



ANALYSIS OF THE LEVEL OF USER AWARENESS OF SAFETY IN USING PUBLIC BUS TRANSPORTATION IN BATAM CITY

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Abstract

Safety awareness among public transport users is a critical component of traffic safety and sustainable urban mobility, yet empirical evidence focusing on passenger-centred behaviour remains limited in developing city contexts. This study examines the level of safety awareness among city bus passengers, identifies factors associated with different awareness levels, and proposes planning-oriented recommendations to enhance public transport safety. A mixed-methods approach was employed, combining a questionnaire survey, exploratory factor analysis (EFA), ordinal logistic regression, and in-depth interviews. The descriptive results indicate that most passengers demonstrate a moderate level of safety awareness, suggesting that basic safety knowledge exists but has not been fully internalised into consistent behaviour across all stages of the journey. The EFA confirms that safety awareness is a multidimensional construct consisting of three domains: boarding safety awareness, on-board safety behaviour, and alighting safety practices. Ordinal logistic regression analysis reveals that demographic characteristics, particularly age and gender, are significant predictors of safety awareness levels, with older passengers and female users more likely to exhibit higher awareness. In contrast, experience of safety incidents, exposure to safety information, and frequency of bus use do not show statistically significant effects, although their positive coefficient directions indicate a supportive role. Qualitative findings further suggest that inexperienced users tend to exhibit riskier behaviours and that learning through experience and information requires structured reinforcement. Overall, the findings highlight that passenger safety awareness is shaped by an interaction between individual characteristics, learning processes, and institutional context. This study contributes to traffic safety research by applying ordinal modelling to passenger safety awareness and provides evidence-based implications for safer public bus systems in medium-sized cities.

Keywords: Transportation safety, Passenger behaviour, Safety awareness, City bus transportation, Mobility planning

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INTRODUCTION

Urban bus transportation systems play a strategic role in supporting sustainable mobility, social inclusion, and cities' decarbonisation efforts in developing countries. Various reviews show that buses are the backbone of daily mobility for low- and middle-income groups with limited access to private vehicles, including in Batam City, where buses are the primary mode for routine trips (Sogbe et al., 2025; Sugito et al., 2024). In addition to providing basic accessibility, bus systems also contribute to road safety by shifting users from high-risk modes, such as motorcycles, to safer public transportation (Ibrahim et al., 2023).

Nevertheless, safety concerns are still a significant obstacle in the use of public transportation. Various studies have concluded that perceptions of safety have a considerable influence on the choice of transportation modes and the sustainability of bus service use, along with traditional factors such as service reliability and comfort (Chau et al., 2024; Sugito et al., 2024). In the Southeast Asian region, this issue is increasingly relevant as national efforts to reduce accidents through the Malaysia Road Safety Plan 2022 - 2030 emphasise the importance of a culture of public safety, including for public transportation users. Related findings point to the need for effective communication strategies and safety campaigns that are adaptive to user characteristics (Sinnappan et al., 2023).

Globally, research on safety in public transportation is also developing by highlighting aspects of safety perception in vulnerable groups, bus stop design, passenger density, and exposure to risks and antisocial behaviours (Mchunu et al., 2025; Soltani et al., 2025). However, empirical evidence on the level of safety awareness among bus passengers is limited, especially in the urban context of Southeast Asia. Most studies focus more on technical risk analysis or aggregate accident data rather than the cognitive dimensions and behaviour of passengers as users of transportation systems (Sethulakshmi, 2023; Sethulakshmi & Mohan, 2024). In fact, findings in traffic safety studies show that safety awareness is an important predictor of safe behaviour, compliance with procedures, and changes in patterns of action in transportation use (Mbagha, 2023; Wang et al., 2020).

Based on these gaps, this study aims to analyse the level of safety awareness of city bus passengers and identify the main factors that affect them in the context of medium-sized cities in Indonesia. Specifically, this study: (1) measured the level of safety awareness at the boarding stage, during the trip, and when getting off the bus; (2) Analyse the relationship between sociodemographic characteristics, travel patterns, safety experiences, and information exposure to the level of awareness; and (3) formulate policy recommendations that can be integrated in the planning and management of city bus services. The academic contribution of this research lies in operationalising safety awareness as a multi-indicator construct for bus passengers, providing empirical evidence from the Southeast Asian context, and translating the findings into actionable planning

recommendations to strengthen the safety culture in the public transportation system.

LITERATURE REVIEW

Quality of Service, Safety, and Behaviour of Public Transportation Users

Studies on public transportation services in developing countries show that safety is a key component in the perception of service quality, along with aspects of comfort, reliability, accessibility, and safety (Sogbe et al., 2025). In the urban context, perceptions of safety directly affect the sustainability of public transportation use and the accessibility of daily activities, so that safety is no longer seen as an additional issue but as a determinant of travel behaviour (Chau et al., 2024). Developments in cutting-edge research show a shift from an engineering-based safety approach to an understanding of user behaviour. Ibrahim et al., (2023) emphasised that safety should be positioned as a core element in mobility management policies and fashion transition strategies. Similar studies show that the quality of perceived safety of corridors, bus stops, and on-board experiences influences users' decisions to choose buses over private vehicles (Soltani et al., 2025). In the city bus system, the passenger safety experience is formed from a series of trips ranging from access to the bus stop, the condition of the waiting room, to the experience on the bus, such as the driver's driving style, passenger density, and the technical condition of the vehicle. Weaknesses in these areas not only increase the risk of incidents but also lower perceptions of safety, potentially reducing long-term bus use in the long term (Sethulakshmi, 2023; Sethulakshmi & Mohan, 2024).

Safety Awareness as a Determinant of Safe Behaviour Practices

Safety awareness is defined as an individual's ability to understand and anticipate risks and choose safe behaviours in a specific context. In the study of transportation behaviour, safety awareness is seen as a prerequisite for the formation of safe behaviour, in line with behavioural theory that emphasises the role of knowledge, attitudes, and perceptions of control in influencing safety practices (Mbagha, 2023). Empirical findings in public transportation show that the level of safety awareness is a strong predictor of compliance with safety procedures, including when boarding and disembarking the bus, using handrails, and avoiding risky behaviours during travel (Henezi & Winkler, 2023). Evidence from other road user groups also reinforces this finding that increased awareness can reduce risky behaviours even when infrastructure is not yet optimal (Asah Nasrudin et al., 2023). Recent studies highlight the mediating role of safety awareness in the relationship between safety attitudes and safe behaviours. Rahman (2024) shows that awareness functions as a mechanism for forming effective safety behaviours, so that educational interventions can

increase the level of compliance and vigilance of passengers (Rahman, 2024). Although the study focused on drivers, the exact psychological mechanisms could potentially apply to bus passengers, given their contribution to safety during the trip.

Determinants of Safety Perception and Awareness

Recent research identified several factors that affect the perception of public transportation safety, including sociodemographic characteristics, travel patterns, bus stop design, and exposure to safety information. A study by Sethulakshmi and Mithun (2023) found that age, gender, frequency of trips, and bus stop conditions have a significant effect on the perception of bus users' safety. Contextual factors such as lighting, passenger density, surveillance, and officer presence also play an important role in shaping users' perceptions of risk and safety (Soltani et al., 2025). The context of vulnerable groups, particularly women and students, shows an additional dimension of safety related to harassment and fear of crime. The study of Mchunu et al. (2025) concluded that the lack of physical protection and weak safety facilities are the main obstacles for women in using public transportation. Research in Malaysia has shown that improvements in bus stop design and security measures, including lighting and surveillance, can enhance the perceived safety of vulnerable users, particularly women (Adilah Shamsul Harumain et al., 2024). In addition, information digitisation also plays a role in increasing safety awareness. Husnina et al. (2022) show that transportation applications with real-time information and travel navigation features can improve the understanding and perception of passenger safety (Husnina et al., 2022). The information indicates that the safety experience is influenced not only by the physical aspects but also by the information the user receives before and during the journey.

Research Gap and Conceptual Framework

A review of the literature indicates three main gaps. First, although the perception of safety in public transportation has been extensively researched, studies on safety awareness as a multidimensional construct in the context of city buses are still limited (Sethulakshmi, 2023). Second, there is a lack of empirical evidence from Southeast Asian cities regarding variations in safety awareness based on user characteristics, travel patterns, and exposure to safety campaigns (Adilah Shamsul Harumain et al., 2024; Husnina et al., 2022). Third, findings on the role of safety awareness in shaping safe behaviour have not been fully applied in the context of planning and designing public transportation services, especially to support sustainable mode switching (Rahman, 2024). In response to these gaps, this study developed a conceptual framework that explains that safety awareness is influenced by: (1) sociodemographic factors (age, gender, education, and

income); (2) travel behaviour (frequency and purpose of travel); (3) previous safety experience; (4) exposure of safety information; and (5) service context (passenger density, driver behaviour, and bus stop/bus conditions). Safety awareness is then predicted to influence passenger safety practices and contribute to the sustainability of city bus use in the long term. This framework is the basis for the preparation of survey instruments and analytical approaches used in the research.

RESEARCH METHODOLOGY

This study was conducted on the city bus transportation system in Batam, Indonesia, where structured route-based services have been implemented. Over the past decade, Batam has experienced significant growth in motor vehicle ownership and congestion, prompting local authorities to modernise bus services as part of a sustainable mobility strategy. This situation reflects broader conditions in many Southeast Asian cities, where motorcycles remain dominant and public transport safety particularly for buses frequently becomes a concern in public discourse. A mixed-methods approach with an explanatory sequential design was employed. Quantitative analysis was first conducted to measure passenger safety awareness, followed by qualitative analysis to explore the underlying reasons and contextual factors. The quantitative phase used a cross-sectional survey conducted through on-board intercepts, with a target of 350 respondents based on multivariate analysis requirements (Sogbe et al., 2025).

For the qualitative phase, semi-structured interviews were conducted with five key informants, including regular passengers, women, students, elderly users, drivers, and operators, to deepen the interpretation of survey findings. A combination of purposive and convenience sampling was applied. Purposive sampling ensured that respondents met inclusion criteria (aged ≥ 18 years and using the bus at least twice per month), while convenience sampling was used due to the dynamic nature of the passenger population. To enhance representativeness, quota-based sampling was applied based on routes, days (weekdays and weekends), and travel times (peak and off-peak), consistent with previous public transport studies (Husnina et al., 2022; Sethulakshmi & Mohan, 2024).

The research instrument comprised four components: sociodemographic characteristics, travel patterns, safety exposure and experience, and a Safety Awareness Scale covering boarding, on-board behaviour, and alighting. All items were measured using a five-point Likert scale. Instrument development was based on prior studies of public transport safety behaviour (Asah Nasrudin et al., 2023; Mbagha, 2023). For the qualitative component, interview guidelines focused on safety experiences, risk perception, and service improvement expectations. Data collection was conducted by trained

enumerators through face-to-face interviews on operating buses. All participants provided informed consent. Qualitative interviews were recorded (with permission) and transcribed for analysis. Data analysis followed the mixed-methods sequence. Quantitative analysis included data cleaning, reliability testing (Cronbach's Alpha), and exploratory factor analysis using KMO and Bartlett's tests. A composite index of safety awareness was then developed and categorised into low, moderate, and high levels. Ordinal logistic regression was applied to identify influencing factors, including interaction effects (e.g., gender and incident experience). Qualitative data were analysed using thematic analysis to identify patterns and to support the quantitative findings.

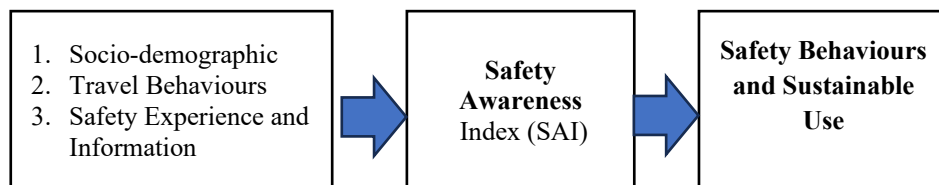


Figure 1: Conceptual Model

ANALYSIS AND DISCUSSION

Respondent Profiles and Descriptive Statistics

A total of 350 respondents participated in the survey. Table X summarises their sociodemographic characteristics and travel-related attributes. The sample is predominantly female (66.6%), compared to 33.4% male respondents, suggesting a higher reliance on public bus services among women in the study area. In terms of age, the sample is heavily concentrated in the 41-60 age group (79.2%), followed by those aged 26-40 years (16.0%) and 18-25 years (4.6%), while respondents over 60 represent only a marginal proportion (0.3%). This distribution indicates that bus usage is largely associated with middle-aged, economically active individuals who depend on public transport for daily activities.

Regarding service frequency, respondents are relatively evenly distributed: 36.3% are high-frequency users (more than five trips per week), 33.4% medium-frequency (three to five trips), and 30.3% low-frequency users (two trips or fewer). This suggests that a substantial proportion of respondents regularly use bus services, reinforcing the importance of safety awareness in routine travel.

In terms of safety experience, only 14.3% of respondents reported having experienced or witnessed a safety incident, while the majority (85.7%) had no such experience. However, exposure to safety information remains limited, with 46.0% reporting low exposure, 29.4% medium exposure, and only

24.6% high exposure. Overall, the findings indicate that although bus services are widely used by regular and economically active passengers, the dissemination of safety information remains insufficient. This highlights the need for more systematic and targeted safety communication strategies to improve safety awareness among users.

Instrument Reliability Analysis

The reliability analysis indicates that all dimensions of the Safety Awareness Scale demonstrate acceptable internal consistency, with Cronbach's Alpha values exceeding the recommended threshold of 0.70. The "Access and Boarding" dimension achieved an Alpha of 0.736, followed by "On-board Safety Practices" (0.708) and "Alighting and Exits" (0.725), indicating consistent measurement across all stages of the bus travel process. Overall, the full scale, comprising 18 items, yielded a Cronbach's Alpha of 0.731, confirming satisfactory internal consistency. These results support the reliability of the instrument for assessing passenger safety awareness and its suitability for further statistical analysis.

Exploratory Factor Analysis (EFA)

The factor feasibility test indicates that the data are suitable for exploratory factor analysis. The Kaiser-Meyer-Olkin (KMO) value of 0.774 reflects good sampling adequacy, while Bartlett's test of sphericity is significant ($\chi^2 = 1154.8$, $p < 0.001$), confirming sufficient correlations among variables. The exploratory factor analysis (EFA) identifies three underlying factors of safety awareness, with items retained based on factor loadings greater than 0.30. The first factor, On-board Safety Behaviour, comprises seven items and explains 14.63% of the variance. The second factor, Access and Boarding Safety Awareness, includes six items and accounts for 14.59%, while the third factor, Alighting Safety Practices, consists of five items and explains 13.63% of the variance. Collectively, these three factors explain 42.86% of the total variance, indicating a meaningful structure of passenger safety awareness. Given the behavioural and perceptual nature of the construct, this level of explained variance is considered acceptable and consistent with previous transport behaviour studies.

Preparation of the Safety Awareness Index (SAI)

The Safety Awareness Index (SAI) was constructed using factor scores and classified into three categories (tertiles). The results indicate that safety awareness is predominantly low to moderate, with 34.6% of respondents in the low category, 58.0% in the moderate category, and only 7.4% in the high category. This distribution suggests that, although a proportion of users demonstrate adequate safety awareness, a substantial share remains at lower levels, requiring attention. Overall, the findings highlight the need for more

targeted safety education and intervention strategies to improve passenger safety awareness.

Ordinal Logistic Regression Results

The ordinal logistic regression analysis identifies age and gender as the only significant predictors of safety awareness among bus passengers, while travel behaviour, incident experience, and exposure to safety information are not statistically significant. Age shows a positive association with safety awareness ($\beta = 0.033$, $p = 0.013$), indicating that older passengers are more likely to exhibit higher awareness, likely due to accumulated experience and increased risk perception. Gender is also significant, with male passengers less likely to demonstrate higher safety awareness than females ($\beta = -0.661$, $p = 0.006$), supporting evidence that women tend to adopt more safety-oriented behaviours in public transport contexts. In contrast, frequency of bus use has no significant effect ($\beta = -0.010$, $p = 0.942$), suggesting that habitual use alone does not enhance safety awareness. Similarly, experience of safety incidents is not significant ($\beta = 0.217$, $p = 0.493$), indicating that experiential exposure without reinforcement may not lead to sustained awareness. Although exposure to safety information shows a positive relationship ($\beta = 0.437$, $p = 0.118$), the effect is not statistically significant, implying that existing communication strategies may be insufficient to influence behaviour. Overall, these findings suggest that safety awareness is more strongly shaped by demographic characteristics than by routine behaviour, prior experience, or passive information exposure, highlighting the need for targeted and behaviourally informed safety interventions.

The ordinal logistic regression results indicate that safety awareness among bus users is primarily influenced by demographic characteristics rather than by experiential or informational factors. Although experience of safety incidents and exposure to safety information are not statistically significant predictors, the positive direction of their coefficients suggests a complementary role in shaping safety awareness. Experience may act as a contextual corrective stimulus that prompts risk reassessment, while safety information may function as a preventive cognitive mechanism by providing anticipatory safety cues, albeit with limited effectiveness when delivered passively. Overall, experiential learning and informational exposure appear to support, rather than determine, safety awareness, operating alongside more stable demographic factors such as age and gender. This relationship can be conceptualised as a partial learning loop, in which experience and information provide situational reinforcement but require structured intervention to translate into higher safety awareness levels, as illustrated in Figure 2.

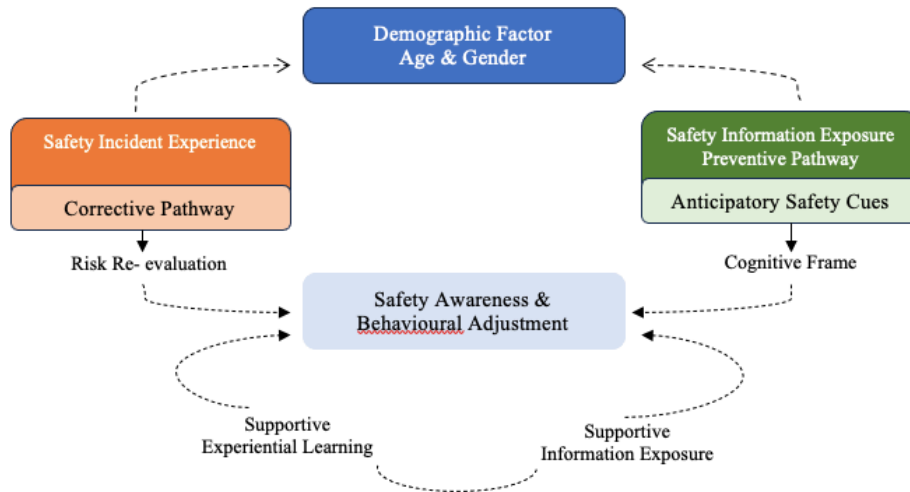


Figure 2. The Learning Loop

Model Analysis

The adequacy of the ordinal logistic regression model was assessed using model fit statistics, pseudo R-square measures, and the proportional odds assumption. The Model Fitting Information shows that the final model significantly improves upon the intercept-only model, with a reduction in $-2 \text{ Log Likelihood}$ from 442.997 to 423.644 ($\chi^2 = 19.353$, $df = 6$, $p = 0.004$), indicating that the predictors jointly contribute to explaining variations in safety awareness levels. The pseudo R-square values suggest modest explanatory power, with Nagelkerke $R^2 = 0.068$, Cox and Snell $R^2 = 0.054$, and McFadden $R^2 = 0.035$. This is consistent with behavioural transport studies, where outcomes are influenced by multiple unobserved factors. The Test of Parallel Lines is non-significant ($\chi^2 = 8.688$, $df = 6$, $p = 0.192$), confirming that the proportional odds assumption is satisfied. Overall, the results indicate that the model is statistically valid, appropriately specified, and suitable for analysing factors associated with safety awareness levels among bus passengers.

Results of Qualitative Analysis

The qualitative findings indicate that user experience and behaviour play a crucial role in shaping safety awareness among bus passengers. A key theme is the limited awareness among new users, who tend to overlook safety practices, such as rushing during boarding and alighting. Awareness typically increases after individuals experience or witness safety incidents, leading to more cautious behaviour. The analysis also highlights the limited availability of safety information, including signage and audio announcements, which hinders the

internalisation of safe practices. In addition, driver behaviour influences passengers' safety perceptions, as aggressive or high-speed driving creates discomfort and anxiety. Furthermore, the findings suggest that a strong safety culture has not yet been established among users. This is reflected in behaviours such as not queuing, standing near doors before the bus stops, and using mobile phones without maintaining stability. Overall, these qualitative insights support the quantitative findings, indicating that experience, information exposure, and operational conditions are key factors influencing safety awareness among bus passengers.

DISCUSSION

The findings indicate that most bus passengers fall within the moderate level of safety awareness, suggesting that basic safety knowledge exists but has not yet been fully internalised into consistent behaviour across all stages of travel. This reflects a knowledge-behaviour gap, where awareness remains largely cognitive rather than habitual. Similar patterns have been reported in previous transport safety studies, where users possess safety knowledge but do not consistently translate it into practice (Febryana & Fitria, 2024; Mbagha, 2023; Wang et al., 2020). In public transport settings, this gap may be explained by dynamic travel conditions such as crowding and time pressure which can override safety intentions. From a theoretical perspective, this finding aligns with the Theory of Planned Behaviour (TPB), which suggests that behaviour is shaped not only by knowledge but also by attitudes, social norms, and perceived behavioural control (Ajzen, 1991). In this context, safety awareness represents a cognitive foundation that requires environmental reinforcement to translate into behaviour. Consistent with prior studies, contextual factors such as infrastructure, passenger density, and driver behaviour play a critical role in shaping safety practices (Sethulakshmi & Mohan, 2024; Soltani et al., 2025). The regression results further show that demographic factors, particularly age and gender, are the most significant predictors of safety awareness. Older passengers tend to exhibit higher awareness, likely due to accumulated experience and greater risk sensitivity. This finding is consistent with previous research indicating that older individuals adopt more cautious travel behaviour (Sethulakshmi & Mohan, 2024). Similarly, female passengers demonstrate higher safety awareness than males, supporting evidence that women are generally more risk-averse and attentive in public transport environments (Mchunu et al., 2025; Soltani et al., 2025).

In contrast, experiential and informational factors do not significantly influence safety awareness, although their effects are positive. This suggests that experience and exposure alone are insufficient to generate sustained behavioural change. From the perspective of Risk Perception Theory, direct exposure to risk may trigger temporary caution but does not necessarily lead to long-term

awareness without reinforcement. Similar findings have been reported in previous studies, where passive safety information fails to produce measurable behavioural change unless supported by active engagement (Sinnappan et al., 2023; Wang et al., 2020). The qualitative findings provide further insight into this mechanism. New or inexperienced users tend to exhibit riskier behaviours, such as rushing during boarding or neglecting handrails, reflecting limited familiarity with safety norms. Awareness often increases after direct or observed incidents; however, this learning process remains inconsistent. Additionally, limited safety communication such as inadequate signage and audio announcements restricts the internalisation of safe practices. Driver behaviour also plays a significant role, as aggressive or high-speed driving increases passenger anxiety and influences safety perception. These findings indicate that safety awareness is shaped by the interaction between individual experience and operational conditions.

Overall, the results highlight that safety awareness is not solely an individual attribute but a social and system-dependent phenomenon. Consistent with existing literature, passenger safety is influenced by the interaction between individual behaviour, operational management, and infrastructure design (Chau et al., 2024; Ibrahim et al., 2023). Safety culture, therefore, emerges from the alignment of these elements rather than from individual learning alone. Supporting this perspective, research in Malaysia demonstrates that improvements in public transport infrastructure including bus stop design, system modernisation, and service integration can significantly enhance perceived safety, particularly among vulnerable users (Dayini et al., 2025; Sugito et al., 2025). From an academic perspective, this study contributes to the literature in three key ways. First, it conceptualises safety awareness as a multidimensional construct across the stages of bus travel (boarding, on-board, and alighting), providing a behaviourally grounded measurement framework. Second, it applies ordinal logistic regression, enabling a more nuanced analysis of awareness levels compared to conventional linear approaches. Third, it integrates quantitative and qualitative evidence to explain the mechanisms underlying safety awareness formation, particularly in a Southeast Asian urban context where such studies remain limited. These contributions shift the analytical focus from general safety perception towards a more behaviour-oriented understanding of passenger safety awareness.

From a practical perspective, the findings emphasise the importance of system-level interventions. Improving safety awareness requires more than individual experience; it depends on structured and behaviourally informed strategies, including clear signage, regular audio announcements, and driver training in safety communication. The integration of digital platforms may further enhance engagement, particularly among younger users. Without consistent institutional support, safety awareness is likely to remain fragmented and

situational, limiting its development into a shared safety culture. Overall, this study provides an evidence-based foundation for designing targeted interventions to improve passenger safety in urban public transport systems.

CONCLUSION

This study examined the level of safety awareness among city bus passengers, identified its key determinants, and explored its implications for improving public transport safety in an urban context. The findings reveal that passenger safety awareness predominantly falls within the moderate category, indicating that while basic safety knowledge is present, it has not yet been fully internalised into consistent behavioural practices across all stages of the journey. This highlights the existence of a knowledge-behaviour gap in public transport use. The study confirms that safety awareness is a multidimensional construct comprising boarding, on-board, and alighting stages, reflecting the sequential nature of bus travel. The results further demonstrate that demographic characteristics, particularly age and gender, are the most significant predictors of safety awareness, while experiential and informational factors play a supportive rather than decisive role. These findings suggest that safety awareness is shaped not only by individual learning processes but also by relatively stable personal characteristics and broader environmental conditions. By integrating quantitative and qualitative analyses, this study provides a more comprehensive understanding of how safety awareness develops in real-world travel contexts. The findings emphasise that experiential learning and exposure to safety information alone are insufficient to ensure consistent safe behaviour without structured reinforcement and supportive system conditions. From a theoretical perspective, this study contributes to the literature by positioning safety awareness as a behaviourally grounded construct that links cognitive understanding with actual travel practices. Methodologically, the use of ordinal logistic regression combined with qualitative insights offers a nuanced approach to analysing variations in awareness levels among passengers. In practical terms, the findings underscore the importance of system-level interventions in enhancing passenger safety. Improving safety awareness requires not only individual adaptation but also the strengthening of infrastructure, operational practices, and safety communication strategies within the public transport system. Overall, this study highlights that passenger safety awareness is a product of the interaction between individual characteristics, learning processes, and institutional environments. Strengthening this interaction is essential for fostering a sustainable safety culture and supporting the development of safer and more inclusive public transport systems in rapidly growing urban areas.

Recommendations and Future Research Directions

Based on the findings, several strategic recommendations can be proposed. First, transport operators and local authorities should prioritise targeted and behaviour-oriented safety communication. Safety information should move beyond passive dissemination and be embedded within daily travel contexts through clear signage, standardised audio announcements, and integration into digital mobility platforms. Second, operational safety practices should be strengthened to support behavioural internalisation. This includes enhanced driver training focused on defensive driving and safety communication, as well as stricter enforcement of boarding and alighting procedures. The presence of operational staff at high-demand locations may further improve compliance, particularly among new users. Third, the development of a collective safety culture should be treated as a long-term institutional priority. Public campaigns promoting behavioural norms such as orderly queuing, waiting for a complete stop before boarding, and using handrails can help translate individual awareness into shared practices. Given the influence of demographic factors, interventions should also be tailored to different user groups rather than adopting uniform approaches.

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