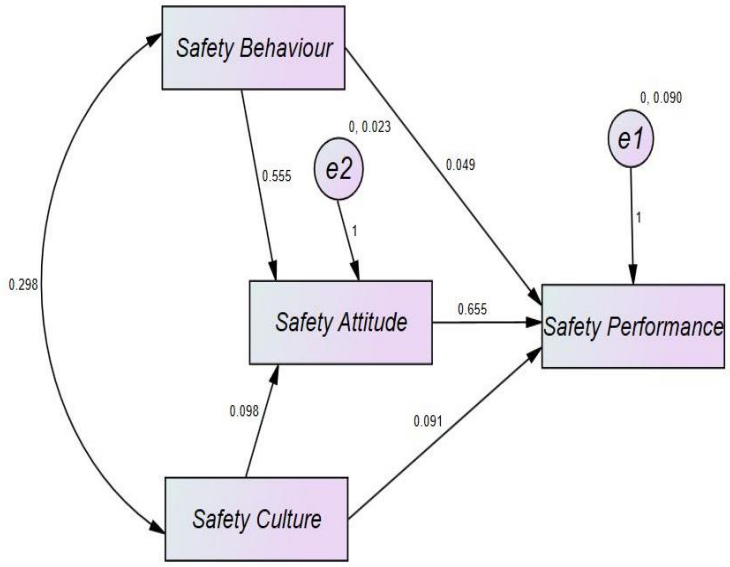


Figure 4.2 Structure Equation Model When Safety Attitude is Mediator

This is the last model figure 4.3 shows the last trial for looking for the significant indirect results among the sections and Safety Culture was section was connected as mediator to find those results.

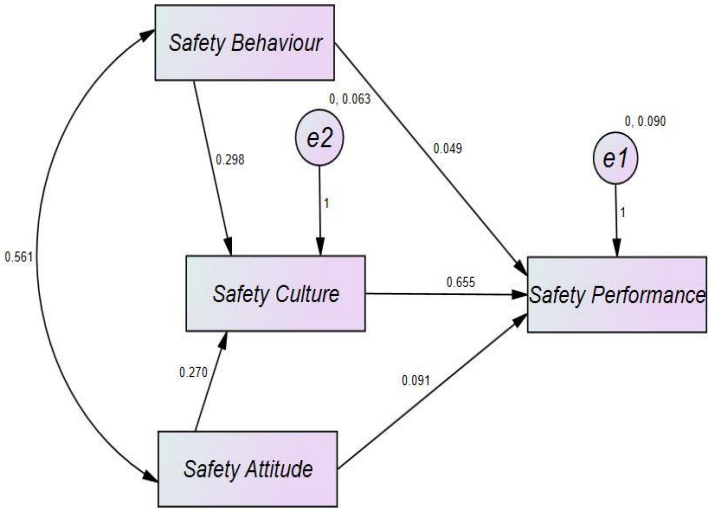


Figure 4.3 Structure Equation Model When Safety Culture is Mediator

*Direct Effects in All Models*

- Behavior on Performance: The direct effect is 0.655, meaning a 1-standard deviation increase in Behavior results in a 0.655 increase in Performance.
- Attitude on Performance: The direct effect is 0.049, indicating a 1-standard deviation increase in Attitude leads to a 0.049 increase in Performance.
- Culture on Performance: The direct effect is 0.091, signifying a 1-standard deviation increase in Culture results in a 0.091 increase in Performance.

*Standardize Direct Effects in All Models*

  

- Behavior on Performance: A 1-standard deviation increase in Behavior results in a 0.346 increase in Performance.
- Attitude on Performance: A 1-standard deviation increase in Attitude leads to a 0.028 increase in Performance.
- Culture on Performance: A 1-standard deviation increase in Culture results in a 0.074 increase in Performance.

*Indirect Effects in All Models In All Models*

- Attitude to Behavior: Indirect effect is 0.317; a 1-standard deviation increase in Attitude results in a 0.317 increase in Performance via Behavior.
- Culture to Behavior: Indirect effect is 0.061; a 1-standard deviation increase in Culture leads to a 0.061 increase in Performance through Behavior.
- Behavior to Attitude: Indirect effect is 0.027; a 1-standard deviation increase in Behavior results in a 0.027 increase in Performance via Attitude.
- Culture to Attitude: Indirect effect is 0.005; a 1-standard deviation increase in Culture results in a 0.005 increase in Performance through Attitude.
- Behavior to Culture: Indirect effect is 0.027; a 1-standard deviation increase in Behavior leads to a 0.027 increase in Performance via Culture.
- Attitude to Culture: Indirect effect is 0.005; a 1-standard deviation increase in Attitude results in a 0.005 increase in Performance through Culture.

*Standardize Indirect Effects in All Models*

- Attitude to Behavior: Indirect effect is 0.179; a 1-standard deviation increase in Attitude yields a 0.179 increase in Performance via Behavior.
- Culture to Behavior: Indirect effect is 0.050; a 1-standard deviation increase in Culture results in a 0.050 increase in Performance through Behavior.
- Behavior to Attitude: Indirect effect is 0.014; a 1-standard deviation increase in Behavior leads to a 0.014 increase in Performance via Attitude.
- Culture to Attitude: Indirect effect is 0.004; a 1-standard deviation increase in Culture yields a 0.004 increase in Performance through Attitude.
- Behavior to Culture: Indirect effect is 0.014; a 1-standard deviation increase in Behavior results in a 0.014 increase in Performance via Culture.
- Attitude to Culture: Indirect effect is 0.021; a 1-standard deviation increase in Attitude leads to a 0.021 increase in Performance through Culture.

*Discussion*

The study emphasizes the critical role of safety behavior in enhancing transportation safety. Recognized across various industries, safety behavior is essential for accident prevention and improved safety performance. In driving, behaviors such as adhering to speed limits, avoiding distractions, and wearing seatbelts directly impact performance and accident likelihood.

Research, including a study in Jordan, reveals a strong correlation between safety behavior and reduced accident rates. Positive safety climates encourage safe behaviors, leading to fewer incidents and better safety outcomes, reflecting the findings of the current study, which highlights how critical safety behavior is to driving performance and, ultimately, road safety [25]. Safety performance is influenced

  

by both individual practices and the prevailing safety culture, which fosters proactive safety measures [11].

Attitudes toward safety also predict accident involvement; drivers committed to safety protocols are less likely to engage in risky behaviors [10]. The influence of safety behavior extends beyond individual actions, encompassing organizational and societal factors. When safety is perceived as a community norm, individuals are more likely to adopt safe driving practices, enhancing overall safety performance [9].

Additionally, safety behavior shapes safety climates, improving working conditions and road safety. This study's findings align with previous research, highlighting that positive safety behaviors reduce workplace and traffic accidents. The impact of safety behavior is evident in lower accident rates and compliance with regulations, underscoring its importance in preventing violations [4].

Governments recognize the need to promote safety behavior through stricter penalties and public safety campaigns. Policies encouraging safe behaviors, such as seatbelt laws and speed limits, lead to significant improvements in road safety, demonstrating the importance of institutional support in fostering safe driving practices and reducing accidents [27].

## V. CONCLUSION AND RECOMMENDATIONS

The research aimed to assess and compare the safety performance of male and female drivers, focusing on safety behaviors, attitudes, safety culture, and their influence on performance. The findings demonstrate that safety behaviors are crucial for both genders, significantly impacting safe driving practices and reducing accident risks. This emphasizes the importance of behavior in promoting road safety. Data were collected through online surveys and manual distribution across driving schools in Saudi Arabia, revealing both positive and negative behaviors in safety factors. While progress is evident, more targeted interventions are needed for younger and less experienced drivers.

Notably, the study found no significant differences in overall safety performance between male and female drivers, challenging stereotypes that suggest male superiority in driving. This reinforces the importance of focusing on individual behaviors rather than gender-based assumptions. The implications are significant for public policy, highlighting the need for targeted education and enforcement to improve safety behaviors. The study contributes to discussions on gender equality in driving, promoting equitable treatment and reducing biases in traffic enforcement and insurance. The findings can inform driving education programs by identifying key areas for development, ensuring inclusivity and improving safety outcomes. Conducted as part of a master's degree in industrial engineering, this research seeks to raise awareness of critical safety factors and promote safer road environments.

In conclusion, the study underscores the role of safety behaviors in enhancing road safety and challenges gender-based stereotypes. The insights provided lay the groundwork for further research and interventions aimed at improving safety for all drivers, fostering a more inclusive and safer driving culture.

*Recommendations*

  

- Increase Penalties: Enforce stricter fines and mandatory courses for repeat offenders.
- Expand Speed Cameras: Install more hidden speed cameras to encourage compliance.
- Awareness Campaigns for Young Drivers: Educate drivers aged 18-25 on safe driving habits.
- Restrict Licenses for Young Drivers: Limit license validity for drivers under 18 to one year.
- Mandatory Re-Testing: Require driving tests every five years for drivers under 30.
- Increase Speed Limit Penalties: Raise fines for young drivers exceeding speed limits.
- Simulator Training: Introduce driving simulators in schools for practical experience.
- Equalize License Fees: Adjust fees for men and women to reflect equal safety performance.
- Public Education on Safety Culture: Enhance campaigns promoting the importance of safety culture.
- Reduce License Validity for Inexperienced Drivers: Issue shorter probationary licenses for drivers with 0-2 years of experience.
- Mandatory Courses for Violators: Require safety courses for drivers with multiple violations.
- Revoke Licenses for Repeat Offenders: Revoke licenses of repeat offenders under 21 after serious violations.
- Improve Speed Camera Coverage: Expand the use of hidden speed cameras.
- Stricter Penalties for Mobile Use: Enforce harsher penalties for using mobile phones while driving.
- Graduated Ticketing System: Allow removal of violations from records after a period of safe driving.
- Community Service for Violation Removal: Enable community service participation to remove traffic violations after a specified time.

*Impacts*

Raising public awareness about the importance of safety behaviors, culture, and attitudes in driving can enhance safety performance. Campaigns promoting safe practices, such as obeying speed limits and avoiding distractions, are vital in reducing road accidents and fatalities. Minimizing traffic violations like speeding and reckless driving is crucial, as studies show that stricter regulations and awareness initiatives effectively reduce risky behaviors and improve compliance with traffic laws. Moreover, fostering a culture of individual responsibility for collective safety encourages safer driving practices. When individuals feel accountable for their own safety and that of others, it leads to a sustained reduction in accidents and a more disciplined traffic system. By addressing both individual behaviors and broader cultural norms, societies can build a conscientious driving community that prioritizes road safety.

Adhering to traffic regulations and practicing positive safety behaviors help individuals avoid fines and financial burdens. Safe driving, such as following speed limits and wearing seatbelts, minimizes the risk of violations (30). Regular vehicle inspections prevent costly repairs by addressing issues early (31). Research shows that improved road safety lowers accident-related costs, benefiting both individuals and governments (32). Overall, positive safety behaviors enhance safety and promote economic efficiency.

Improving safety behaviors, attitudes, and culture will significantly reduce driving risks and enhance road safety performance. Fostering a proactive safety approach increases drivers' awareness of hazards, helping them avoid risky behaviors like speeding and distractions, major contributors to accidents [30]. As safety factors improve, traffic violations decrease, and drivers' confidence grows, creating a positive feedback loop that encourages responsible driving behaviors [31]. Research indicates that

  

enhancing safety culture leads to improved accident prevention and reduces accident severity [32]. Long-term promotion of these factors will save lives and foster a safety-conscious driving community where individuals take responsibility for others' well-being on the road [30].

Reducing road accidents benefits the environment by minimizing waste from damaged vehicles and infrastructure. Improperly disposed crashed cars release toxic materials, contributing to landfill overflow and ecosystem contamination [34]. Severe accidents cause air and soil pollution, requiring costly cleanups that further degrade the environment [33]. Fewer road accidents also protect public infrastructure, reducing the need for repairs and the associated energy consumption and carbon emissions. By improving safety behaviors, accident-related emissions can be minimized, promoting environmental preservation [35]. Ultimately, fostering a culture of safety leads to a cleaner and safer environment for society.

*Research Limitations*

This study faced several limitations that should be noted. The initial plan to gather driving records from government sources was hindered by strict data security regulations, leading to a reliance on socio-economic survey data. While this approach allowed for data collection, surveys are less accurate than official records, and participants may underreport or overestimate their driving behaviors, introducing potential bias.

The representativeness of the sample was also a concern. Although distributed across driving schools and public venues in Saudi Arabia, regional differences and varying access to technology may have limited response diversity. Some responses were excluded due to reliability issues, affecting the generalizability of the findings.

Logistical challenges arose from the manual survey distribution, requiring significant time and effort to collect responses and ensure data accuracy. These limitations emphasize the need for future studies to explore alternative methods, such as obtaining official driving records, for greater accuracy and applicability.

**Conflict of interest:** The author declares that there is no conflict of interest.

**Ethical statement:** The author declares that he followed the ethical responsibilities.

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