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Abstract
Ensuring safety along door-to-door Public Transport trips is a fundamental challenge to service providers since safety influences individuals' mobility. Using reported safety perceptions of travelers waiting at six bus stops with different characteristics in Stockholm, this study investigates the factors that are more impactful in determining travelers´ perceived safety and crime perceptions. This is done by assessing the importance of Real Time Information provision, environmental characteristics of bus stops at day and night and for different types of crime, after controlling for travelers´ individual characteristics, their trip characteristics and their previous victimization. Interaction effects of age, gender and travel frequency are also tested. The results suggest that, in general, shelter, natural surveillance and trustworthy Real Time Information are the most important factors influencing safety and crime perceptions. In addition, safety perceptions are highly influenced by direct and indirect victimization experiences. The effect of perceived crime and safety feelings are found to be nuanced by age and gender. Unlike some common believes, travelers: (1) are actually feeling less worried of becoming a victim of any type of crime at stops associated with high crime rates, (2) at night, prefer opaque shelters and (3) have higher safety perceptions when the stop is located in mixed land-use. In addition, the impact of stop´s number of passers-by is found insignificant. No direct or indirect effects can be attributed to frequency of travel by bus, indicating that familiar places and previous experience have no effect on declared crime and safety perceptions.

1. INTRODUCTION

Safety is one of many factors influencing individuals' mobility. Ensuring safety along door-to-door Public Transport (PT) trips is a fundamental challenge to those responsible for providing the service. PT travel experience is comprised of moving times (on-board and walking/cycling) and waiting and transferring times. Waiting times are a paramount part of the entire trip since they are usually despised by travelers and have been found to be a key component when forming an overall satisfaction evaluation of a door-to-door PT trip (*1*). It is known that places where PT travelers spend their waiting time, including stops and stations, tend to be more criminogenic than elsewhere (*2, 3*).

Travelers´ perceived safety is more important than actual safety in influencing perceived travel and waiting times (*4*) and influences travel behaviour: the decision to use PT (*5*), travel time and travel mode choice (*6*). Moreover, there is a strong link between travelers´ safety perceptions and overall travel satisfaction, which in turn affects PT customer retention and recommendation. Travelers' safety perceptions have been consistently found to be amongst the most important determinants of travel satisfaction (*7*) including in an analysis of a 13-year period (*8*). Therefore it is essential to investigate how safety is perceived by travelers in waiting environments.

Previous studies (*5, 3*) have demonstrated that fear of crime and safety perceptions are correlated with actual crime levels, surrounding environment and overall design quality and features of the transport facilities. However, hitherto, there are no scientific findings concerning the impact of bus stop factors (RTI- Real Time Information, stops and stops surrounding characteristics) on safety perceptions, in particular in relation to variations by time of the day (day and night) and the type of crime (person and property). It also remains unknown whether travel frequency moderates the effect of the factors.

To explore these questions, the objectives of this study are twofold. First, the article takes a new look at the factors that might influence travelers´ self-reported safety perceptions. We focus on travelers' experience while waiting at bus stops since buses constitute the primary and most-heavily used PT travel mode in many urban environments. This is done by assessing the importance of RTI provision and the environmental characteristics of bus stops at day and night and for different types of crime (personal and property), after controlling for travelers´ individual characteristics (socio-demographics), their trip characteristics and their previous victimization. Second, the study aims to extend the current knowledge of how age, gender and travel frequency moderates the effect of stop design, RTI, surrounding characteristics and crime experience on safety perceptions. Obtaining the key design and information factors that minimize travelers' perception of being unsafe will allow stakeholders (urban and transport planners) and those responsible for the design and maintenance of stops to provide environments that are perceived safer when waiting for the bus.

Firstly, this study reviews the relevant literature on crime and on aspects that influence safety perceptions such as socio-demographic, travel characteristics, stops and stop surrounding characteristics, crime experience and RTI variables. It then presents, in section 3, the dataset and the investigated bus stops. It continues, in section 4, with descriptive statistics and exhibiting and discussing model estimation results. This study ends with a discussion of policy implications, study limitations and future research, section 5.

2. LITERATURE REVIEW

There are a number of factors that affect travelers' perceived safety at bus stops. Some of them are related to the characteristics of those who fear (e.g. gender, age, disability, previous victimization), while others are triggered by the environment (e.g. the characteristics of the bus stop, the neighbourhood, the type of transportation system) or by other, less tangible factors that affect individuals' overall levels of anxieties (e.g. fears about terrorism and the future). In this study we focus on two dimensions, the bus stops environments and the travelers' individual characteristics

2.1 Travelers' Socio-demographics and Travel Characteristics

There is a considerable amount of evidence in the criminology and transport literature that socio-demographic characteristics such as ethnicity, income level, gender and age affect travelers' safety perceptions (*8, 9, 10*). Safety is gendered and age dependent and interacts with bus stops environments in a variety of ways. For example, feeling safe while waiting for the PT mode was more important for women than men (*11*) and young women feel less safe than men while traveling by PT (*12*). Furthermore, Tucker (*13*) concluded that women and the elderly are especially fearful to crime and have a higher apprehension to waiting the bus. Women's fear was attributed to their concern for feeling more exposed to affective crimes and for their caregiving for their children. The elderly using bus service frequently perceive that they are less safe (*10*)**.** Yavuz and Welch (*9*) studied interaction effects based on gender for train trips. At rush-hour, and thus it is expected with more overcrowded stations, men feel safer while the feel of safety does not increase for women. Men's travelers´ security perceptions are highly impacted by reliability of the service followed by the presence of police and previous crime experience. By contrast, for women it is mainly previous crime experience that affects their security perception, followed by the presence of police, reliability of the service and the presence of CCTV cameras.

However, some studies did not find any effect of age and gender on security perception on PT. For example, Delbosc and Currie's (*14*) structural equation model showed indirect negative effects for female and the elderly through feeling safety in the home (age and gender) and in the neighborhood (age). In addition, Currie et al., (*15*) found that for young travelers´ safety perceptions were mainly influenced by feeling comfortable when traveling around unknown people. In their study, gender and actual experiences of unsafe events were found to exert a moderate effect. The relationship between gender and safety goes beyond the dichotomy female-male. Ceccato and Paz (*16*) indicate the need of considering safety from the perspective of those who are potentially more targeted at PT, such as the lesbian, gay, bisexual, trans and queer community, as recent research shows that gay and transgendered persons are more often targets of harassment and violence in PT.

Very few studies have been published with focus on the influence of travel characteristics such as trip purpose or travel frequency on crime and safety perceptions. Nothing has been found on trip purpose and the very little found on travel frequency has been inconclusive. For example, Currie et al. (*15*) for young travelers and Yavuz and Welch (*9*) for train riders, found no influence of travel frequency on travelers´ safety perceptions. In contrast, the UK department of transportation indicates that familiarity with an area and a transportation mode is an important factor positively influencing perceived safety. In other words, those who frequently use PT feel safer than infrequent users (*17*). In addition, Wallace et al. (*18*) demonstrated that travelers that more frequently traveled were more able to notice transport security measures, thus, indirectly feeling safer.

2.2 Bus Stop design, environmental characteristics

A travelers' declared perceived safety at bus stops depends on multiscale environmental and temporal features that start when the traveler leaves their starting point of their trip. Yet, there are particular sites (such as bus stops and/or stations) that shape travelers' safety since people spend a considerable amount of time in them while traveling. The international literature has long shown that the environment features of these sites are bound to affect travelers' perceived safety (*13*). This implies that environments can be planned in a way that reduces the possibility of crime occurring and improving overall perceived safety. In this line of thought, Crime Prevention Through Environmental Design (CPTED) suggests that "the proper design and effective use of the built environment can lead to a reduction in the fear of crime and the incidence of crime, and to an improvement in the quality of life" (*19*). CPTED points out environmental principles that by design can stimulate natural surveillance, foster territoriality and reduce areas of conflict by controlling access. Corroborating CPTED principles, Tucker's review (*13*) indicates that there are a number of features in bus stops that contribute to increase security's perception amongst travelers. These include: shelters, benches, lighting, location, surrounding environment, design, maintenance and cleanliness of the stop, number of people waiting and passing-by, the amount of time waiting, monitoring the stop (CCTV) and the access provided to and from the stop.

Travelers' declared perceived safety is also affected by what happens in bus stops and surrounding areas. Bus stops can concentrate large amounts of people, which make it easier for offenders to commit crime. They can potentially pull motivated offenders towards them by the types of environments they offer (*2, 3, 20*). Liggett et al. (*3*) found in the United States that opaque shelter, litter and bus stops located at/near empty areas and close to liquor stores, pubs and establishments for adults lead to a higher crime incidence. For metro stations in Stockholm, Ceccato et al. (*11*) found that around half of the variation in travelers' perceived safety was explained by stations' environmental conditions and the conditions in the stations' surrounding areas. Unsafe stations were associated with visible social disturbance in stations' lobbies, poor surveillance, and higher rates of violence and events of public disorder. In turn, safe stations had effective formal social control, CCTV cameras or presence of guards, and had a high potential for promoting natural surveillance.

Yet crime does not happen at random in bus stops. Crime tends to follow individuals' daily rhythmic patterns of activities, and crime may just occur in some of areas/times in which a potential offender is aware of them. According to routine activity theory (*21*), for a crime to happen in a bus stop, some conditions must be in place: a motivated offender, a potential victim and lack of controllers (handlers, guardians and place managers). If the target is an individual then guardians can be other passengers who are at the same bus stop as the target. Place managers can be shopping personnel just in front of the bus stop who is able to watch what happens at the bus stop. In general, crimes can be categorized into property and violent (person) (*22*). The main difference between them is that the former involves violence aiming to acquire anything tangible such as belonging or money (theft, robbery) while the latter has an emotional component and includes: assault, murder, disorder, rape.

Risk for crime and travelers' perceived safety varies temporarily, hourly, daily, weekly and seasonally (*20*). On top of light conditions, daily time and specifically rush hours are characterised by larger flows of travelers (targets) with more potential guardians than off-peak hours. Therefore, declared safety at bus stops may reflect a number of other conditions

experienced along the trip in a diverse array of transit environments during daily activities, (*23*). These conditions are bound to have an effect on travelers' perceived safety.

2.3 RTI and previous victimization

Some authors have partially explored how RTI variables impact on safety and crime perceptions. Dziekan and Kottenhoff (*24*) synthesized a series of benefits attributed to at-stop RTI. Amongst them, the most relevant for this study were: reduced perceived waiting time, travel behaviour adjustment, travel mode choice and positive psychological effects which comprised increased personal safety perception. Zhang et al. (*25*) concluded that travelers' safety perceptions and overall travel satisfaction increased when introducing RTI at stops. Not only at-stop RTI but also RTI available at handheld devices shows similar effects. For example, the results of a trial implementation of mobile RTI in Seattle (USA) showed that travelers' feel safer, wait less, are more satisfied with their trip and increase their weekly ridership (*26*). In turn, Brakewood et al. (*27*) determined that in addition to the improvement in travelers' waiting time perception, the stress and anxiety were reduced while the sense of personal safety was increased. Moreover, thanks to RTI travelers´ safety perception increased at daytime with regard to the control group. However, no significant differences on travelers´ security perceptions were found at night.

Fear of crime has been widely studied. In an in-depth review (*28*), some evidences were found that direct previous crime experience does not show a strong relation with fear of crime (crime and safety perceptions). In contrast, hearsay, media and crime experienced by acquaints exert an impact on these perceptions (*28*). However, Teseloni and Zarafonitou (*29*) demonstrated that direct and indirect crime experience is associated with feeling unsafe walking alone at night. In addition, they found that people that was more exposed to crime by living either in criminogenic areas or by being more active in their day to day life (commuters) were more prone to feel victimized. What is more, Quann and Hung (*30*) showed that the relationship between victimization and safety and crime perceptions varies according to crime type when comparing crimes related to the person and to property in the household.

2.4 Hypotheses of study

Taken together, the existing literature suggests that individual and environmental factors have an impact on travelers' declared perceived safety at bus stops. For the purpose of this study, we follow the recent strand of Western research on perceived safety in PT environments and hypothesize that perceived safety at bus stops is related to the environmental conditions at the station itself but also to its surroundings, such as the land use and socio-economic and city contexts. Individual characteristics are also expected to affect traveler's perceived safety. Hence, this study will test the following set of hypotheses:

(1) Assuming CPTED principles, travelers' perceived safety is reduced by bus stops with poor capacity to promote natural surveillance (opaque surface, low traffic, few passers-by, low PT service). Their perceived safety is affected negatively in bus stops that are crime attractors/generators (more criminogenic). Equally important is the bus stop surroundings. Travelers´ perceived safety is impacted by bus stops surroundings (mixed land use more criminogenic than other land use types).

(2) Travelers' individual characteristics also matter in determining declared perceived safety levels. We expect that women declare feeling less safe than men. Passengers that have

been victimized by crime tend to declare feeling less safe at bus stops than those who have not being a victim of crime.

(3) Frequency of travel from the bus stop should have an impact on safety and crime perception. Those who are frequent bus users, that are familiar with the schedules, the security measures of the stop and the characteristics of the environment will be more satisfied with their safety (familiarity)

3. METHODOLOGY AND SURVEY DESCRIPTION

A paper-and-pencil survey was designed to evaluate traveler's safety perceptions at different bus stops. The survey was carried out in autumn 2016 with a random sample of 123 travelers who waited at 6 different bus stops in Stockholm, Sweden. No significant events were reported during the data collection that could affect the survey results.After the dataset was cleaned and verified for completeness 108 samples were kept. Out of the 108, almost 75% were collected in three of the stops (namely Arkitektur-Moderna museet, Barnängen and Mariatorget), while the remaining 29 respondents were waiting in the three remaining stops (Hötorget, Erstagatan and Slussen). The stops were selected so that while all of them are located in areas of the inner city, they vary in their environmental characteristics such as land use, number of passers-by and crime counts. The stops differ also in terms of their service characteristics, such as their design, frequency of service and passenger volumes.

The survey included questions related to safety perception (general, at day and at night), for different types of crime (involving both offences against the person and the property), crime experience, socio-demographic, travel characteristics, planning and information variables. The length of the questionnaire was approximately 5 minutes.

In order to study the factors that influence safety perceptions at bus stops, we employ the following variables:

- *Socio-demographic and travel characteristics*: Gender, age, children in the household, marital status, frequency of travel from the given bus stop, and travel purpose.
- *Safety perceptions*: feeling safe around or at the bus stop (Safe day), feeling safe at night around or at the bus stop (Safe night), worried of becoming a victim of violence (Crime person) and theft/robbery (Crime property) around or at the bus stop.
- *Previous victimization*: Having ever been victim of a crime (Victim crime), in the past two years having been victim of theft (Victim theft), in the past two years having been victim of violence (Victim violence), and knowing anyone, either family or friends who have been victim of a crime in the last 2 years (Family).
- *Information and planning related*: Planning the trip so to spend as little as possible time at the stop (Plan stop), trusting real time information shown in the panels (Trust info), feeling safer when real time information shows that the bus comes soon (Real time soon), feeling safer because of real time information (Real time presence).

In addition to the aforementioned variables that were collected in the survey, the following variables were included in the survey and specified based on site-visits, Geographical Information System - GIS tools and PT service information:

- *Immediate stop surrounding characteristics*: Crime rate and number of passers-by; high or low. Land use; mixed or other (commercial and residential).
- *Bus stop characteristics*: Shelter, natural surveillance and presence of CCTV. Stop's frequency of service, number of passers-by and road traffic level have the same response pattern (low/low/low or vice versa) for the same stops and thus are interchangeable.

The scale of measurement of information, planning and safety perceptions is a Likert scale from 1 (completely disagree) to 5 (completely agree). Safety perceptions, crime experience and stop characteristics variables are defined as dummy variables. Natural surveillance was assessed by considering aspects such as direct view, view from outside towards the inside of the stop, lighting of the place and objects obstructing direct view. Following Loukaitou-Sideris et al. (*31*), crime rate at stops is calculated by normalizing crime counts by the yearly ridership per bus stop. The threshold between high and low crime rate was based on quantile classification and set to 250 boarding passengers per crime.

4. ANALYSIS AND RESULTS

4.1 Descriptive Analysis

Table 1 presents the summary statistics of the socio-demographic, travel characteristics, safety perceptions, crime experience, information and planning-related, stop and stop surrounding characteristics. In some cases the data is shown as the percentage of respondents by category (in %) while for the likert-scale variables the mean is shown. Variables shown with an asterisk have "other" as the alternative response category. For the remaining nominal variables the alternative response category is shown in brackets.

About half of the respondents are middle-aged and single and have one or more children in the household. Almost three-quarters of the sample travels frequently (weekly or more often) and most of them performed a commuting trip. Not surprisingly and in line with previous research (*9*), safety perceptions are higher during daytime than at night. Stops are characterized by having transparent shelters, not having CCTV surveillance, being well-lighted and located along the street, having no litter, no signs of vandalism, no barriers and with windows in multiple sides. Furthermore, about half of the stops are very well served by PT and are subject to natural surveillance. Around half of the stops are located in areas with mix land use and have high crime rates and number of passers-by.

Every fourth respondent has either an acquaintance or has personally been a victim of crime in the past. However, from amongst them only about a 10% have been subject to theft or violence in the last 2 years. Travelers overall trust the real time information displayed at stops and in planning their trips so they wait as little as possible. In addition, travelers report feeling rather safe when real time information is displayed at stops and when it shows that the bus is coming soon.

TABLE 1 Summary Statistics of Sample Profile

Socio-demographic and travel characteristics (in %)	Gender	Female (Male)	42.6
	Age	< 30	32.4
		31-50	52.8
		> 50	14.8
	Children in the household	Yes (No)	41.7
	Marital status	Single*	52.8
	Frequency trip	Frequent (Weekly)	73.2
	Travel purpose	Commuting*	53.7
Safety perceptions (mean)	Safe day		4.15
	Safe Night		3.83
	Crime person		2.71
	Crime property		2.81
Crime experience (in %)	Victim crime	Yes (No)	25
	Victim theft	Yes (No)	9.3
	Victim violence	Yes (No)	13
	Family	Yes (No)	23.1
Information and planning related (mean)	Plan stop		4
	Trust info		3.96
	Real time soon		4
	Real time presence		3.91
Stop surrounding characteristics (in %)	Crime rate	High (Low)	44.4
	Passers-by	High (Low)	48.1
	Land use	Mixed*	56.5
Stop characteristics (in %)	Natural surveillance	Good (Bad)	51.9
	Shelter	Opaque (Transparent)	21.3
	Service frequency	High <10 min. in peak-time (Low)	48.1
	CCTV	Yes (No)	14.8

* Other

A t-test identified a significant average difference between being a victim of specific type of offences, crime person and crime property (sig.=0.063). Additionally, significant average differences were also found when comparing safe day and safe night (sig.=0.000). The results of the t-tests provide evidence that different types of offences and safety perceptions at different types of the day should be examined individually.

4.2 Safety Perception Models
In order to systematically investigate both the factors influencing safety perceptions at different parts of the day, and crime perceptions for different type of offences (violence and theft/robbery) four regression models were estimated. The first two models specify as dependent variables "Safe day" for Model 1, and "Safe night" for Model 2. In turn, "Crime person" and "Crime

property" are the dependent variables of the remaining two models, M3 and M4 respectively. The model specification of all four models is composed of the same set of explanatory variables. This set of variables includes all socio-demographic, travel characteristics, crime experience, information and planning related, stop and stop surrounding characteristics listed in table 1. Models 1 to 4 control for a large number of factors that influence crime and safety (socio-demographic, travel characteristics) and therefore will allow to better identify the most influential ones among them. The independent variables were tested for multi-collinearity issues flagging CCTV which then was dropped from the models. As explained in section 3 bus service frequency and road traffic level are equivalent to passers-by and therefore were neither included in the models.

Models 1 to 4 are also enriched with the inclusion and test of interaction effects. Two-way interaction terms were included with the aim of examining whether gender, age and travel frequency exert a differential impact on safety and crime perceptions. These base variables were selected based on the findings of previous research (*8, 13*) and tested against with travel information, stop and stop surrounding characteristics variables. A manual stepwise backwards method was employed to keep in the model the significant interaction effects. This method consists of including at first, main effect variables and all two-way interactions effects. Then, after checking the model output, all main effects are retained but only significant interaction effects. A number of iterations are run until the models converge into a model specification that includes all main effects but only the significant interaction effects. The total number of iterations per model was five for model 1 (crime person) and three for models 2, 3 and 4 (crime property, safe day and night).

Since the dependent variables are ordinal, ranging from 1 (completely disagree) to 5 (completely agree), ordered logit models are most adequate. In general, order logit model can be expressed as:

$$y_k^* = X_k \beta + \varepsilon_k \tag{1}$$

Where y_k^* is the latent dependent variable of individual k. X_k is the explanatory variable set of individual k, which includes all the aforementioned main and interaction effects for individual k. Note that the intercept is dropped for identification issues. β is the corresponding vector of parameters to be estimated. ε_k is the error term which is assumed as an identically distributed logistic error-term. The latent dependent variables are then associated with the observed dependent variables, y_k (5 likert scale), with m=1..5, defined as follows:

$$y_k = \begin{cases} 1, & \text{if } -\infty < y_k^* < \mu_1 \\ 2, & \text{if } \mu_1 < y_k^* < \mu_2 \\ & \dots \\ m, & \text{if } \mu_{m-1} < y_k^* < +\infty \end{cases} \tag{2}$$

For each of the four models, Table 2 displays the estimated coefficients in one column (Estim.) and the significance values (Sig.) in another. Most of the significant values are at a 99% significance level. However, the table also shows significant values at a 95% and 90% confidence interval represented by one or two asterisks respectively. The insignificant variables (<90%) are marked with 'ns'. Not applicable 'na' refers to the interaction terms that were found insignificant and which, thus, were not included in the models.

Table 2 shows the widely used Nagelkerke pseudo R square index. It is evident that all safety models have a high goodness of fit, explaining between a 36% (Crime person -M1) and a 45% (Safe night –M4) of the variation in safety and crime perceptions. All models are superior to the intercept-only models according to the log-likelihood ratio test.

TABLE 2 Safety Perception Models.

	M1.Crime Person		M2.Crime Property		M3.Safe Day		M4.Safe Night	
	Estim.	Sig.	Estim.	Sig.	Estim.	Sig.	Estim.	Sig.
Gender (Female)	1.218	.004	1.609	0.006	ns.	ns.	-1.086*	.011
Children HH. (No)	-.866**	.099	ns.	ns.	ns.	ns.	ns.	ns.
Low freq. travel	ns.	ns.	ns.	ns.	ns.	ns.	ns.	ns.
Purpose (Commuting)	ns.	ns.	ns.	ns.	ns.	ns.	ns.	ns.
Purpose (Other)	Ref.value		Ref.value		Ref.value		Ref.value	
Married & Living together	ns.	ns.	ns.	ns.	ns.	ns.	ns.	ns.
Single	Ref.value		Ref.value		Ref.value		Ref.value	
Age (<30)	-20.574	.000	-19.948	.000	2.347*	.029	2.180*	.018
Age (30-50)	-21.155	.000	-21.009	.000	1.730**	.051	2.013	.010
Age (>50)	Ref.value		Ref.value		Ref.value		Ref.value	
Plan Stop	-.403*	.048	-.376**	.072	-1.170	.005	ns.	ns.
Trust info	ns.	ns.	ns.	ns.	.838*	.033	.730*	.040
Real time soon	ns.	ns.	ns.	ns.	ns.	ns.	-3.098	.000
Real time presence	ns.	ns.	ns.	ns.	ns.	ns.	ns.	ns.
Victim Crime (Yes)	ns.	ns.	ns.	ns.	-22.378	.000	-21.814	.000
Theft (Yes)	ns.	ns.	ns.	ns.	-2.477	.003	ns.	ns.
Violence (Yes)	2.318	.010	ns.	ns.	ns.	ns.	-1.180**	.068
Family (Yes)	1.481*	.040	ns.	ns.	23.331	.000	21.021	.000
Crime Rate (High)	-19.498	.000	-18.554	.000	ns.	ns.	-3.999*	.024
Land Use (Mixed)	ns.	ns.	ns.	ns.	ns.	ns.	3.226	.004
Land Use (Other)	Ref.value		Ref.value		Ref.value		Ref.value	
Natural Surveillance (Yes)	-16.974	.000	-16.498	.000	ns.	ns.	-4.377	.000
Shelter (Opaque)	19.447	.000	18.339	.000	-1.726**	.082	1.958	.032
Passers-by (High)	ns.	ns.	ns.	ns.	ns.	ns.	ns.	ns.
<30 * (Crime Rate=High)	20.304	.000	19.467	.000	na.	na.	na.	na.
30-50 * (Crime Rate=High)	20.783	.000	20.203	.000	na.	na.	na.	na.
<30* (Natural Surveillance=Good)	16.989	.000	16.843	.000	na.	na.	na.	na.
30-50*Natural Surveillance=Good	18.429	.000	19.542	.000	na.	na.	na.	na.
<30 * (Shelter=Opaque)	-20.928	.000	-21.157	.000	na.	na.	na.	na.
30-50 * (Theft=Yes)	3.509*	.044	na.	na.	na.	na.	na.	na.
Female * (Victim crime=Yes)	na.	na.	na.	na.	-1.945**	.076	na.	na.
<30 * (Family=Yes)	na.	na.	na.	na.	-22.595	.000	-21.520	.000
30-50 * (Family =Yes)	na.	na.	na.	na.	-24.152	.000	-21.474	.000
<30 * (Victim crime =Yes)	na.	na.	na.	na.	21.680	.000	22.224	.000

	M1.Crime Person		M2.Crime Property		M3.Safe Day		M4.Safe Night	
	Estim.	Sig.	Estim.	Sig.	Estim.	Sig.	Estim.	Sig.
30-50 * Plan Stop	na.	na.	na.	na.	**1.534**	.004	na.	na.
<30 * Real time soon	na.	na.	na.	na.	na.	na.	**2.734**	.001
30-50 * Real time soon	na.	na.	na.	na.	na.	na.	**2.564**	.002
Female*Natural surveillance=Good	na.	na.	**-2.235***	.015	na.	na.	na.	na.
Female * (Shelter=Opaque)	na.	na.	**3.499**	.006	na.	na.	na.	na.

	M1.Crime Person	M2.Crime Property	M3.Safe Day	M4.Safe Night
Log-LL zero	339.182	340.592	264.474	304.064
Log-LL final	293.069	286.496	210.211	244.026
Nagelkerke Rsq	.363	.411	.432	.454
N	108	108	108	108

Significance levels: ns. Not significant // **: 90% // *: 95% // Otherwise 99%
na. not applicable

As expected, and in accordance with previous research (*6, 9*) female travelers feel less safe than male travelers. In contrast to some previous findings (*14*), travelers younger than 50 years old feel safer compared to older ones. Travelers with no children in the household and thus conceivably traveling without any person in charge, are found to be less worried for becoming a victim of crime in M1 (crime person). This may indicate that when travelling with children, travelers are more concerned about personal offences due to their sense of responsibility. However, the models do not allow to determine whether this finding is gender-specific as in some previous results (*13*) or if it is cross-gender.

Interestingly, travel characteristics related variables, trip purpose and travel frequency, are found insignificant. This altogether indicates that there are no safety benefits of being familiar with the stop and schedule and is in disagreement with findings showing that perceived waiting times are longer for utilitarian trips (commuters) (*32*). Moreover, marital status has no influence on safety and crime perceptions.

Overall, real information related variables are insignificant, thus contradicting previous evidences (*25, 26*). The exception is the positive impact that trusting real time information displayed at stops has on safety perceptions at day and night (M3 and M4). This proves the perceived safety implications that showing trustworthy and accurate RTI has on travelers. Interaction effects show that travelers between the age of 30 and 50 that spend as little time as possible at the station (Plan stop) tend to have a higher perceived safety.

Surprisingly, model estimation results indicate that RTI showing that the bus is coming soon influences negatively safety perception at night. This finding substantiates Brakewood's (*27*) insignificant results of RTI at night time. Interaction effects unveil that feeling unsafe when RTI shows that the bus is coming soon applies only for the older traveler segment (over 50 years old). This counter-intuitive finding might be attributed to different causes such as that older generations not pay the same amount of attention to RTI. Alternatively, their waiting time perception at night might be perceived as longer, considering that this age group does not use

their smartphone as intensively as others and that there is not much people around to get distracted with.

In accordance with previous research (*9, 29*) travelers who have been subject to crime in the past feel less safe at and around the stops at day and night (M3 and M4) when compared with those that have not. However, interaction effects show that this only holds true for travelers over the age of 30 and for female travelers (M3). The age effect might be explained by the fact that people feel more vulnerable over time (*33*). This gender moderating effect of direct victimization on safety perceptions was already noted by Yavuz and Welch (*9*). Furthermore, travelers that have been victim of theft (M3– safe day) and of violence (M1 and M4) have modest higher crime and lower safety perceptions. Curiously, travelers with a family member or friend that has been victim of crime feel safer at day (M3) as well as at night (M4). Interaction effects, however indicate that this only applies for those over 50 years old. This may suggest that only direct experiences but not third-person experiences influence safety perceptions of the elderly. Moreover, interaction effects show that travelers between the age of 30 and 50 that have been victim of theft are more worried than others for becoming a victim of violence (M1). All in all, unlike Quann and Hung (*30*) results, no evidences of crime specific differences of previous victimization were found.

Model estimation results suggest that safety perceptions not only do not correspond to reported crime rates but that they even exercise a negative correlation. In other words, the higher crime rates are, the lower travelers' crime perceptions become (Crime person -M1 and Crime property -M2). This negative correlation concurs with a number of earlier research (*20*). Interaction effects, however, reveal that this only holds for travelers older than 50. At night (M4), and as expected, travelers feel less safe waiting at stops with high crime rates.

In line with Ceccato et al. (*11*), the results indicate that for the crime models (M1 and M2), a good natural surveillance may decrease the perception of crime. Interaction effects, however, show that this only holds for travelers over the age of 50. Additionally, there is a weak negative impact on property crime perception for women (M2) which indicates that the positive influence of having a good natural surveillance is greater for men. Interestingly, natural surveillance also has a negative influence on safety perception at night (M4).

In general, opaque shelters decrease travelers´ safety perception. This is in line with previous results (*13*) showing that glass or transparent shelters were preferred by travelers. However, at night (M4) travelers feel the opposite. This might be explained by a feeling that one is less visible. Alternatively, this might be caused by the influence of a fishbowl effect (*34*) which would make people waiting in brightly lit stops, with dark surroundings, feel less safe. Interaction effects indicate that women are especially more worried of becoming a victim of theft and/or robbery when waiting at stops with opaque shelters. In contrast, travelers under 30 years old are much less worried of becoming a victim of person and property crimes (M1 and M2) when the stop shelter is opaque.

In contrast to earlier findings (*13*), a large number of passers-by, and by extension a frequent bus service and close to a road with high levels of traffic, is found insignificant in all models. It is reasonable to think that a frequent bus service would be associated with higher perceptions of safety since travelers' exposure time to crime is reduced. At the same time, stops located in areas with a large number of passers-by and of traffic should be also associated with higher safety perception levels since there are more informal guardians who can prevent crime to occur. The insignificance of these results may indicate that the differences between stops are too small and therefore the subjective thresholds between low and high are not different enough. The

results may also indicate that some other important elements might have been left out of the model. For example, while it is true that Arkitektur-Moderna museet stop has a low bus service (and of traffic and passers-by), there might be some other features of the built-environment (confinement of a small island linked to mainland by a single bridge which hosts a number of museums and hotels), not captured by land use, that may somehow attenuate the in theory negative effect on perceived safety. A mixed land-use urban environment positively impact safety perceptions at night (M4) signifying that at dark having a balanced and adequate amount of activity and of passers-by is preferred when compared to commercial and residential only uses.

The fact that no differences across the crime models were found indicates that crime associated with higher levels of crowding (petty crime – crime property) and those associated with lower ones (person crime) do not diverge.

All in all, the interaction effects tested are mainly found significant with age but also with gender variables. No significant interaction effects were found with frequency of travel indicating that experience with PT does not play a mediating effect. In general, the estimated coefficients for crime (M1 and M2) and safe (M3 and M4) models are consistent regarding sign and magnitude. In addition, while main effects were very similar across crime and safe models they were significantly different regarding the interaction terms.

5. CONCLUSIONS

In this study we have investigated the factors that are more impactful in determining travelers´ perceptions of safety and crime. The analysis is based on reported safety perceptions of travelers waiting at six bus stops with different characteristics in Stockholm while controlling for a range of factors that affect these perceptions. The analysis was performed using a modest sample size and the generalization of the results should be therefore done with caution. Notwithstanding its limitations, the results of a series of OLM estimations suggest that, across the board: shelter, natural surveillance and trusting RTI are the most important factors influencing safety and crime perceptions. In addition, safety perceptions (M3 and M4) are highly influenced by direct and indirect victimization experiences.

With regard to bus characteristics (hypothesis 1) there is a mix of anticipated and unexpected results. As hypothesized, stops providing good natural surveillance and transparent shelters are found to increase safety perceptions (*3, 10*). In contrast, surprisingly travelers feel less worried of becoming a victim of any type of crime in stops associated with high crime rates, and no significant impact is found for the number of passers-by (traffic and bus service frequency). Mixed land-use increases safety perceptions at night maybe due to the fact that bus stops that are around commercial and institutional use (stores, bars, restaurants, cinemas) keep people around at all times, promoting more guardianship.

Regarding individual attributes (hypothesis 2), women indeed feel less safe than men across all models. As a wealth of literature had already determined (*8, 9*) the effect of perceived crime and safety feelings are found to be nuanced by age and gender. As expected, for the safety models (M3 and M4) travelers that have been victimized by crime feel less safe. Contrary to expectations the results show that no direct or indirect effects can be attributed to frequency of travel by bus (hypothesis 3). This indicates that familiar places and previous experience have no effect on declared crime and safety perceptions.

The finding related to the preference for natural surveillance opaque shelters at night might be addressed by introducing smart stops that depending on the time of the day may dim

the colour of the shelter. The insignificant effect of travel characteristics suggest that the inclusion of these variables in perceived safety surveys can be disregarded in favor of some other more impactful ones. In general, the results of the crime models (M1 and M2) show that travelers' perceptions seem not to be affected by crime type (property or violence).

This paper provides an important understanding of all type of elements that impact travelers´ declared safety and crime perceptions. However, there are important issues to be addressed in future studies. It would be particularly insightful to repeat this study at bus stops with even more contrasting characteristics, including a differing land-use, very different location, CCTV, RTI, lighting, litter, vandalism, windows, or existing barriers to the stop. This would allow identifying the impact of more tangible elements that stakeholders could directly implement in the bus network to boost safety perceptions. Furthermore, different urban development and cultural contexts can be considered.

ACKNOWLEDGEMENTS

Abenoza R.F., Ceccato V., Susilo Y. and Cats O. (2018). Individual, Travel and Bus Stop Characteristics Influencing Traverlers' Safety Perceptions. *Transportation Research Record. Accepted.*

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