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DOI

[10.1016/j.tranpol.2020.05.009](https://doi.org/10.1016/j.tranpol.2020.05.009)

Publication date

2020

Document Version

Final published version

Published in

Transport Policy

Citation (APA)

Chowdhury, S., & van Wee, B. (2020). Examining women's perception of safety during waiting times at public transport terminals. *Transport Policy*, 94, 102-108. <https://doi.org/10.1016/j.tranpol.2020.05.009>

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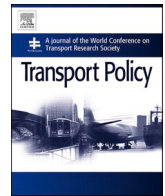
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Examining women's perception of safety during waiting times at public transport terminals

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ARTICLE INFO

Keywords:

Gender
Women
Public transport
Waiting time
Safety

ABSTRACT

In many cities, public transport has a higher ridership level from women compared to men, yet most systems are not designed for them. Many female riders fear of being a victim. Most of their negative experiences are usually associated with the urban environment in and around stations/stops. Integrated public transport systems will require users to make more transfers, thus increasing the proportion of their journey time they spend waiting for a vehicle (initial and transfer waiting time). Previous research revealed that women are very sensitive to transfer waiting times but the reason is not clear. This study investigates how the fear of victimization influences female riders' perception of safety during waiting times. An online survey was undertaken in Auckland, New Zealand and responses from 448 female public transport users were attained. Findings provide some evidence of the concerning level of anxiety women experience while waiting. Results showed that they rely on mobile phones and headphones as a defense mechanism to their feeling of apprehension. They remain alert of their surroundings and pretend to be confident while waiting. Women with ethnic backgrounds feel less safe during the day compared to Caucasian women. They were found to be more frequent users of mobile apps to determine the duration of waiting time compared to Caucasian women. In addition, it was found that social perceptions of safety from family and friends has an influence on how women perceive their personal safety while waiting at terminals. To create an equitable public transport service, where the predominant users are women, decision makers are recommended to more explicitly consider the safety needs of female riders in and at surrounding areas of terminals.

1. Introduction

Transport is a critical means by which people are able to reach opportunities provided by a city (Hamilton and Jenkins, 2000; Levy, 2013). Women are commonly identified as a group of public transport (PT) users who experience unique barriers compared to male commuters. Fear of harassment has been identified as the greatest barrier for women to ride PT (Smith, 2008). Women's concerns about crime affects not only the threshold decision of *whether* to use PT, but also *when* to use it and *which* mode. Fear can lead women to completely avoid the use of PT, particularly at night. Despite these fears, globally, women have a higher probability of using PT for trip purposes other than commuting compared to men (Kuhnimhof et al., 2006). With women on average earning at least 20% less than men (Pew Research Center, 2018), they are more reliant on PT as an affordable transport mode. Women being disadvantaged in how they use PT is an equity issue. Wee and Geurs

(2011) state that "a paramount goal of transport policy is to improve accessibility". However, equity is a complex topic with many different ways to measurement fairness. This study focuses on one of the aspects and that is to provide gender-based evidence of women's perception of waiting times and how it is related to their sense of personal safety. Unless female riders' needs are addressed, they will continue to be limited in their use of PT and be unable to receive the full benefits provided by an integrated system. This study focuses on the most vulnerable point in a PT journey, the waiting time at a station (Atkins, 1990; Wardman, 2004).

This topic is becoming increasingly important now that more PT systems are being transformed into integrated systems to provide travelers with an affordable and efficient alternative to cars. Integrated systems rely on users to make transfers, which means that women will be required to spend more time outside the vehicle. It is common practice to include gender as just a factor in a travel behavior analysis without

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<https://doi.org/10.1016/j.tranpol.2020.05.009>

Received 18 September 2019; Received in revised form 2 April 2020; Accepted 13 May 2020

Available online 16 May 2020

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looking critically at gender differences (International Transport Forum, 2018). This is one of the reasons why the design of some PT systems overlook the needs of women. A recent study by Chowdhury (2019) indicated that women were very sensitive to waiting times. The study was limited in its understanding of why gender played a critical role in the perception of waiting times. To the authors' knowledge, there has not been an in-depth study that examines current, female PT riders' perception of waiting time. This research gap formed the motivation of the present study. The aim is to determine the how women's fear of being victimized influences their perception of waiting time at terminals. In addition, the study takes a deeper look within the group by examining any differences in the perception of safety while waiting at terminals between women from ethnic minority backgrounds and Caucasian women. This is because ethnic minority women rely more on walking and PT as they are less likely to possess a car or a driving license, compared to non-European men (Uteng, 2009). People from ethnic minority backgrounds were also found to be more fearful at public places, mostly due to racial violence and harassment (Pain, 2001; Loukaitou-Sideris, 2009). The next section provides a summary of findings from relevant literature. Section 3 presents the methodology, followed by Section 4 presenting the results, and finally Section 5 which contains a discussion of the findings and the conclusions.

2. Overview of relevant literature

This section provides an overview of the relevant literature related to: (a) women's mobility, in particular the challenges, (b) female PT users' fear of being victimized and (c) service attributes which have an impact on waiting time perception.

2.1. Women's mobility

Literature on gender division of transport often discuss the restrictions encountered by women when accessing opportunities. Historically and at present, women often face mobility hurdles due to safety concerns, sociocultural norms and differential access to private vehicles at home (Loukaitou-Sideris, 2016; Kash, 2019). These restrictions signify exclusion, oppression and subordination for those who are transport disadvantaged (Cass et al., 2005; Rama, 2018). Dobbs (2007) discusses how women are "stuck in the slow lane" and how mobility deprivation confines them to family responsibilities, part-time or low paid work. Some women are able to achieve "masculine" levels of mobility freedom based on their education level and financial resources (Baumgarten and Franchi, 2018). However, those who are captive users of undesirable transport options have to deal with unequal mobility opportunities (Stark and Meschik, 2018).

Most ethnic minority women and those who are immigrants rely on PT. Amar and Teelucksingh (2015) stated that 44.8% of non-Western immigrant women in Canada use PT, compared to only 28.2% of immigrant men. Rama (2018) found similar results of more women using PT in South Africa. Uteng's (2009) study in Norway examined how cultural norms contribute to immigrant non-Western women's management of their daily mobility requirements. Factors such as income, location of household and education were seen to contribute to their social exclusion. Access to a private vehicle and owning a driver's license was more common among immigrant men than it was for women. As such, women are forced to be dependent on non-motorized alternatives, to become car passengers or ride PT, when it is feasible.

Rama (2018) proposes a different angle to examine women's transport limitation. Women's mobility should be examined from a macro-level to construct gender-sensitive transport policies and interventions. Complex trip-chains, which are commonly made by women, need to be captured in National Household surveys. A study in Calgary, Canada, shows that women's daily activities, including shopping, domestic work and religious activities, are commonly more outside the peak periods compared to men (Zhong et al., 2012). As such, the focus of

designing transport systems need to move away from commuter journeys only (peak hour journeys) to daily mobility (Law, 1999; Hine and Grieco, 2003), to facilitate non-peak trips by women.

2.2. The role of gender in public transport use

Globally, almost on a daily basis women are subject to unwanted attention and sexual harassment when riding PT (Gekoski et al., 2017). As such, the focus of most studies on women's use of PT have been on their safety needs (Matthies et al., 2002; Delbosc and Currie, 2012). Lubitow et al. (2020) discussed that gendered minorities are either limiting or altering their use of PT to avoid victimization. Personal safety is constantly found to be the most important factor in women's travel decisions (Atkins, 1990). A study (Kash, 2019) in Colombia and Bolivia stated that 37% of female PT riders reported to unwanted sexual harassment. However, these figures are often lower than the actual number due to underreporting. When victims attempt to report to police or authorities, they often encounter hostility or indifference about the incidence (Natarajan et al., 2018). The fear of harassment and of becoming a victim can constrain how women travel and be the primary decision-making factor for mode choice, route selection and time of day of travel (Smith, 2008; Loukaitou-Sideris, 2014; Gardner et al., 2017). Most women are afraid of travelling alone and at night; thereby limiting their access to public spaces (Gardner et al., 2017; Lubitow et al., 2020). Harassment can be classified as non-confrontational (e.g. leering, sexualized slurs, offensive language) and confrontational (e.g. following the victim, aggressive speech, sexual assault) (Gardner et al., 2017; Stark and Meschik, 2018). In many cities, women are captive users of PT due to their education, sociocultural norms and have constrained access to a private vehicle (Smith, 2008). Fear of victimization can limit their access to education, employment and other opportunities.

Commonly, women are seen to make minor modifications to their trips in response to the fear of harassment. This includes getting off the vehicle at an earlier stop, moving to a safer space in the station or vehicle, standing with other women, and placement of their bag to avoid unwanted touching (Jubainville and Vanier, 2017). Many women use their mobile phones to connect to friends and family as an active measure to reduce their anxiety (Nasar et al., 2007). Not all women are able to develop avoidance behavior. Those who are frequent riders cannot develop extensive avoidance behavior. Being a captive user and feeling unsafe is particularly detrimental to their mental well-being. Women from low-income groups are among the captive users. They have no other transport option but to use the available PT services. Women who have experienced sexual harassment while using PT and need to continue riding out of necessity, exhibit victim-specific defensive behavior. This includes avoiding travel at certain times of day, travelling in groups and standing near "safe" people (Kash, 2019).

These issues exist to date due to the approaches and data which are used to inform decision makers. A recent report by the International Transport Forum (2018), titled "Women's Safety and Security: A Public Transport Priority" called out for more gender-based evidence data. The report which is a compilation of research studies, discussed that at present, in many parts of world women are still reliant on PT and that a majority of them still feel unsafe while travelling. The authors of the report argue for a fundamental change in culture to design transport systems with women's needs in mind.

2.3. Waiting time

Studies (Van de Walle and Steenberghen, 2006; Iseki and Taylor, 2009) have shown that waiting times are perceived to be more burdensome than walking times. PT users perceive waiting times to be almost three times greater than the actual time (Guo and Wilson, 2004) and 2.6 times more than in-vehicle time (Wardman, 2004). This is because waiting time is perceived to be unproductive time. The stress due to waiting times is associated with delay in arrival times and

incurring additional time for making transfers (Wardman, 2004). Integrated PT systems aim to increase reliability of transfer waiting times by implementing timed-transfers (Becker and Spielberg, 1999). Information and personal safety, followed by weather protection are the three factors which influences the perception of waiting times.

Cheng (2010) found that poor timetables can increase commuter's anxiety due to missed transfers; thereby causing the commuter to wait longer. Studies (Van de Walle and Steenberghen, 2006; Muller and Furth, 2009) have examined timetable scheduling methods to minimize transfer waiting times, and thereby reduce the burden perceived by riders to make a transfer. Molin and Chorus (2009) discussed that passengers are willing to pay for more information when transferring from a high to a low frequency service. Findings from Chowdhury et al. (2013) has shown that commuters prefer well-designed terminals over information provisions. The layout of a terminal, which is open-planned and has weather protection with adequate information provisions, such as maps of local street networks and walkways between terminals, is desired by PT users. Real-time information such as audio announcements and displays showing arrival and departure times can also ease the burden of waiting for a vehicle (Iseki and Taylor, 2009). Chowdhury (2019) found transfer waiting time to be the most sensitive factor in women's decision to use an integrated route.

As discussed earlier, more transport authorities are focusing on transforming their PT network into an integrated multi-modal system (Chowdhury et al., 2016). As these systems are reliant on transfers, it means that a typical route will require the user to spend more time outside vehicles compared to a direct route. For women, it means more time being exposed to the physical environment of a station. The present study addresses this research gap by examining women's perception of their safety during waiting times.

3. Questionnaire design and data collection

The data was collected in Auckland, New Zealand's most urbanized city with a population of 1.6 million and also the most ethnically diverse city (Statistics New Zealand, 2013). The median age of those living in Auckland is 35 years. The median household income is \$76,500 per annum, which is the highest median across the country (Statistics New Zealand, 2013). Auckland is located in north island of New Zealand. Auckland's PT system includes bus, train and ferry services. In 2013, Auckland Transport, the government authority, produced a statutory document, the Regional Public Transport Plan. It aims to provide commuters in Auckland with a sustainable transport system that is inclusive, safe, integrated, and affordable. In August 2016, a new integrated smart-ticketing system called the HOP was implemented. This electronic ticketing system does not require riders to purchase additional tickets when making transfers. During this time, a new mobile application that provides real-time information for navigation also became available.

Data was collected using a survey company. Using their extensive database, the company sent the online questionnaire to potential respondents. The targeted participants were those who identified as female or gender diverse and those who are frequent riders (used PT at least once a week). All participants are 16 years old (the minimum age to apply for a driver's license in New Zealand) or more. The response categories for age and ethnicity were adopted from the national census questionnaire. The online questionnaire was sent out to female respondents, of which 448 participants were eligible and completed the survey. The response rate was 27%. Overall, the survey company ensured that the sample closely represents the population. The survey over-sampled ethnic minority women to attain a comparable sample size. Around 57% of the participants are non-European and approximately 42% identified themselves as "New Zealand European" or "Other European". Table 1 provides a break-down of the participants' selected ethnicity and age group.

The questionnaire began with two questions for screening: gender and frequency of PT use. Other socio-demographic questions included

Table 1
Participants' ethnicity and age group.

| Ethnicity | Participants (n = 448) | Percentage |
|-------------------------|------------------------|------------|
| New Zealand European | 162 | 36 |
| Other European | 29 | 6 |
| Southeast Asian | 24 | 5 |
| Chinese | 43 | 10 |
| Other Asian | 32 | 7 |
| Middle Eastern | 7 | 2 |
| African | 4 | 1 |
| Latin American/Hispanic | 11 | 2 |
| Maori | 22 | 5 |
| Pacific Islander | 33 | 7 |
| Indian | 58 | 13 |
| Other | 23 | 5 |
| Age | | |
| 16–18 | 31 | 7 |
| 19–30 | 191 | 43 |
| 31–45 | 141 | 31 |
| 46–65 | 65 | 15 |
| >65 | 20 | 4 |

average annual personal income, and ethnicity. Participants were asked about the main purpose of their trips, the average time they wait for a PT vehicle, access to a car, use of mobile application, and if they normally travel alone. They were also asked if they feel safe waiting at their current station during daylight and night time. The response categories were very safe, mostly safe, somewhat safe and not safe at all. Those who selected "not safe at all" were asked to select any of the reasons given, which were: (a) not enough lighting, (b) fear of being harassed, (c) fear of theft and (d) fear of being followed. In addition, participants were asked to choose from a 5-point Likert Scale (strongly agree to strongly disagree) for the statements given in Table 2.

These statements were derived from a mixture of results from previous literature along with discussions with female PT users. The discussion gave a personal insight into how women have adapted to riding PT, particularly at night. Statements 1, 2, 3, 7 and 11 are from personal discussions and are included to provide a more in-depth understanding of how current female riders perceived waiting at stops/stations. Statements 4 to 6 reflect social norms, view point of family members and other women. As discussed by Ajzen (2005), social norms play a key role in the formation of intention and behavior. Statements 8, 9 and 10 are based on findings from studies on waiting time perception and the impact of information (Molin and Chorus, 2009), personal safety (Atkins, 1990) and security and scheduling (Wardman, 2004).

Table 2
Statements for participants.

| | |
|----|--|
| 1 | I usually <i>pretend to be confident</i> while waiting at the station/stop to avoid unwanted attention (e.g. staring). |
| 2 | I usually use my headphones or my phone to be busy while waiting at the station/stop. |
| 3 | I am usually aware/alert of my surrounding when waiting at the station/stop. |
| 4 | My family members think public transport is safe. |
| 5 | My family members are not worried about me using public transport at night. |
| 6 | Most women in Auckland are NOT worried about using public transport at night. |
| 7 | I feel safer waiting in a <u>crowded station/stop</u> . |
| 8 | There is enough security (e.g. <i>good lighting, security guards</i>) at my public transport station/stop. |
| 9 | I usually have to wait a longer time than the scheduled time for my bus/train/ferry. |
| 10 | There is enough information (such as <i>audio announcements, arrival displays</i>) to know the arrival of my bus/train/ferry. |
| 11 | I use my phone (e.g. <i>talking on the phone</i>) to feel safe while walking home at night. |

4. Results

4.1. General description of participants

Examining the socio-demographic characteristics of the participants did not reveal any anomaly in the data. The majority (89%) of the participants are between the ages 19 to 65. Only 7% are in the age group 16–18 and 4% are more than 65 years old. The proportion of senior citizens in the sample is a little lower than the average population in Auckland which is 12% (Auckland Council, 2016). Around 39% of the participants earned less than NZD 30,000 annually (low income) and 41% earned between NZD 30,000 to 70,000 (medium income). Only 20% earned more than NZD 70,000 (high income). This is aligned with the general population in the country. The gender gap in New Zealand has remained static since 2017, with women on average earning NZD 24.50 per hour compared to men, on average, earning \$27.00 hourly. Lower paid employment, such as clerical and administrative, has the highest percentage of women at 73.5% (Statistics New Zealand, 2019).

The main trip purpose was found to be work (55%), followed by education (24%). Other trip purposes included recreation (8%) and doing errands (12%). Most participants (69%) have access to a car, while 31% did not. Around 87% of the participants travel alone when riding PT. Participants were asked how long they typically waited for their vehicle at the beginning of their trip. Around 44% said they waited for 5–10 min, followed by 25% waiting 3–5 min and 13% waiting 10–12 min. Only 10% waited more than 15 min. When asked if they use a mobile app to receive arrival time information, 58% selected “yes”. More ethnic minority women said they used a mobile app compared to Caucasian women (p-value = 0.001 from Mann-Whitney *U* test).

For statements 1 to 11, a Mann-Whitney *U* test was conducted to determine any differences in the responses between Caucasian women and ethnic minority women. Table 3 provides the p-values which shows if there is any statistical significance between the median values of the two groups. Only three statements have a statistically significant difference. Statement 6 refers to the perception of the individual female rider on other women. Ethnic minority women were more likely to agree with this statement than Caucasian women. Statement 9 and 10 refer to the services. Again, ethnic minority women were more likely to agree with the statement than Caucasian women. Given that majority of the statements were not statistically significant when the data set was divided into Caucasian women and ethnic minority women, the remainder of the analysis (Exploratory and Confirmatory Factor

Table 3
Comparison between Caucasian women and ethnic minority women.

| Number | Statements | p-value |
|--------|--|---------|
| 1 | I usually pretend to be confident waiting at the station/stop to avoid unwanted attention (e.g. staring). | 0.190 |
| 2 | I usually use my headphones or my phone to be busy while waiting at the station. | 0.421 |
| 3 | I am usually aware/alert of my surrounding when waiting at the station/stop. | 0.081 |
| 4 | My family members think public transport is safe. | 0.720 |
| 5 | My family members are not worried about me using public transport at night. | 0.561 |
| 6 | Most women in Auckland are NOT worried about using public transport at night. | 0.001* |
| 7 | I feel safer waiting in a crowded station/stop. | 0.673 |
| 8 | There is enough security (e.g. good lighting, security guards) at my public transport station/stop. | 0.266 |
| 9 | I usually have to wait a longer time than the scheduled time for my bus/train/ferry. | 0.039* |
| 10 | There is enough information (such as audio announcements, arrival displays) to know the arrival of my bus/train/ferry. | 0.008* |
| 11 | I use my phone (e.g. talking on the phone) to feel safe while walking home at night. | 0.694 |

*p-value < 0.05.

Analysis) was undertaken for the full data set.

4.2. Perception of safety during day and night

Participants were asked how safe they feel waiting in their current PT stops/stations during the day and at night. Fig. 1 provides the proportion of participants responding “somewhat safe” and “not safe at all”. It can be seen that, on average, 50% of the participants felt unsafe at night, compared to 20% during the day. The only female group that felt almost equally unsafe during the day and night were women who identified themselves as Maori. Maori are the indigenous people of New Zealand. Of the 22 Maori women participants, 40% felt unsafe during the day and 50% felt unsafe at night. Comparing between ethnic minority women’s and Caucasian women’s perception, the results were similar with, on average, 51% of ethnic women feel unsafe compared to approximately 48% of Caucasian women feeling unsafe during the night. Interestingly, a Mann-Whitney *U* test revealed statistical significance (p-value = 0.011) between the responses for feeling unsafe during the day. Ethnic minority women were more likely to select “somewhat unsafe” and “not safe at all” compared to Caucasian women.

When asked to select their reasons for feeling unsafe at night, 18% selected “not enough lighting”, 26% selected “fear of harassment”, 21% selected “fear of theft” and 23% selected “fear of being followed”. For Statement 11 in Table 1, “I use my phone (e.g. talking on the phone) to feel safe while walking home at night”, almost half of the participants (49.47%) agreed with the statement, while only 6% strongly disagreed with it. Comparatively, participants were less concerned about their safety in their current terminal. For Statement 8, around 42% of the participants agreed that there is enough security. The data is almost equally divided for those aged 30 and below and those aged above 30. A Mann-Whitney *U* test was run to determine if there is a difference with respect to age for perceived safety for waiting times during day and night trips. The results showed that there are no statistical difference between the two age groups.

4.3. Exploratory and confirmatory factor analysis

Factor analysis is commonly used in social science research to examine factors which are qualitative (latent variables). Exploratory Factor Analysis (EFA) is undertaken before Confirmatory Factor Analysis (CFA) to determine the number of latent variables and to have an understanding of the groupings of the measurement variables (Brown, 2006). EFA was used to determine the factors which influenced female PT users’ perception of waiting time at terminals. Statements 1 to 10, given in Table 2, were analyzed using the Statistical Package for Social Science (SPSS) to conduct the factor analysis. The results showed that the statements can be grouped into three latent factors. The Kaiser-Meyer-Okin measure is 0.702 (greater than threshold value of 0.5) and the Bartlett’s test shows significance (p-value = 0.000). The Rotation Sums of Squared Loadings provides the distribution of the variance amongst the factors. Factor 1 is 26.10%, for Factor 2 it is 19.80% and Factor 3 it is 11.64%. Together the factors explain more than 50% of the variance. The proportion of total variance explained by the three factors is greater than 50%. Table 4 provides the factor loadings. All loadings are above 0.40, which is considered to be stable for a sample size greater than 150 (Lewis-Beck, 1994).

Factor 1 describes social perceptions of safety. The Cronbach’s alpha, which measures the correlation among the items, is 0.737. Item 1 and 2 (0.786) have the highest loading of the four, with Item 3 not too far away (0.754). An explanation for the similarity in the loading values of items 1 and 2 is that both statements refer to social perception of using PT at night. This finding shows that family members. Around 40% of the participants agreed with Item 1 with 56% agreeing with Item 2, how safe other women feel is riders’ perception of safety at terminals. Item 4 (loading = 0.630), the item with the lowest loading factor, reveal that security provisions at stations improve riders’ perception of safety but to

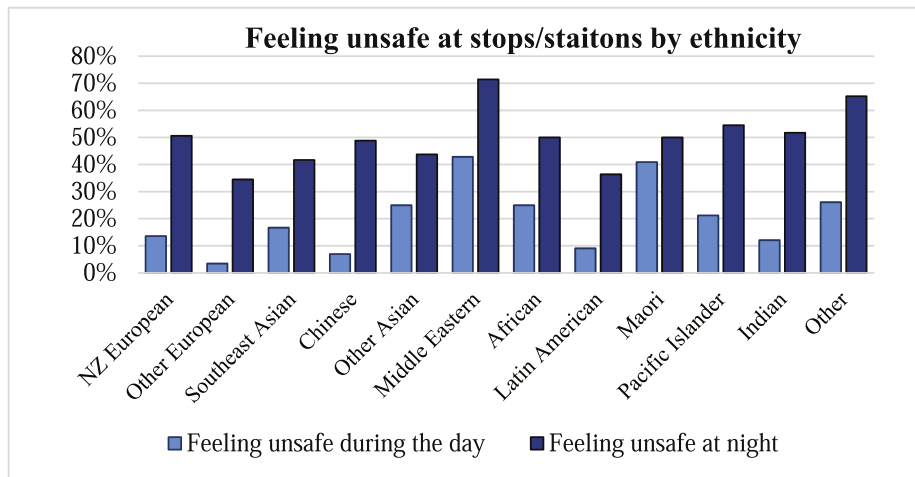


Fig. 1. Women public-transport users' perception of safety at their current terminal.

Table 4
Factor loadings (n = 448).

| Item number | Statements | Factors | | | Cronbach's alpha ^a |
|-------------|--|---------|------|------|-------------------------------|
| | | 1 | 2 | 3 | |
| 1 | My family members are not worried about me using public transport at night. | .786 | | | 0.737 |
| 2 | Most women in Auckland are NOT worried about using public transport at night. | .786 | | | |
| 3 | My family members think public transport is safe. | .754 | | | |
| 4 | There is enough security (e.g. good lighting, security guards) at my public transport station/stop. | .630 | | | |
| 5 | I usually use my headphones or my phone to be busy while waiting at the station. | | .777 | | 0.642 |
| 6 | I use my phone (e.g. talking on the phone) to feel safe while walking home at night. | | .774 | | |
| 7 | I usually pretend to be confident waiting at the station/stop to avoid unwanted attention (e.g. staring). | | .650 | | |
| 8 | I usually have to wait a longer time than the scheduled time for my bus/train/ferry. | | .484 | | 0.412 |
| 9 | I am usually aware/alert of my surrounding when waiting at the station/stop. | | | .738 | |
| 10 | There is enough information (such as audio announcements, arrival displays) to know the arrival of my bus/train/ferry. | .427 | | .578 | |
| 11 | I feel safer waiting in a crowded station/stop. | | | .544 | |

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

^a Note: Cronbach's alpha higher than 0.60 indicate that the items within the factors are interrelated.

a lesser degree compared to the opinions of friends and family.

Factor 2 represents a female rider's attitude during waiting times. Items 5 and 6 have similar factor loadings and represent the reliance on mobile phones to feel connected to friends and family and therefore feel

safe. Item 7, pretending to be confident, also contributes to a female rider's attitude towards waiting time. The keyword in this statement is pretending. Around 68% of the participants agreed to this statement and only 12% strongly disagreed and disagreed. This finding aligns with the results in Section 4.2, where majority of the women feel unsafe. Item 8 has the lowest factor loading for this latent variable. Around 70% of the participants agreed to this statement. So although the factor loading is low (0.484), it has an impact on attitude.

Factor 3 represents feeling anxious while waiting. Item 9 has the highest loading. Around 87% of the women agreed with this statement, while no one strongly disagreeing. Item 10 has a slightly higher loading than Item 11. This finding is reasonable as information can reduce anxiety as riders are informed of their waiting time. Being in a crowd is positively correlated with their perception of safety; around 76% of the participants agreed with this statement. The Cronbach's alpha for Factor 3 does not meet the criterion (>0.60). However, the factor loadings are all above 0.5, as such the CFA included this factor. Lewis-Beck (1994) suggested the deletion of variables to maintain a neat factor analysis can lead to erroneous conclusions.

Fig. 2 shows the CFA model with the best goodness of fit measures. The goodness of fit measures of the model meet the recommended criteria: $\chi^2 = 34.85$, $p = 0.007$, RMSEA = 0.048 (<0.06), CFI = 0.973 (>0.95), SRMR = 0.039 (<0.08) (Brown, 2006). Factor loading less than 0.30 were removed. In the initial model, there was a positive correlation between measurement errors of Item 7 and 9. As such Item 7 was added as one of the items for Factor 3 from Factor 2. This improved the goodness of fit measures, indicating a better fit. Moving this item has changed the meaning of the latent variable. Factor 2 represents the reliance on technology while waiting and walking from PT terminals.

For Factor 1, Social Perception, Item 1 has the highest loading of 0.81. The factor loading for Item 2 and 3 are very similar, 0.66 and 0.62, respectively. This finding shows that family members' perception of riding PT at night has the most influence on riders' perceived safety of their terminals. This is more aligned with previous studies where it was found that opinions of family members had a higher importance than friends and society (Bamberg et al., 2007; Eriksson and Forward, 2011). Female PT users are most sensitive to travelling at night as discussed in Section 4.2 and this item also includes the opinion of family members. For Factor 2, Item 6 has a higher loading than Item 5, which emphasises the reliance on mobile phones to feel safe. Item 7 has the highest factor loading on Factor 3, while Item 9 and 11 have similar weights. This finding is reasonable as pretending to be confident can be a defence mechanism when feeling anxious. An explanation for the similar factor loadings for Item 9 and 11 is that both items present an awareness of the environment while waiting. A positive correlation (0.67) exist between

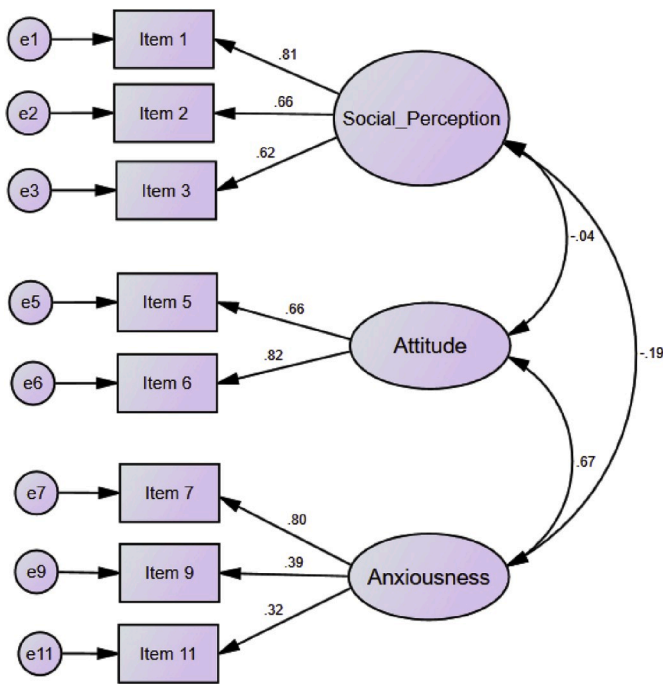


Fig. 2. Latent variables which form female public transport users' perception of waiting times.

Factor 2 and 3, while the correlation is negative for both latent variables with Factor 1. The items for Factor 2 and 3 represent feelings of apprehension when waiting while items for Factor 1 represent feelings of being safe.

5. Discussion

Results of this study provide some evidence on the level of anxiety women experience on a daily basis while waiting for their PT vehicle. Overall the findings show that women approach waiting times at terminals with apprehension. This is found from Factor 3 which encompasses items related to riders feeling anxious while at the terminals. The items are “pretending to be confident”, “always being alert/aware” and “feeling safer in a crowded station”. In addition, riders use their mobile phones while waiting at the station and walking home at night from the station to feel safe, thus further highlighting their feeling of apprehension. This result explains the correlation value of 0.67 between Factor 2 and Factor 3. Taking a closer look at the data revealed that the majority of the participants were worried about waiting at their current terminals at night. When asked to select the reasons, 70% of the responses were related to fear of victimizations (for example, fear of theft, fear of being followed). This finding aligns with previous studies (Gardner et al., 2017; Vanier and Jubainville, 2017) which have discussed how fear limits women's freedom of mobility and in particular, their trips at night. Research studies, such as the present one, continue to provide evidence that women are part of the marginalized group of PT riders. Such results oblige the question, what is acceptable social behavior towards female riders? Unless *acceptable* behavioral conduct is reformed, women's travel will continue to be confined by societal misconduct.

Ceccato (2017) discussed that women cannot be classified into an homogeneous group and that socio-economic characteristics should be examined to understand which groups are effect by what factors. In the present study, perceived safety of waiting times was examined from an ethnicity perspective. Findings showed that women from an ethnic minority background felt more unsafe during the day than Caucasian women. This finding relates to other studies in social sciences about people of color feeling unsafe in urban spaces, due to racial

comments/threats, and violence (Pain, 2001). Lubitow et al. (2017) discussed that most PT systems are designed to meet the needs of a commuting population and are less adaptive to the needs of marginalized riders (women, low income, people with disabilities etc.). The study discussed that ethnicity and gender can amplify the barriers experienced by captive riders. According to Wesely and Gaarder (2004) the perception of safety is rooted in cultural norms and values. This could be a reason for one of the findings in the present study which showed that the opinions of friends and family are more prominent in their sense of safety compared to security provisions at stations. Ethnic minority women were also more frequent users of mobile applications and this could be related to their heightened sense of safety to determine their waiting time compared to Caucasian women. However, there is a limitation in the understanding of the factors which causes women from ethnic background to be more fearful. This is a knowledge gap that remains to be explored in future studies.

These results provide some explanation as to why women are significantly more sensitive to waiting times compared to men as found in a previous study by Chowdhury (2019). With more PT systems being converted to integrated systems, women will be required to make more transfers. This increases the waiting times in their total journey time (initial waiting time and transfer waiting time). Findings from this study show that integrated systems will very likely add to the existing anxiety experienced by female PT riders, unless specific measures will be taken to improve women's safety (perceptions). To alleviate the continuous issue of women travelers being part of the marginalized group, transport authorities are required to set requirements for acceptable behavior when riding PT and more importantly, be clear on the consequences of behavioral misconduct. Unless societal reforms occur, women's fear will exist as a major barrier to their freedom of mobility.

6. Conclusion

In many countries, ridership of public transport (PT) are predominantly by women. Many of women's trips are usually undertaken outside the peak periods when frequency is lower and waiting times are higher. Two main reasons are typically provided for women's off-peak trips. The first is that women take a greater share of household responsibilities and second, their overall income is lower, as indicated by the gender pay gap (Pew Research Center, 2018). With more PT systems being transformed into a multi-modal integrated system, it is imperative to understand their perception of safety during waiting times. The aim of this study was to determine factors which influences female public transport (PT) riders' perception of waiting times. The results, overall, reveal that women feel anxious during the waiting time period. They use technology such as their mobile phones and headphones as a defense mechanism to their apprehension. The opinions of friends and family played a more critical role in their perception of safety compared to security provisions. Women from ethnic minority backgrounds were found to be more frequent users of mobile apps compared to Caucasian women.

The question that PT planners and operators must ask themselves is “for whom is the system being designed?”. To move towards an equitable society, women should be able to feel safe to ride PT, in particular, they should not feel apprehensive when waiting for a vehicle to arrive. Transport authorities are encouraged to work with the police to provide protection in areas at and surrounding major terminals. Police patrols can lower crime rates. Knowledge of enforcement can help women feel safer to wait at terminals. Walking to and from the station was explored in a limited manner in this study as it was not part of the scope. The relevance of Item 6 for Factor 2 (women's attitude towards waiting times) highlight the importance of providing surveillance around the terminal. In some countries, such as the Netherlands, all train stations have an emergency button users can press when they feel unsafe. Moreover, it is recommended that policies and designs are derived from gender-differentiated data. Findings of this study show the importance

of not treating women as a homogeneous group. Future research studies are encouraged to consider the intersectionality of socio-demographic characteristics such as income, age, and ethnicity to move towards understanding the root causes of fear. To provide an equitable society, where a woman does not need to pay-the-price of making a “wrong choice”, further research is required to gain a deeper understanding of the environmental factors which contribute to negative transit experiences. One of the limitation of this study is the small sample size. Future research is encouraged to design the data collection to allow for more rigorous statistical analysis with more data points and thus providing stronger empirical evidence.

CRedit authorship contribution statement

Subeh Chowdhury: Conceptualization, Data curation, Methodology, Formal analysis, Writing - original draft. **Bert van Wee:** Writing - review & editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.tranpol.2020.05.009>.

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