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# An Analysis of the Women Commuters' Satisfaction in the Public Bus Service in Bangladesh: A Survey on Local Buses in Major Cities

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## Abstract

Bangladesh is one of the most populated developing countries where public bus service plays a vital role as a public transport mode since it is easily available and cost-effective. In the social, commercial, educational, and administrative spheres, women's participation in the labor force in economic enterprises is steadily expanding in the country. Very little research considers only women commuters to analyze the service quality of public buses and they selected only Dhaka city as a study area. However, a large number of trips were generated by women commuters in the industrial and commercial zones such as Gazipur, Narayanganj, and Dhaka. This paper ascertains the public bus service attributes that affect women commuters' satisfaction as well as finds out the major problems of women commuters while traveling on public buses and the possible solutions to them. This survey included 766 women commuters from Dhaka, Narayanganj, and Gazipur who were interviewed face to face. Structural Equation Model (SEM) was used as the instrument for identifying the service quality (SQ) attributes that influenced the women commuters' satisfaction. A series of models were developed based on the trial-and-error method and the model $M_3$ is selected as the best fit according to SEM fit indices values. The study's main goal was to compile a list of service quality attributes that influence women commuters' satisfaction. Major issues with the current public bus service in terms of safety and security, as well as remedies, were identified through discussions with experienced female commuters. These findings reveal that women commuters' satisfaction is primarily influenced by safety and security, as well as the degree of comfort provided by bus service because they frequently encounter major safety and security issues on public buses and want an immediate remedy. This paper offers some po-

tential strategies for addressing the issues, which may prompt policymakers to pay more attention to these aspects in transportation planning.

## Keywords

Public Bus, Service Quality, Women Commuters' Satisfaction, SEM

## 1. Introduction

Bangladesh's commercial and industrial cities are among the most densely populated cities with the world's highest population growth rate. The male to female ratio in Dhaka, the capital city of the country is roughly 1:1, as it is in most other cities. Dhaka, Bangladesh's primary commercial city, is the center of employment opportunities as well as all vital facilities such as health, education, and so on.

Public transport (PT) is the most efficient mode of transportation for addressing travel demands in heavily populated urban regions. People in cities are forced to relocate frequently to participate in economic activities, which help to develop social networks and make family life easier.

Women's participation in the labor force in economic undertakings is increasing day by day. In the social, commercial, educational, and administrative sectors, the majority of women have a considerable presence [1]. The number of women working has increased from 54 million in 2010 to 61 million in 2017. Bangladesh is the world's second-largest exporter of Ready-made Garments (RMG) after China [2]. The RMG sector employs approximately 4.2 million people, with women accounting for 80 percent of the workforce [3], with a significant number of garment and textile industries located in Gazipur and Narayanganj. Women's economic participation is intimately tied to their mobility and ability to meet transportation demands, which increases the demand for safe and secure local bus service in major cities. In Dhaka city, more than 60% of passengers use public transportation to get to work [4]. As a substantial number of individuals cannot afford personal vehicles owing to low-income levels, the bulk of trips in Dhaka are served by public transportation options, as they are in other Asian cities [5]. Thus, the demand for public transportation modes (buses) is increasing. Because of social exclusion, women in Dhaka confront social barriers in gaining access to public transportation [6].

In today's world, the success of a public transportation system is determined by the number of passengers it can attract and maintain. As a result, service quality becomes a critical problem, as it is well recognized that improved service quality leads to higher passenger satisfaction and more use of the system. The quality of public transportation service is determined by several factors. Customer satisfaction is an excellent indicator of the quality of service. To develop an appropriate public transport service, previous researchers measured the perception of passengers and their satisfaction through surveys, and the data col-

lected was used to develop indices providing useful information about the quality of the service and its evolution over time. However, to determine these, the researchers need not only to know the perceptions about the attributes of quality but also to identify which attributes have the highest influence on the passengers' satisfaction.

The public transportation system of Bangladesh is inefficient, nonproductive, hazardous, underfunded, and overcrowded [7] [8]. Because of a greater variety of social classes, cultural backgrounds, and economic situations in the urban context of developing countries, travel patterns between male and female members of the same household are different [9]. Researchers have been studying the relationship between the quality of transport services and people's accessibility in recent decades [10]. Several studies on the quality of public bus services have been undertaken, but none have taken gender into account [9] [11] [12] [13] [14].

In Bangladesh, very few studies on bus service quality have taken into account the safety and security concerns of female commuters. The majority of the researchers looked at the quality of public bus service and passenger satisfaction from the perspective of all passengers as well as the main study region in Dhaka. However, the industrial and commercial cities, where large numbers of women, commute for employment, household, business, and other reasons, have yet to be considered. For the past two decades, policymakers and transportation planners have focused on gender issues in the public transportation sector, recognizing the differences in women's and men's travel and activity patterns around the world [9] [15]. Women commuters must relocate to gain access to services and job possibilities [16]. As a result, it is considered critical to pay special attention to women commuters' satisfaction.

Improvement of the urban public transportation system (Goal 11) in the SDGs mentions urban public transportation system improvement in general for males and females. We need to focus on a gendered perspective. Because access to safe mobility directly relates to the fulfillment of the 2030 agenda for SDGs. Sustainable Development Goal (Goal 5) achieve gender equality and empower all women and girls, and both promote removing mobility constraints, ensuring a safe and reliable transport system for women to ensure their mobility rights. Thus, urban development must view and consider women's diverse needs as end-users of public transportation in Bangladesh.

This research aims to explore the variables that affect women commuters' satisfaction with the prevailing service quality of buses, and to determine the problems faced by women commuters while traveling by bus and the possible solutions to these problems. For the analysis, the Structural Equation Model (SEM) was used. SEM is a multivariate analysis technique that allows for the modeling of a situation in which latent and observable variables form a series of correlations. Multiple regression and factor analysis are combined in SEM. A more sophisticated analytical method, such as SEM, is now being used in services marketing research [17]. It is not uncommon to use SEM to determine the fit-indices

of a given model [17]. Considering the intricacy of the phenomenon, the produced model can be deemed satisfactory, despite the literature's recommendations for creating an appropriate model.

The rest of this research work is divided into the following sections: the past research on SQ assessment of public transportation and bus service is discussed in Section 2. Section 3 discusses the sampling method and data collection, as well as the respondents' descriptive statistics, preliminary statistics, and recommended empirical models. The study's findings and discussions are presented in Section 4. Sections 5 and 6 summarize the findings and draw some inferences.

## 2. Literature Review

The majority of Bangladeshi women are involved in social, cultural, economic, and political activities, and they rely on public transportation to meet their everyday needs. Even though both men and women contribute to the country's economic success, female commuters face a significant disparity in the provision of efficient, safe transportation. The number of female commuters has been rapidly increasing in recent years for reasons such as education, employment, and business, women especially low-income women, are more reliant on public transport than men [18] and produce a huge number of trips a day. Women, on average, have a stronger effect than men. So there have been different transportation patterns between men and women, [19] on gender issues and transportation in both the developed and developing worlds, which suggests that men and women use transportation in different ways.

In Bangladesh, the public bus is one of the most popular transport services. Although various research [7] [20] [21] alleged that current bus services are inefficient, unproductive, and unsafe because of long wait times, delays in plying, longboarding times, overloading, discomfort, and a long walking distance from home/work to bus stops, among other things. Passengers are dissatisfied for three reasons, according to earlier research: unsafe driving, inappropriate boarding and alighting, and a lack of law enforcement surveillance [22]. It is also worth mentioning [23] that passengers waiting to board the bus have been waiting for an indeterminate period with no indication of when the bus would come.

In a study of female students in Lucknow, India, [24] discovered that sexual harassment occurs primarily on public buses. A comparable study of New York City students looked at the entire trip chain of a journey, including walk access to and from the subway station, and discovered that those female college students are vulnerable to sexual exploitation at all stages of their subway commute to and from campus [25]. The fact that women are subjected to sexual harassment when walking or on public transportation underscores the security needs of female passengers on public transportation [26] [27].

The SEM approach has been widely employed in a variety of study fields, and it is now being used more frequently in the subject of evaluating mass transit efficiency. The proposed SEMs introduced several latent variables like tangible

responsiveness, empathy, assurance, food, timeliness, safety, and information [28]. The findings show that only tangible factors have a substantial impact on passenger happiness [29].

SEM has some major advantages over traditional multivariate techniques. SEM models estimate the parameters of measurement error variance for both dependent and independent variables [10]. Hence, the measurement error can be lowered. Furthermore, SEM allows the estimation of latent unobserved variables from observed variables; thus, the formation of composites envisages measurement error. Besides, fully developed models can be tested against the data using SEM as a conceptual or theoretical structure, or the model can be assessed for sample data fit.

From the literature review, it can be identified that in most situations, SQ used data from developed countries to investigate consumers' opinions on public buses; on the other hand, a lot of dissimilarities are observed, like, indeed, expectations, personalities, perception, and needs between developing and developed countries. Women commuters face more difficulties in Bangladesh while traveling in public buses. Furthermore, very limited research has been conducted to address the authors' concern about women commuters' satisfaction with the quality of public bus service. This study is an endeavor to focus on the female commuters' satisfaction with bus service quality and determine their major problems and possible solutions.

## 3. Methodology

### 3.1. Sampling Techniques and Data Collection

A comprehensive questionnaire survey was conducted with female commuters on public buses in major cities (Dhaka, Narayangonj, and Gazipur) in Bangladesh. The survey was conducted during working days and holidays in June and July 2021, when users (women) of public bus services commute to different destinations. A total of 24 service attributes were asked of the respondents regarding their socio-economic characteristics and overall satisfaction level with the current condition of public bus service. To better understand the users, both qualitative and numerical scales have been used in the questionnaire. To evaluate the women commuters' satisfaction with bus service, passengers were requested to rate their experience on a cardinal scale of five points varying between 1 to 5 (1 is for "excellent" and 5 is for "very poor"). A similar classification was also considered by [30] and [31].

A total of 800 samples were collected by interviewing the candidates face-to-face. After data screening, 766 were finally selected. A convenience sampling technique was implemented for the survey. [32] mentioned that the sample size should be above 200. The model complexity and parameter distribution features determine the needed sample size. Three models were developed to explore the associations of public bus service quality with different service variables. A two-tailed t-test with a critical value of 1.96 for a 95% confidence interval was considered as the

boundary value to examine the model significance.

## 3.2. Descriptive Statistics of the Respondents

The sample size is defined by the total number of female commuters. About 68.71% of the respondents' age limits are between 21 and 30 years, while 21.57% and 9.45% of the respondents' age limits are between 11 to 20 and 31 to 40 years, respectively. About 62.05% of the respondents are household workers, while 34.35% are students and 3.33% are businessmen. 60.45% of the respondents' monthly income range is 10,000 BDT to 20,000 BDT, while 21.04% of their monthly income range is less than 10,000 BDT. The majority (97.87%) of the respondents use local buses on a daily basis as their main mode of travel. Table 1 shows the general characteristics of the respondents.

## 3.3. Preliminary Statistics

A cardinal scale of 1 to 5 was used to assess the respondents' level of importance and satisfaction with public bus service quality. Preliminary statistics of the public bus service quality demonstrate a mean range from 3.21 to 4.51 and standard deviations from 0.535 to 0.841. The lowest mean value of travel time in holidays is 3.21 and the highest mean value of travel time on an office day is 4.51.

**Table 1.** Descriptive statistics of the respondents.

| Features | Statistics |
|---|---|
| Age | 11 - 20 years old (21.57%) |
| | 21 - 30 years old (68.71%) |
| | 31 - 40 years old (9.45%) |
| | 41 - 50 years old (0.27%) |
| Occupation | Service holder (62.05%) |
| | Students (34.35%) |
| | Businessman (3.33%) |
| | Others (0.27%) |
| Monthly salary range features | <10,000 (BDT) (21.04%) |
| | 10,000 - 20,000 (BDT) (60.45%) |
| | 20,000 - 30,000 (BDT) (13.45%) |
| | 30,000 - 40,000 (BDT) (3.46%) |
| Educational qualification | Below SSC (6.52%) |
| | SSC (11.45%) |
| | HSC (10.25%) |
| | Graduate (68.71%) |
| | Post Graduate (3.06%) |

## 3.4. Structural Equation Model

Twenty-four question attributes are used in this study, which are presented in Table 2 with mean, standard deviation, and scaling. To find the attributes which are influencing the female commuter's satisfaction and the best fit, SEM was chosen by trial and compared with the standard best range. This study recommended developing models with various structures and observing the fitness to determine the optimal model.

**Table 2.** Summary of the statistics of observe variables.

| Item No. | Variables | Mean | Standard Deviation | Numerical Scale | Qualitative Scale |
|---|---|---|---|---|---|
| 1 | Overall Physical Condition of bus. | 4.26 | 0.535 | 1 - 5 | Excellent to very poor |
| 2 | Condition of reserved seat for women commuters. | 4.13 | 0.719 | 1 - 5 | Excellent to very poor |
| 3 | The comfort level for women commuters inside the bus. | 4.19 | 0.646 | 1 - 5 | Excellent to very poor |
| 4 | Frequency of bus service. | 4.18 | 0.585 | 1 - 5 | Excellent to very poor |
| 5 | Punctuality of bus service. | 4.25 | 0.570 | 1 - 5 | Excellent to very poor |
| 6 | The convenience of bus service. | 4.14 | 0.589 | 1 - 5 | Excellent to very poor |
| 7 | Convenient ticketing system to women commuters. | 4.05 | 0.660 | 1 - 5 | Excellent to very poor |
| 8 | Reasonable transport cost for women commuters. | 3.78 | 0.841 | 1 - 5 | Excellent to very poor |
| 9 | Safety at Bus stands for women commuters. | 4.14 | 0.719 | 1 - 5 | Excellent to very poor |
| 10 | Security of women passengers (off-peak periods). | 4.24 | 0.699 | 1 - 5 | Excellent to very poor |
| 11 | Levels of women commuters' personal safety. | 4.17 | 0.688 | 1 - 5 | Excellent to very poor |
| 12 | Driving safety (drivers' skill). | 4.17 | 0.630 | 1 - 5 | Excellent to very poor |
| 13 | Convenient boarding and alighting facilities for women commuters. | 4.05 | 0.551 | 1 - 5 | Excellent to very poor |
| 14 | Punishment for women commuters' harassment. | 3.89 | 0.763 | 1 - 5 | Excellent to very poor |
| 15 | Behavior of drivers. | 4.10 | 0.585 | 1 - 5 | Excellent to very poor |
| 16 | Courtesy of helpers/contactors. | 4.17 | 0.588 | 1 - 5 | Excellent to very poor |
| 17 | The behavior of ticket counter's staffs. | 3.78 | 0.689 | 1 - 5 | Excellent to very poor |
| 18 | Reliability of Bus services. | 4.06 | 0.574 | 1 - 5 | Excellent to very poor |
| 19 | Accessibility of Bus. | 4.08 | 0.575 | 1 - 5 | Excellent to very poor |
| 20 | Travel time (office days). | 4.51 | 0.669 | 1 - 5 | Excellent to very poor |
| 21 | Travel time (holidays). | 3.21 | 0.834 | 1 - 5 | Excellent to very poor |
| 22 | Accessibility of Bus stand. | 4.01 | 0.551 | 1 - 5 | Excellent to very poor |
| 23 | Availability of information. | 4.08 | 0.573 | 1 - 5 | Excellent to very poor |
| 24 | Do you think women commuters are satisfied with the prevailing overall bus stand? | 4.07 | 0.643 | 1 - 5 | Excellent to very poor |

### Development of Model-1 (M₁)

The postulate of Model-1 is that the female commuter's satisfaction (C) prevailing in the public bus service quality has three latent: overall service quality, the behavior of personal, reliability, and accessibility. These latent are predicted by individual attributes of bus service, such as "Overall Physical Condition of the Bus", "Condition of reserved seats for women commuters", "The comfort level for women commuters inside the bus", "Frequency of bus service", "Punctuality of bus service", "The convenience of bus service", "Convenient ticketing system for women commuters", "Reasonable transport cost for women commuters", "Courtesy of helpers/contactors", "Behavior of ticket counter staff", "Reliability of bus services", "Accessibility of bus", "Travel time (office days)", "Travel time (holidays)", "Accessibility of bus stand", and "Availability of information", respectively. The constructed structural equation model (M₁) is shown in **Figure 1**.
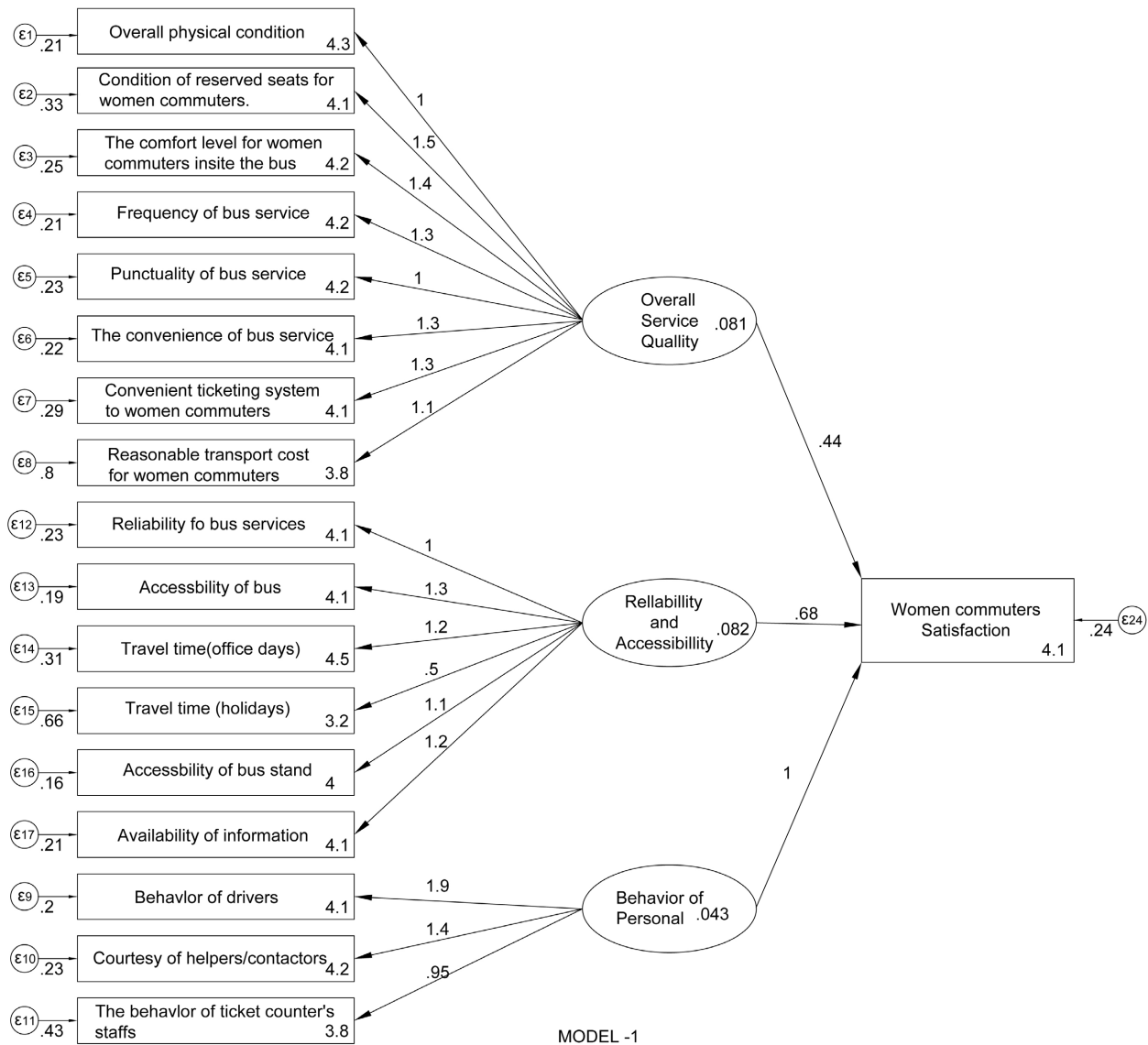


**Figure 1.** Schematic diagram of structural equation model (SEM) M₁.

### Development of Model-2 (M₂)

Model-2 hypothesizes that female commuter satisfaction (C) is comprised of four latent variables: overall service quality, personal behavior, reliability and accessibility, and female commuters' safety and security. These latent are predicted by individual attributes of bus service, such as "Overall Physical Condition of the Bus", "Condition of reserved seats for women commuters", "The comfort level for women commuters inside the bus", "Frequency of bus service", "Punctuality of bus service", "The convenience of bus service", "Convenient ticketing system for women commuters", "Reasonable transport cost for women commuters", "Behavior of drivers", "Courtesy of helpers/contactors", "The behavior of ticket counter's staff", "Reliability of bus services", "Accessibility of buses", "Travel time (office days)", "Travel time (holidays)", "Accessibility of bus stands", "Availability of information", "Safety of women commuters", "Driving safety (drivers' skill)", "Convenient boarding and alighting facilities for women commuters", "Punishment for women commuters' harassment" respectively. The conceptual structural model (M₂) is shown in **Figure 2**.

### Development of Model-3 (M₃)

Model-3 hypothesizes that the female commuters' satisfaction (C) has two main components: overall service quality and safety and security of female commuters.
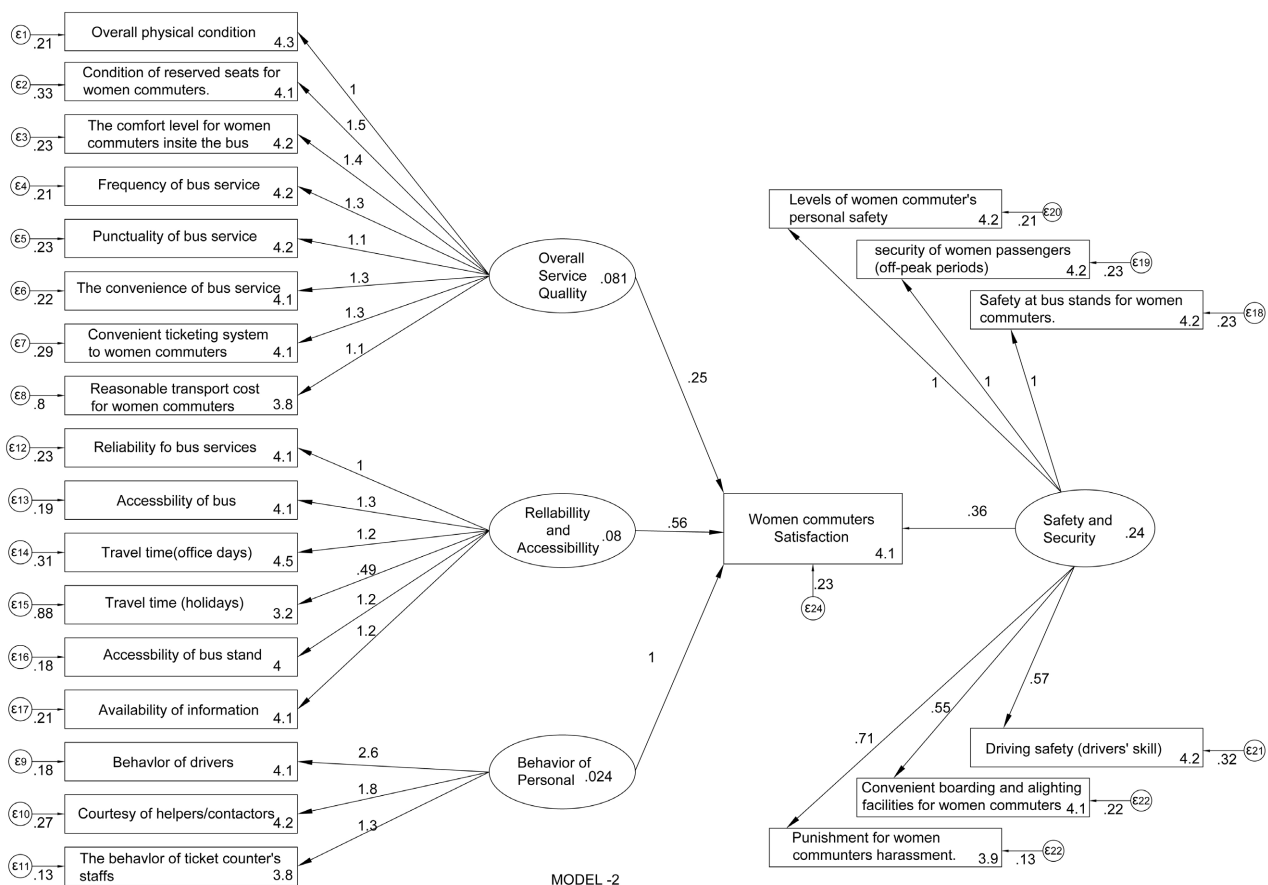


**Figure 2.** Schematic diagram of structural equation model (SEM) M₂.

They also have two latent components (behavior of personal, reliability, and accessibility), which are co-related with the latent overall service quality. These latent are predicted by individual attributes of bus service, such as "Overall Physical Condition of the Bus", "Condition of reserved seats for women commuters", "The comfort level for women commuters inside the bus", "Frequency of bus service", "Punctuality of bus service", "The convenience of bus service", "Convenient ticketing system for women commuters", "Reasonable transport cost for women commuters", "Behavior of drivers", "Courtesy of helpers/contactors", "The behavior of ticket counter's staff", "Reliability of bus services", "Accessibility of buses", "Travel time (office days)", "Travel time (holidays)", "Accessibility of bus stands", "Availability of information", "Safety of women commuters", "Driving safety (drivers' skill)", "Convenient boarding and alighting facilities for women commuters" and "Punishment for women commuters' harassment" respectively. The optimal best-fit structural equation model ($M_3$) for this research is shown in **Figure 3**.

## 4. Empirical Analysis and Results

The accuracy of the measuring technique is referred to as reliability. Though there are a variety of dependability factors, Cronbach Alpha is one of the most frequently utilized. It is a method of determining internal consistency. The degree to which a collection of objects is linked together. Cronbach Alpha for this study is 0.86, which is higher than [33] the acceptable limit of 0.6 and also falls in the category of good ($a = 0.80 - 0.89$) internal consistency. As a result, the internal consistency of the variables employed in this study is exceptional. This study used SEM methodology to examine the satisfaction of women commuters with
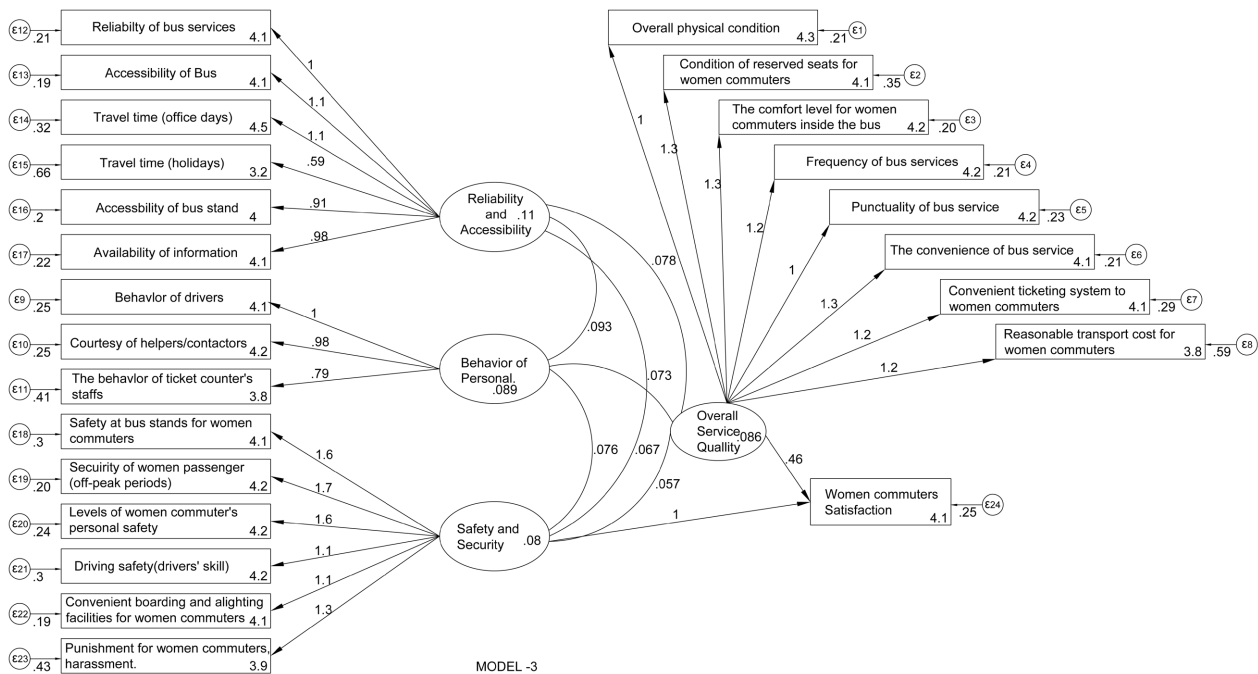


**Figure 3.** Schematic diagram of structural equation model (SEM) $M_3$.

the quality of public bus service. As [34] suggested, the authors tested and compared three alternative SEM models to estimate the plausibility of best-fitted one. These models explored the associations of general service quality attributes with different variables. The parameter estimates of the variables used to create the models are shown in Table 3. To evaluate the produced models and to choose the best one, various indices evaluating model fitness are used. The fit indices of the three created models are listed in Table 4, including the Root Mean Squared Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), Comparative Fit Index (CFI), Tucker-Lewis index (TLI), and Akaike's Information Criterion (AIC).

As shown in Table 3, $M_1$ is a three-factor model and had "Behavior of the Personnel" as the major contributor (b = 1, p < 0.01) in "Women Commuters' Satisfaction" with the bus service, based on the factor loadings. The next significant contributor (b = 0.68, p < 0.01) that positively drives the "Women Commuters' Satisfaction" has been "Reliability and Accessibility," whereas "Overall Service Quality" statistically has been the lowest contributor (b = 0.44, p < 0.01). $M_1$ somehow showed a poor fit on the data (CFI = 0.661, TLI = 0.610, RMSEA = 0.104, SRMR = 0.182, AIC = 22545.152). Therefore, re-specification of the model was inevitable [35].

$M_2$ has been a four-factor model with the addition of the "Safety and Security" dimension of the "Women Commuters' Satisfaction" (Figure 2 and Table 3 and Table 4). "Personnel Behavior" (b = 1, p < 0.01) and "Reliability and Accessibility" (b = 0.56, p < 0.01) contributed in the same order as $M_1$. Based on the factor loadings, the newly added factor, *i.e.*, "Safety and Security" (b = 0.36, p < 0.01), was contributing more than "Overall Service Quality" (b = 0.25, p = 0.012) as compared with $M_1$. With respect to model fitness, $M_2$ showed some improvement (CFI = 0.624, TLI = 0.583, RMSEA = 0.100, SRMR = 0.204, AIC = 30023.457), but still this improvement has not been sufficient. Therefore, testing of another alternative SEM model was necessary.

$M_3$ had the same factors as $M_2$, but the authors re-specified it by changing the relationships among the contributing factors. Since "Behavior of the Personnel" and "Reliability and Accessibility" has been contributing significantly and consistently, the authors checked which of the other two variables contributes more. According to Figure 3 and Table 3 and Table 4, "Safety and Security" (b = 1, p < 0.01) contributed more than "Overall Service Quality" (b = 0.46, p = 0.001). Additionally, $M_3$ showed good improvement with respect to fitness of data with the model (CFI = 0.816, TLI = 0.793, RMSEA = 0.071, SRMR = 0.061, AIC = 29116.523). So, it was implied that $M_3$ is the best among the alternative SEM models.

Identifying the major problems faced by female commuters while traveling on public buses in Bangladesh, a survey was conducted with a predesigned questionnaire, where 766 women respondents participated. Table 5 and Table 6 show the summary of problems and the types of harassment faced by female commuters while travelling by public bus in Bangladesh. The responses reveal

**Table 3.** Estimated model results of women commuters' opinion.

| Item No. | Description | M-1 | | M-2 | | M-3 | |
|---|---|---|---|---|---|---|---|
| | | Estimated Parameter | p-value | Estimated parameter | p-value | Estimated parameter | p-value |
| 1 | Overall Physical Condition of bus | 1[a] | 0.00 | 1[a] | 0.00 | 1[a] | 0.00 |
| 2 | Condition of reserved seats for women commuters | 1.5[a] | 0.00 | 1.5[a] | 0.00 | 1.3[a] | 0.00 |
| 3 | Comfort level for women commuters inside the bus | 1.4[a] | 0.00 | 1.4[a] | 0.00 | 1.3[a] | 0.00 |
| 4 | Frequency of bus service | 1.3[a] | 0.00 | 1.3[a] | 0.00 | 1.2[a] | 0.00 |
| 5 | Punctuality of bus service | 1[a] | 0.00 | 1.1[a] | 0.00 | 1[a] | 0.00 |
| 6 | Convenience of bus service | 1.3[a] | 0.00 | 1.3[a] | 0.00 | 1.3[a] | 0.00 |
| 7 | Convenient ticketing system to women commuters | 1.3[a] | 0.00 | 1.3[a] | 0.00 | 1.2[a] | 0.00 |
| 8 | Reasonable transport cost for women commuters | 1.1[a] | 0.00 | 1.3[a] | 0.00 | 1.1[a] | 0.00 |
| 9 | Safety at Bus stands for women commuters | N/A | … | 1[d] | 0.00 | 1.6[d] | 0.00 |
| 10 | Security of women passengers (off peak periods) | N/A | … | 1[d] | 0.00 | 1.7[d] | 0.00 |
| 11 | Levels of women commuter' personal safety | N/A | … | 1[d] | 0.00 | 1.6[d] | 0.00 |
| 12 | Driving safety (driver's skill) | N/A | … | 0.6[d] | 0.00 | 1.1[d] | 0.00 |
| 13 | Convenient boarding and alighting facilities for women commuters | N/A | … | 0.5[d] | 0.00 | 1.1[d] | 0.00 |
| 14 | Punishment for women commuters' harassment | N/A | … | 0.7[d] | 0.00 | 1.3[d] | 0.00 |
| 15 | Behavior of drivers | 1.9[b] | 0.00 | 2.6[b] | 0.001 | 1[b] | 0.00 |
| 16 | Courtesy of helpers/contractors | 1.4[b] | 0.00 | 1.8[b] | 0.00 | 0.98[b] | 0.00 |
| 17 | The behavior of ticket counter's staffs | 0.95[b] | 0.00 | 1.3[b] | 0.001 | 0.79[b] | 0.00 |
| 18 | Reliability of Bus services | 1[c] | 0.00 | 1[c] | 0.00 | 1[c] | 0.00 |
| 19 | Accessibility of Bus | 1.3[c] | 0.00 | 1.3[c] | 0.00 | 1.1[c] | 0.00 |
| 20 | Travel time (office days) | 1.2[c] | 0.00 | 1.2[c] | 0.00 | 1[c] | 0.00 |
| 21 | Travel time (holidays) | 0.5[c] | 0.00 | 0.5[c] | 0.00 | 0.59[c] | 0.00 |
| 22 | Accessibility of Bus stand | 1.1[c] | 0.00 | 1.2[c] | 0.00 | 0.91[c] | 0.00 |
| 23 | Availability of Bus stand | 1.2[c] | 0.00 | 1.2[c] | 0.00 | 0.98[c] | 0.00 |
| 24 | Do you think women commuters are satisfied with the prevailing overall bus services | 0.43[s] 1[s] 0.68[s] | 0.00 | 0.25[s] 1[s] 0.56[s] 0.35[s] | 0.012 0.00 0.00 0.00 | 0.46[s] 1[s] | 0.001 0 |
| 25 | Overall service quality | 0.43[Lt] | 0.00 | 0.25[Lt] | 0.012 | 0.45[Lt] | 0.001 |
| 26 | Behavior of personal | 1[Lt] | 0.00 | 1[Lt] | 0.00 | N/A | … |
| 27 | Reliability and accessibility | 0.68[Lt] | 0.00 | 0.56[Lt] | 0.00 | N/A | … |

a = influences "Overall Service Quality", b = influences "Behavior of Personal", c = influences "Reliability and Accessibility", d = influences "Safety and Security", s = indicates "Endogenous Variables", t = indicates "Exogenous".

Table 4. Model fitness.

| Fit statistic | M-1 | M-2 | M-3 | Good fit | References |
|---|---|---|---|---|---|
| Standardized Root Mean Squared Residual (SRMR) | 0.182 | 0.204 | 0.061 | <0.1 | [36] |
| Root Mean Squared Error of Approximation (RMSEA) | 0.104 | 0.100 | 0.071 | <0.1 | [37] |
| Tucker-Lewis Index (TLI) | 0.610 | 0.583 | 0.793 | Close to 1.00 | [29] |
| Comparative Fit Index (CFI) | 0.661 | 0.624 | 0.816 | Closer to 1.0 | [17] |
| Akaike's Information Criterion (AIC) | 22545.152 | 30023.457 | 29116.523 | N/A | |

Table 5. Summary of problems faced by women commuters.

| Type of problem | "Yes"-Faced (%) | "No"-Not Faced (%) |
|---|---|---|
| Harassment | 99.74 | 0.26 |
| Overcrowding and inadequate seats | 99.61 | 0.39 |
| Poor and insecure boarding and alighting facilities | 100 | 0 |
| Safety issues at bus stand | 99.74 | 0.26 |
| Long waiting at bus stand | 99.48 | 0.52 |
| Security issues during off-peak hour | 100 | 0 |
| Difficulties of movement inside bus | 99.21 | 0.79 |
| Dirty and untidy environment inside bus | 99.61 | 0.39 |
| Lack of fan and lighting facilities | 99.35 | 0.65 |
| Aggressive driving and violation of traffic rules | 99.48 | 0.52 |

Table 6. Type of harassment faced by women commuters.

| Type of harassment | Percentage (%) |
|---|---|
| Sexual | 6.41 |
| Verbal | 2.75 |
| Physical | 4.06 |
| Humiliation | 4.45 |
| Pick Pocketing | 2.75 |
| Sexual and Physical | 22.25 |
| All of the above | 54.84 |

that 99.74% of female commuters are facing harassment while traveling on public buses, and the types of harassment are sexual, verbal, physical, humiliating, and pickpocketing. Among these types of harassment, 6.41% of women commuters are sexually harassed, and the ratios of verbal, physical, humbling, and pickpocketing are respectively 2.75%, 4.06%, 4.45%, and 2.75%. Furthermore, nearly 22.25% of female bus passengers reported being both physically and sexually harassed. 54.84% of female commuters are facing harassment above all categories (sexual, verbal, physical, humiliation, pickpocket) at different times on public buses. On public buses, female commuters are facing overcrowding and insufficient reserved seats. According to the survey results, 99.61% of women commuters have faced the problem. The boarding and alighting facilities are very poor in Bangladesh for public buses, especially for female commuters. The problem that is widely (almost 100%) faced by women commuters is poor and insecure boarding and alighting facilities. The infrastructure of the local buses in Bangladesh is poor and quite unsafe for female passengers. There is no maintenance of rules and regulations while boarding and alighting from the bus, and thus female passengers become the worst victims of this poor maintenance. The safety condition of traveling in a public bus at the bus stand for women commuters is very poor. According to this survey, 99.74% of respondents' responses about the condition of the safety of bus stops are poor. Most of the city's people are service holders, and they travel to and from their offices, but it's a major issue to arrive at their destination on time using the public bus. The waiting time at the bus stand is too long. 99.48% of commuters expressed their long wait for the bus at the bus stand. In Bangladesh, women's safety and security are the most important issues while traveling by bus, and it is also a vital issue in the off-peak period. The survey data said that 100% of women commuters are facing insecurity in the off-peak period. The authorities of local buses are profit-oriented and don't bother about the comfort and safety of the passengers. They take passengers into the bus restlessly, and thus the overcrowding inside the bus. As a result, it is difficult to move inside the bus, and sometimes there is a lack of space to move. As shown in Table 5, 99.21% of commuters expressed that they struggled a lot due to the lack of space to move inside the bus. Usually, most of the buses are dirty and untidy in Bangladesh, so the passengers face the problem of dirtiness. This study finds that 99.61% of female commuters feel dirty and untidy inside the buses. The fitness of the bus is the most important issue, where the fan and lighting facilities are part and parcel of the physical condition of buses. 99.35% of passengers agreed that there is a lack of lighting and fan facilities on buses. When traveling on a bus, the driver's behavior and driving quality are most important because passengers' safety depends on the driver's driving quality. But most of the drivers drive in an aggressive mood and violate the traffic rules. About 99.48% of women commuters revealed that they have faced the bad and unfriendly behavior of bus drivers and contactors. The survey reports show that women commuters are day-to-day sufferers of these types of problems and harassment, and there is no means of safety and comfort for them on the local bus in Bangladesh.

The opinions of a number of female passengers were sought to resolve the major problem faced by female commuters while traveling by public bus in Bangladesh. Among them, 78% of women commuters suggested that "several campaigns should be run against all types of harassment towards women commuters", "complaint boxes or a hot-line should be introduced for reporting and recording events of harassment", "number of buses should be increased to solve the overcrowding problem", "installing CCTV cameras inside the bus and stoppages to ensure women commuters' personal safety", "proper actions should be taken to keep the environment neat and clean inside the bus", "bus drivers and conductors should be trained properly on how to deal with women commuters in a civilized society," and "the concerned authorities should strictly monitor the proper execution of traffic laws" will be the possible solution. And also, 15.55% of women commuters suggested the above issues except that "about 25% of seats should be reserved for women commuters considering the total bus commuters" to investigate further why they think such.

## 5. Conclusions

This study aimed to analyze women commuters' satisfaction with the public bus service in Bangladesh. Women have a direct contribution to the development of any economy. Public transport indirectly helps women workers to efficiently sustain their contributions by facilitating their commute to and from the workplace, especially in a growing economy like Bangladesh. So, virtually, there is an indirect link between the satisfied commute and the performance of women workers. Anyhow, our study has been an attempt and focused on figuring out the factors contributing to the satisfaction of female bus commuters in Bangladesh. The authors therefore analyzed three alternative SEM models by specifying different combinations of "Behavior of the Personnel", "Reliability and Accessibility", "Safety and Security", and "Overall Service Quality", and the results showed that $M_3$ (with CFI = 0.816, TLI = 0.793, RMSEA = 0.071, SRMR = 0.061, and AIC = 29116.523) was best suited for the research model. In general, the data showed that "behavior of the personnel" and "reliability and accessibility" are the most important factors in elevating the satisfaction levels of female commuters. Specifically, there have been some serious issues faced by women commuters too, which are discussed in the following parts along with recommendations and future possibilities of research focusing on the dynamics of women's commute.

Although more women have been joining the workforce in Bangladesh and their first choice is the public buses, the travel experiences have mostly remained unsatisfactory for them. Because of some issues like security of female passengers in off-peak periods, female commuters feel insecure from pickpockets, physical or sexual harassment, etc., and there is a lack of personal safety at the bus stand for female commuters. When waiting for the bus at the bus stand, the waiting room for female commuters and washroom facilities are essential for them, but there are no such facilities for their safety. The majority of the female com-

muters on the bus were sexually, physically, or verbally harassed by bus staff or other male passengers. The treatment of female commuters is highly unsatisfactory as there is no provision in law for instant punishment for harassment. If there were such strict laws and simultaneous penalties for harassment of women, their security risks would be reduced, and their satisfaction would be increased. Moreover, in the survey report, 99.5% to 100% of women commuters have experienced harassment and overcrowding; inadequate seats; poor and insecure "boarding and alighting facilities", "poor safety conditions at bus stands", "long waiting times", "lack of security for women commuters during the off-peak period", "difficulties of movement inside the buses", "dirty and untidy environment inside the bus", "lack of fan and lighting facilities", and "aggressive driving and violation of traffic rules".

The main conclusions from this study should be addressed by public bus service operators when evaluating methods to improve public bus services for female passengers. This study's findings are based on users' perspectives, which represent their expectations and desires. Advanced modeling tools can, however, be used to study stimulating consequences for public transit operators and policymakers when applied to this type of data. The outcome may also be effective in improving collaboration between academics and administrators. More samples from other cities may be included in future studies to represent the entire country. More research into passenger satisfaction in terms of security and comfort is needed.

## 6. Recommendations

Experienced female commuters suggested some applications to help them deal with their problems while riding the bus, such as an instant campaign system to combat all forms of harassment directed at female commuters in the bus and bus stop so that they can get help right away, and a complaint box and hot-line in the bus to expect proper harassment action. Since very poor conditions remain inside the bus for female commuters, such as it's not easy to move, a lack of reserved seats for female commuters, etc., the level of comfort inside the bus is badly experienced. Long waiting times at the bus stand for a bus cause insecure and unsafe circumstances for female commuters. The frequency of bus service should be increased to reduce the waiting time at the bus stand. The ticketing system is beneficial for female commuters as they take a ticket from the ticket counter, take their fixed seat according to the seat number given, and then they no longer have to travel standing, leading to a lower chance of physical harassment. The skills of drivers are a vital issue when traveling on buses because sometimes an unskilled person drives the bus. Sometimes they unnecessarily compete with another bus as well as whimsically go for over-speeding, which is very unsafe for passengers. So, the drivers must have authentic licenses with regular monitoring of their performances, and awareness training sessions need to be arranged for them to improve the drivers' efficiencies.

To alleviate overcrowding, the number of buses should be increased, and a separate gate for female passengers should be installed. More buses decrease bus wait times while also improving bus station safety and security. When compared to the overall number of bus commuters, approximately 25% of seats should be dedicated to women. This will reduce physical harassment on the bus because women will not be forced to ride standing. Besides, installing CCTV cameras inside buses and at bus stops, with an authority monitoring the footage and alerting authorities to take action against harassment and security.

Further recommendations include: "proper actions should be taken to keep the environment neat and clean inside the bus", "bus drivers and conductors should be properly trained on how to deal with women commuters in a civilized society", and "the concerned authorities should strictly monitor the proper execution of traffic laws".

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## Conflicts of Interest

The authors declare that they have no conflicts of interest regarding the publication of this paper.

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