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Sexual Violence on the Move: An Assessment of Youth's Victimization in Public Transportation

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ABSTRACT

Informed by principles of environmental criminology, this study assesses patterns of sexual victimization among young riders of rail-bound public transportation using a sample of 1,122 university students in Stockholm, Sweden. Exploratory data analysis and logistic regression models underlie the methodology of the study. Findings indicate that the physical and social characteristics of transit environments have an impact on the likelihood of sexual victimization after controlling for individual factors. The theoretical and practical implications of these results are discussed.

KEYWORDS

Assault; CPTED; environmental design; intersectionality; Scandinavia city; sexual harassment; transit safety; whole journey approach

INTRODUCTION

Sexual harassment and other forms of sexual violence in public spaces are everyday occurrences for women and girls around the world. They constitute a vast array of unwanted sexual behaviors that affect women's ability to participate in public life (UN-Habitat, 2019). They can be nonverbal (staring, making indecent gestures, taking photos), verbal (catcalling, sexual invites) or physical (touching, groping, assault) (Ceccato and Loukaitou-Sideris, 2020). Although not well understood, the risk of sexual violence in public places are expected to vary across different types of urban environments. Among public places, transit environments (bus stops, train stations and the way/to from them) constitute fertile settings for crime and in particular sexual violence (Abenzo, Ceccato, Susilo, & Cats, 2018; Ceccato & Paz, 2017; Ceccato, Uittenbogaard, & Bamzar, 2013; LaVigne, 1997; Levine, Wachs, & Shirazi, 1986; Loukaitou-Sideris, 2012; Newton, 2008).

This study contributes to this knowledge base by assessing the impact of physical and social characteristics of transit environments on the likelihood of sexual victimization after controlling for individual factors of travelers.

Research shows that whether in an empty wagon or on a crowded train platform (or on the way to them), women are by far overrepresented among victims of sexual violence in transit environments (Ceccato, Li, & Haining, 2018; Gekoski et al., 2015; Loukaitou-Sideris, 2004; Natarajan, 2016; Natarajan, Schmuhl, Sudula, & Mandala, 2017; Smith, 2008). Young women, in particular, have to do their "safety work" (Gray, 2018; Whitzman, 2007) before leaving their homes, or commuting to college, work and recreation. Increasing the safety of women passengers has, for various reasons, not been high on the agenda of transport agencies and governments, often adopting gender neutral policies (e.g., Loukaitou-Sideris, 2014). Similarly, despite the existence and scale of

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sexual violence on public transport worldwide, the issue has been relatively ignored by research (Gekoski et al., 2015).

The study reports results of a study of university students in Stockholm, Sweden that assesses levels and types of victimization in rail-bound public transportation with particular focus on women's sexual violence, split by three types: verbal, non-verbal and physical. Using logistic regression models, the study assesses whether physical and social characteristics of transit environments affect women's victimization controlling for young riders' individual characteristics.

The majority of university students are young people (18–30), an age group that is likely to be affected more than other age groups from sexual harassment. Focusing on young people makes sense as they tend to be the primary victims of assault and sexual harassment (Beller, Garelik, & Cooper, 1980; Tripathi, Borrión, & Belur, 2017). Answers from the survey came (total number of students) from a particular group of students (1,122 university students), and we therefore not claim that this sample is representative for the whole population of young people. Additionally, this population group is one of the most active segments of the population that has special daily and nocturnal routine activities, studying in the evening and nights. They often have lower incomes and lower car ownership rates than the general public and may have to rely on transit more extensively than many other urban residents. At the same time, researchers can reach large numbers of university students easier than other groups through their universities. Lastly, university students are more similar to each other in age than the general population, and this allows us to control for some factors in our analysis, and also have comparisons in the patterns of transit use and feelings of safety among students globally. For more details, see Ceccato and Loukaitou-Sideris (2020).

THEORETICAL BACKGROUND

Sexual Violence in Public Places

Sexual violence comes in many forms, and it is a common phenomenon in public venues worldwide. Cohan and Shakeshaft (1995) suggest a definition that distinguishes between what they call noncontact and contact sexual abuse. In the noncontact category, they identify nonverbal sexual abuse (such as exhibitionism, showing sexually explicit pictures, or making gestures) and verbal sexual abuse (such as sexual comments, jeering or taunting, and asking questions about sexual activity). In the contact category, they include sexual abuse of kinds like, touching, kissing, and rape. Yet, despite the common occurrence, the majority of cases go underreported as these unwanted sexual behaviors become normalized (Mellgren, Andersson, & Ivert, 2018) through individuals' actions and experiences (Beebejaun, 2017; Lea, D'Silva, & Asok, 2017), becoming an invisible problem. High rates of underreporting mean a lack of reliable information about sexual violence in public transportation, constituting a key barrier to its prevention (Solymosi, Cella, & Newton, 2018).

Sexual victimization of students on university campuses has long been a focus of the international literature (e.g., Benson & Thomson, 1982; Mustaine & Tewksbury, 2002; Reilly, Lott, & Gallogly, 1986), but at the neglect of the places where it occurs, especially when it takes place in public spaces. A study in Sweden reported victimization among college students most frequently occurring at clubs or restaurants (Mellgren et al., 2018) but it does not say much about other public places, such as transit environments (for a review, see Gardner, Cui, & Coiacetto, 2017).

In order to better succeed at preventing sexual violence in transit environments, the evidence is needed about its prevalence by type and the situational conditions under which it occurs. Sexual violence against female students is a day-to-day reality (Natarajan, 2016; Natarajan et al., 2017), especially in environments where the activity spaces of victims and perpetrators converge (Brantingham & Brantingham, 1995; Felson & Eckert, 2017) such as stations and bus stops

(Ceccato, 2014). Therefore, sexual violence is expected to occur where such a behavior is imbedded in the place's morality (Wikström & Treiber, 2017), often in socially disorganized ecological contexts, characterized by poor social control (Shaw & McKay, 1942; Wilson & Kelling, 1982) interacting with particular situational conditions familiar to young people (Ceccato, 2014; Ceccato et al., 2018; Maimon & Browning, 2012).

Risk of Sexual Victimization

Whether one runs a higher risk of being victimized in a train depends on one's personal characteristics, such as age, gender, and ethnicity but also the intersection and meanings of these qualities in particular social and structural contexts. Viewing victimization through an intersectional lens allows us emphasize that structures of gender, race, ethnicity, class, and sexuality weave together to create a complex mix of opportunities and motivations that shape variation in violence across groups and situations (De Coster & Heimer, 2017).

Sexual violence transcends age, race, and income for both offenders and victims and is consistently experienced by women in transit in public transportation or walking around the city (Loukaitou-Sideris, 2014). Previous research has evidenced that belonging to the LGBTQTI community also add an additional risk of sexual assault (Ceccato & Paz, 2017; Coulter et al., 2017; Gekoski et al., 2015), which disproportionately affects several sexual, gender, and racial/ethnic minorities. With college students, in particular, Coulter et al. (2017) found independent and interaction effects of sexual identity, gender identity, and race/ethnicity on past-year sexual assault from 2011 to 2013 in the United States. For instance, sexual assault was highest among transgender people, followed by cisgender women, and lowest among cisgender men. Age significantly decreased the odds of becoming a victim of sexual assault. Other individual factors, such as previous and indirect victimization, also affect one's risk of victimization (Abenoza et al., 2018). Women are more often victims of sexual violence in transit environment figures worldwide. For example, as many as 30% of British women ages 18–24 reported unwanted sexual attention, and even 5% cited inappropriate touching, all of which made them feel fearful and limited their capacity for carefree movement in public (Gekoski et al., 2015). A recent survey in Brazil shows that two of three women declared being victims of sexual violence while in transit, half of them on public transportation, while the proportion among men is 18% (Datafolha, 2014). Similar patterns are found in Japan (Horii & Burgess, 2012), France (d'Arbois de Jubainville & Vanier, 2017), the United States (Hsu, Boarnet, & Houston, 2019; Natarajan et al., 2017) and Australia (Gardner et al., 2017), just to name a few.

Transit Environments Affecting Sexual Victimization

If riders feel at risk in public transportation, they may avoid using it, at least certain routes or at particular times (Frazier, Tashiro, Berman, Steger, & Long, 2004). This issue is not only important because safety influences passengers' mobility but also because the risk of being a victim of crime is not homogeneously spread across transit riders. Below we discuss in detail whether and how transit environments (bus stops, train stations and the way/to from them) can affect the risk for unwanted sexual behavior.

Train stations and bus stops are places where people converge at particular times of the day. This rhythmic pattern of movement and convergence in transportation nodes is crucial for crime to occur. As suggested by routine activity theory (Cohen & Felson, 1979), most crimes depend on the intersections of a motivated offender, a suitable target and the absence of responsible guardians. Crimes occur within the offender's "awareness and activity space" (Brantingham & Brantingham, 1995), which means that the crime's location is often a familiar spot for both offender and victim.

Yet, not all transport nodes are exposed to crime in the same way. This is because social interactions, including those that result in victimization, are dependent on multiscale conditions that act at various levels. These conditions are determined by the environmental attributes of the train station, the type of neighborhood in which the station is located, and the relative positions of both the station and the neighborhood in the city (Ceccato et al., 2013; Newton, 2008). The design and layout of stations, for instance, affect the potential offender's likelihood of escaping without being detected (Clarke & Felson, 1993). Crime Prevention Through Environmental Design—CPTED (Crowe, 2000), points out environmental design principles that can stimulate natural surveillance, foster territoriality and reduce areas of conflict by controlling access. A failed design can make it difficult for outsiders to see what is happening because of obstructed visibility, such as hidden corners and darkness (Loukaitou-Sideris, 2012). Lighting, fencing, security hardware, and open design that allow opportunities for surveillance can discourage crime (Harris, 1971). Cozens, Neale, Whitaker, and Hillier (2003) indicated visibility to be the most crucial part of safety in rail-bound transportation. Some of these features will more highly affect perceived safety than will actual victimization at a transportation node (see e.g., Tucker, 2003), such as quality of 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.

The presence of incivilities, signified by poor maintenance, with concentrations of graffiti and litter, is also likely to have an impact on crime levels (Skogan, 1990; Wilson & Kelling, 1982), since they indicate poor social control at the stations, through lack of personnel, security guards or the police. In particular, transit environments facilitate sexual violence and other types of offenses (Ceccato & Paz, 2017). Crowded rush hours might provide just the right opportunity for groping and all sorts of inappropriate, unwanted sexual behaviors (Gardner et al., 2017; Madan & Nalla, 2016; Natarajan, 2016) while an empty train in the evening might provide the anonymity that an offender needs to commit a rape (Ceccato, Wiebe, Eshraghi, & Vrotsou, 2017). For the prevention of sexual violence, it would be particularly useful to understand whether physical sexual violence (e.g., groping or opportunistic touching) varies along the trip (Gardner et al., 2017), such as at the train station and on the way/from to it. This claim is endorsed by Natarajan et al. (2017) that also suggests that there is a need for further research on young women's safety conditions in public transportation adopting a whole journey approach.

RESEARCH METHODS

Hypotheses of Study

Taken together, the existing literature suggests that individual and environmental factors both have an impact on the declared levels of sexual violence in rail-bound public transportation. For the purpose of this study, we follow the recent strand of Western research on safety in transit environments and hypothesize that sexual violence is related to the individual characteristics of riders as well as the environmental conditions at stations. Hence, this study will test the following set of hypotheses:

1. Women run a higher risk of being a victim of sexual violence while in public transportation—the *gender hypothesis* (see e.g., Gardner et al., 2017; Natarajan et al., 2017; Smith, 2008).
2. Risk of sexual victimization is gendered but gender is not the only factor affecting victimization. Younger riders, frequent users, those taking long trips are more at risk than the rest of riders—the *intersectionality hypothesis* (see e.g., Gekoski et al. 2015).

3. Differences in sexual victimization by group of riders vary by time of the day and by place (at the station and on the way from/to it)—*the spatio-temporal hypothesis* (see e.g., Natarajan et al., 2017).
4. The impact of the stations' environment on sexual violence differs by the type of crime (Ceccato & Paz, 2017). Physical sexual violence (e.g., groping), often a more serious act, dependent on physical contact, is more dependent on the environmental characteristics of the stations than are verbal (e.g., catcalling) or non-verbal (e.g., staring), for instance—*the environmental hypothesis*.
5. Sexual victimization tends to happen more often in transit settings with clear signs of poor social control (formal and informal) than in stations embedded in contexts with high social control—*the social control hypothesis* (e.g., Loukaitou-Sideris, 2004; Wilson & Kelling, 1982).

The analysis is limited to the environment of rail-bound transportation because stations of subways or commuting trains tend to follow some common standards, such as having platforms and entrances, although they too are far from homogeneous and can differ in design, security resources and location, which potentially impact their vulnerability to crime as well. In order to assess the potential impact of these transit environments on different types of sexual offenses, victimization was split into nonverbal, verbal and physical violence, as described above, after controlling for the students' individual characteristics.

This study is part of a larger empirical work in 18 cities in 15 different countries that give a global perspective to the sexual harassment phenomenon. For more details, see Ceccato and Loukaitou-Sideris (2020).

The Study Location

Stockholm County has 268 train stations (subway, light rail, commuter train) and 6,587 bus stops (TSL, 2017). The Stockholm Metro consists of three lines, while the three suburban rail systems consist of eight lines. More than 800,000 people travel with public transport each day, with a weekday average of 44 min spent on commuting with public transport. Females tend to use public transport more than males, and young adults (16–24 years old) use public transport to a significantly higher degree than middle aged people (40–64 years old).

According to Stockholm Public Transport, 80% of their passengers are pleased with public transport in general. Young passengers (16–24 years old) are less satisfied than older passengers. Safety concerns are one of the causes of dissatisfaction, often related to events of public order, drugs, and alcohol. The largest share of reported incidents, regardless of data source, is composed of events of public disorder (unlawful activities or anti-social behavior). The majority of the crimes (15% of recorded incidents) that occur in underground stations are fights (about 40%), vandalism, public disorder, and threats, followed by other types of violence, then property crimes. Individual stations along the Red line (Figure 1) often show lower crime rates than the Green and Blue line stations. A large share of reports of violence are against personnel, guards, and drivers (Ceccato et al., 2013).

Empirical Study: University Student Travel Questionnaire

The Questionnaire

The web-based platform, *Crowdsignal* (<https://crowdsignal.com/>), was used to administer the questionnaire, consisting of 52 questions. The questionnaire was first approved by Swedish Ethical Review Authority in April 2018. The invitation to fill out the online questionnaire, including a link to the questionnaire, was emailed to students at the main campus of Stockholm's largest technical university. In the first part of the questionnaire, respondents were asked about trips with public transportation, including questions on travel frequency,

Stockholm Rail Network Map

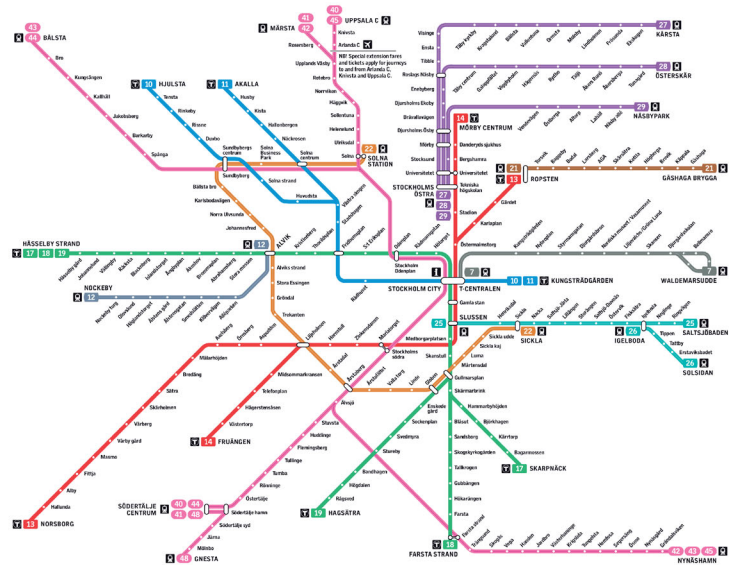
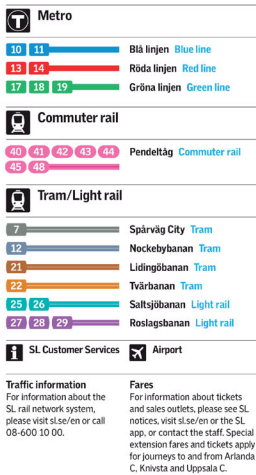


Figure 1. Map of the public transportation network in Stockholm. Source: Stockholm Public Transport, 2019.

perceived safety, and different concerns related to traveling with public transportation. It also contained questions about transit victimization by different types of crime in public transportation (with focus on sexual violence) and about perceived safety when using private transportation (such as car, taxi, and bike). In the final part of the questionnaire, respondents were asked about individual characteristics (age, gender, and place of birth), reporting practices, as well as what they would like to improve in the public transportation system. This questionnaire was initially tested in 2016 in a pilot study in Stockholm and later revised by researchers participating in the global study on sexual violence summarized in Ceccato and Loukaitou (2020). Figure 2 illustrates the main parts of the safety questionnaire.

The Sample and Context

Case studies such as the Stockholm case had to meet the following criteria to take part in the global research project with a total of 1,122 university students. These criteria were (a) Have a minimum sample of at least 300 university students per city to make possible to draw conclusions and establish a comparative framework. (b) All researchers had to agree to use the same survey questions to allow comparability of results, with the exception of cases where the use of a particular question was not allowed in one country or by the Ethics Committee. (c) All researchers had to follow a pre-determined time schedule. Additionally, our original goal was to have gender-balanced samples, and this was satisfied for Stockholm.

The questionnaire was sent to students at the KTH Royal Institute of Technology in Stockholm, a technical university that had 13,323 students at the time of the questionnaire (KTH, 2019), of which 34% were female and 66% were male. The university is located rather centrally in the city, with a less than 10-min subway ride to the central station (where all the subway lines meet), and with access to several bus lines and the light rail line Roslagsbanan.

The basis for this study consists of 1,122 university students who responded to the questionnaire, of which 43% identified as female, 52% as male, 2% as LGBTIQI (stands for Lesbian, Gay, Bisexual, Transgender, Queer or Questioning, and Intersex), and 3% selected the category *other*. The large majority of the respondents were between 18 and 29 years old and born in Sweden, but 16% of the respondents were older than 29 years old and 21% of the respondents were born

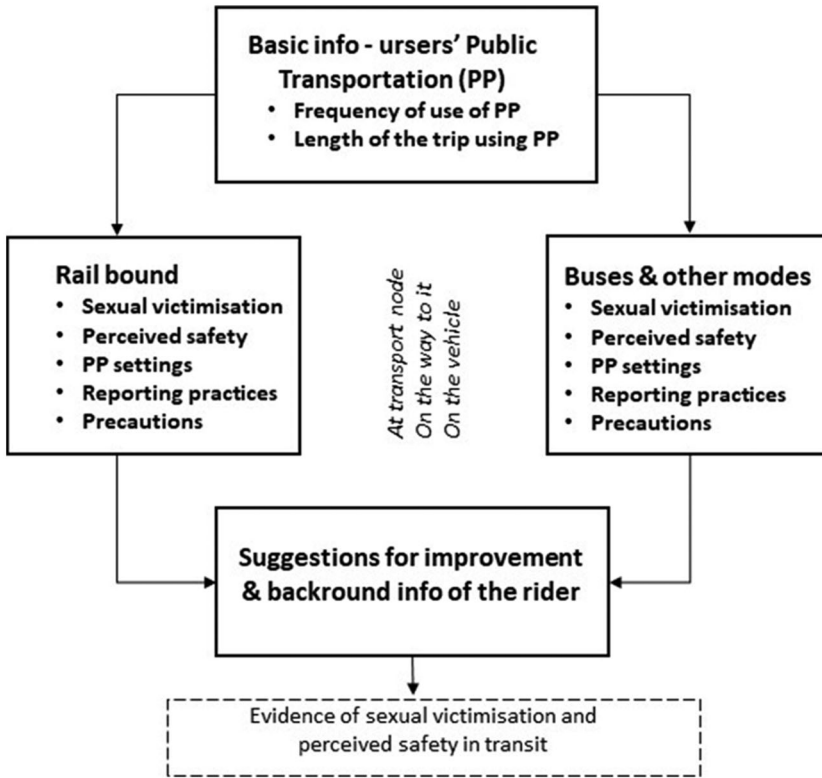


Figure 2. The structure of the questionnaire on sexual violence in public transportation.

outside of Sweden. The majority (64%) of surveyed students used the metro at least four days per week, while 32% used buses at least four days per week.

Statistical Methods and Data Management

The data was transferred from the web-based platform, *Crowdsignal*, via Excel to the statistical softwares SPSS and SAS in which the analyses were carried out (SAS, 2017; SPSS, 2018). The 5% level of significance was considered and in the case of a statistically significant result the probability value (p -value) has been provided. Descriptive statistics were used to characterize the data and, in order to test for differences between two independent groups, statistical comparisons were performed using the Student's t -test for uncorrelated means. In order to evaluate the hypotheses in contingency tables, the chi-square test was utilized or, in the case of small expected frequencies, Fisher's Exact Test. The Pearson correlation coefficient was used in order to test the independence between variables.

Binary logistic regression was used in order to further explore the relationships between victimization, individual factors, and environmental factors. First, a number of questions in the questionnaire that had response options related to the social and physical environments in public transport were identified. These environmental variables were then tested one by one, univariate, in relation to the variable that represented experience of sexual violence in public transport. The environmental variables that were significant at the 10% level were then used in the multivariate model together with individual characteristics. The result from the multivariate model was then used to sort out the significant variables for the final model.

Experience of sexual violence related to a trip with rail-bound public transport during the previous three years was used as the dependent variable (No = 0, Yes = 1). In order to test the hypotheses, three set of covariates were selected: variables indicating the individual characteristics of the riders; variables indicating the physical environment of the stations and finally, variables testing the social environmental of the stations. The selection of these variables was performed based on the current international literature that links transit safety conditions to riders' characteristics as well as the physical and social environments of the stations. This selection was also based on the results from the exploratory analysis given the importance of particular factors for riders' safety. Beyond the differences between men and women, we also modeled for the LGBTQI group plus those who chose other, but the model did not show meaningful results and thus it will not be discussed further in this context.

FINDINGS

Overall Patterns of Sexual Victimization

Almost four out of ten students (respondents) have experienced sexual violence while in transit using rail-bound transportation. Verbal sexual violence is more common than physical or nonverbal; namely, 34.2% of the respondents have experienced verbal sexual violence, and 22.2% physical sexual violence, 17.5% nonverbal sexual violence. Note that students can have responded that they experienced more than one of these types of sexual violence. More often these events occur in public transportation environments than in other public places.

Women run a significantly higher risk of experiencing violence while in transit ($p < 0.001$) than any other group, including LGBTQI. A total of 61.6% of the female students responded that they were victimized at least once in the previous three years; the same figure for men is 26.6%. A larger share of students born in Sweden declare being victimized more often than those born abroad ($p = 0.014$), and younger riders (18–29 years old) are more at risk than those who are older ($p < 0.001$). Finally, previous victimization can be an explanatory factor, depending on the type of crime the respondent has experienced. Previous victimization by violent crimes (such as assault, robbery, and rape) does not relate to the risk of being victimized by sexual violence in public transport ($p = 0.952$) in this model, but previous victimization by property crimes does (such as theft or robbery) ($p = 0.002$).

The Effects of Individual Characteristics on Sexual Victimization

Although women experience a higher rate of sexual violence while in transit than men do, there also exist other individual differences that might place some groups of women at greater risk than others. In this section, we discuss differences in victimization by subgroups of women and men as suggested in hypotheses 2. Our findings show that native-born women experience a higher rate of sexual violence while using rail-bound transportation than those born abroad, 65% vs. 48% ($p = 0.004$). Among the ones that experience sexual violence, 84% were born in Sweden and 16% born abroad. This may be a result of the fact that only 20% of women were born abroad in our sample, which is worth noting as this fact will, of course, affect all future comparisons. For men born in Sweden versus those born abroad, we find no statistically significant difference in the proportion experiencing sexual violence ($p = 0.35$).

Most of the sexual violence was experienced during the trip (88%), followed by events happening at the station (60%) and/or on the way to or from the station (55%). When assessing potential daily differences in victimization for these two groups (between daytime and night-time), a similar pattern of victimization was found. Later, the analyses were repeated to assess individuals' risk of experience of sexual violence by place while in transit, namely "on the way to the station"

and “being on the platform,” between native-born women and those born abroad. Again, women born in Sweden run a higher risk of sexual victimization than those born elsewhere, 54% vs. 39% ($p=0.011$). Similarly, no statistical difference between men born in Sweden and those born abroad was found for the proportion of sexual violence when traveling at night ($p=0.478$), nor for the proportion of sexual violence on the way to the station or on the platform at night ($p=0.889$). Since these results show no or poor statistical significance of sexual violence by groups and by place and time while in transit, the temporal and spatial dimensions by groups are no longer to be included in the modeling section.

Findings also show that victimization by sexual violence varies by type of violence and characteristics of the riders. For example female riders that use public transport are more than three days a week more exposed to physical sexual violence than other females ($p=0.008$), while there is no significant difference in the experience of nonverbal sexual violence ($p=0.818$) or verbal sexual violence ($p=0.151$). Males do not show any significant difference between frequent and less frequent users ($p=0.460$). The result also shows that younger females are more exposed to both nonverbal ($p=0.002$) and verbal sexual violence ($p<0.001$), as well as physical sexual violence ($p=0.010$) while using public transport than older females. Among men, there is no significant difference between younger and older male riders in the experience of non-verbal ($p=0.272$), verbal ($p=0.102$), and physical sexual violence ($p=0.729$).

Modeling Sexual Violence: The Effect of Physical and Social Characteristics of Transit Environments

The overall model results indicate that sexual violence is more likely to take place in rail-bound public transportation settings that show problems of management of these environments, in particular, lack of maintenance and lack of guardianship. As expected, riders that declared being victims of sexual violence during the previous three years also indicated discontent with both the physical and social environments of the metro, trams or commuting trains (Tables 1 and 2). In fact, among the physical environment variables, findings show that “dirty environment” best explained the variation in students’ sexual victimization in rail-bound public transportation. Sexual victimization is about twice as likely among those students who complained about a “dirty environment” compared to those who expressed satisfaction with those environments.

Among the social environment variables, respondents who stated that drunk people at the stations are a safety issue are twice as likely to declare that they have experienced sexual violence, while respondents who complained about panhandling and those who wished for increased police patrolling are one-and-a-half times more likely to declare that they have experienced sexual violence. There are also differences by gender (Table 1). For example, complaints about panhandling are a more powerful explanatory variable in the model of men’s sexual victimization than it is in the model of women’s victimization. Wishing for increased police patrol in these transit environments, on the other hand, comes up as an important factor in modeling women’s victimization than in modeling men’s. Note that this analysis included a model for sexual victimization among LGBTQI (stands for Lesbian, Gay, Bisexual, Transgender, Queer or Questioning, and Intersex) but results were poor so, therefore, we focused the modeling section on women and men’s differences of victimisations only.

Gender is the individual factor that is of greatest significance when modeling the variation in sexual violence among these young riders. Women are about four times more likely than men to declare being sexually assaulted/harassed while in rail-bound public transportation. Therefore, these modeling results confirm findings from the exploratory analysis, namely that riders’ individual characteristics (particular gender) are also important for explaining the variation in sexual violence in rail-bound public transportation. Below we discuss this issue in more detail.

Table 1. Sexual violence by gender.

	Sexual violence, female (N = 394)			Sexual violence, male (N = 419)			Sexual violence, total (N = 813)		
	OR	CI 95%	p	OR	CI 95%	p	OR	CI 95%	p
Individual attributes									
Female	–	–	–	–	–	–	4.045	2.911	5.621
Born in Sweden	0.495	0.286	0.012*	0.975	0.535	0.935	0.676	0.449	1.016
18–29 years old	1.739	0.913	0.093	1.804	0.896	0.098	1.731	1.084	2.765
Previously victimized, violence	0.770	0.327	0.549	1.834	0.738	0.191	1.142	0.604	2.158
Previously victimized, property	3.687	1.403	0.008*	1.321	0.486	0.586	2.188	1.150	4.166
Frequent user	1.550	0.880	0.129	1.310	0.702	0.396	1.424	0.937	2.166
Physical environmental attributes									
Dirty environment	2.006	0.735	0.174	2.078	0.857	0.106	2.004	1.043	3.850
Isolated station	1.108	0.361	0.858	1.887	0.241	0.545	1.341	0.511	3.515
Increase CCTV	1.083	0.682	0.735	1.185	0.725	0.500	1.139	0.817	1.588
Increase illumination	1.227	0.761	0.401	1.390	0.824	0.217	1.254	0.886	1.775
Social environmental attributes									
Concern with antisocial behavior	1.633	0.895	0.110	0.901	0.434	0.781	1.271	0.812	1.990
Poor surveillance, empty station	1.221	0.457	0.691	1.341	0.412	0.626	1.335	0.634	2.811
Parhandling	1.463	0.764	0.251	1.668	0.911	0.097	1.547	1.000	2.395
Drunk people	1.956	1.110	0.020*	2.153	1.006	0.048	2.004	1.281	3.135
Increase police patrolling	1.857	1.134	0.014	1.296	0.789	0.306	1.500	1.068	2.107

A model for sexual victimization among LGBTQI (lesbian, gay, bisexual, transgender, queer, or intersex) but results were poor so therefore we focused the modeling section on women and men's differences of victimisations only. OR: Odds ratio; CI: Confidence interval; p: p-value; *Statistically significant at the 5% level at most.

Table 2. Sexual violence by type.

	Sexual violence, nonverbal (N = 813)			Sexual violence, verbal (N = 813)			Sexual violence, physical (N = 813)					
	OR	CI 95%	p	OR	CI 95%	p	OR	CI 95%	p			
Individual attributes												
Female	5.201	3.197	8.461	<0.001*	3.534	2.514	4.966	<0.001*	7.692	4.853	12.190	<0.001*
Born in Sweden	0.714	0.413	1.236	0.229	0.533	0.345	0.823	0.004*	0.502	0.298	0.848	0.010*
18–29 years old	3.243	1.461	7.199	0.004*	2.140	1.284	3.568	0.004*	1.436	0.788	2.617	0.237
Previously victimized, violence	1.459	0.699	3.044	0.315	1.153	0.611	2.178	0.660	0.693	0.317	1.511	0.356
Previously victimized, property	1.916	0.944	3.888	0.072	1.508	0.811	2.802	0.194	1.967	1.000	3.870	0.050*
Frequent user	0.914	0.533	1.567	0.743	0.369	0.887	2.111	0.156	1.517	0.894	2.575	0.123
Physical environmental attributes												
Dirty environment	1.845	0.934	3.647	0.078	1.896	1.016	3.539	0.045*	1.118	0.555	2.253	0.754
Isolated station	2.183	0.849	5.613	0.105	0.919	0.370	2.282	0.856	1.158	0.453	2.957	0.760
Increase CCTV	1.050	0.686	1.609	0.821	1.053	0.751	1.478	0.763	1.249	0.840	1.858	0.272
Increase illumination	1.473	0.958	2.264	0.077	1.222	0.860	1.737	0.264	1.415	0.954	2.118	0.092
Social environmental attributes												
Concern with antisocial behavior	1.979	1.192	3.285	0.008*	1.355	0.869	2.111	0.180	0.949	0.573	1.573	0.840
Poor surveillance, empty station	1.446	0.692	3.023	0.327	1.624	0.803	3.287	0.178	1.164	0.556	2.440	0.687
Panhandling	1.189	0.707	2.001	0.514	1.092	0.705	1.691	0.695	1.319	0.802	2.171	0.275
Drunk people	1.395	0.838	2.322	0.201	1.745	1.239	2.459	0.026*	2.185	1.348	3.542	0.002*
Increase police patrolling	1.393	0.908	2.138	0.129	1.393	0.908	2.138	0.001*	1.539	1.030	2.300	0.035*

OR: Odds ratio; CI: Confidence interval; p = p-value; *Statistically significant at the 5% level at most.

Previous victimization affects the likelihood of being a victim of sexual violence while in rail-bound public transportation. An individual who has for instance been victimized (for property crimes) previously is twice more likely to declare being a victim of sexual violence while in transit than the rest of the sample with no previous experience of victimization. More interestingly, results show that previous victimization is more powerful for explaining the variation in sexual victimization among women than among men. A female student that declared having been a victim of property crime(s) is 3.7 times more likely to declare being sexual assaulted while in transit than other females in the sample. However, in our dataset, previous victimization has no effect on the likelihood to be sexually victimized among male riders. Young riders (18–29 years old) are more exposed to sexual violence than the other respondents. Although our sample is composed of fairly young riders, our sample still shows a significant effect of age on sexual victimization while in rail-bound public transportation, as younger riders are 1.7 times more likely to declare that they have experienced sexual violence than older students during the previous three years.

The frequency of use of public transportation and place of birth (in or outside Sweden) also help explain the individual differences in sexual violence victimization while in rail-bound transportation. For instance, frequent riders (at least four days per week) are 1.4 times more likely to declare that they were victimized by sexual violence than those who travel less often. Respondents who were born in Sweden are almost 1.5 times more likely to declare that they experienced sexual violence than the rest of the sample, but there are gender differences (see [Table 1](#)), as discussed above.

Type of Sexual Violence in Rail-Bound Public Transportation

In order to assess the potential differentiated impact of transit environments on riders' victimization, three new models were created dividing sexual violence in nonverbal, verbal and physical violence. Findings from these models confirm previous results shown above but also indicate some independent impacts of these settings on different types of sexual offenses after controlling for individual characteristics of students, as discussed below.

Respondents that complained about the physical environment of the stations, such as poor illumination, are around 1.4 times more likely to declare that they have experienced sexual violence (verbal or non-verbal sexual violence). Those who are dissatisfied with the dirty environment at the station are around 1.85 times more likely to declare that they have experienced nonverbal or verbal sexual violence than the rest of the sample. However, the poor maintenance of these settings does not preclude individual victimization for physical sexual violence (note: variable is not significant).

How one experiences transit environments over the day has a direct and significant impact on the likelihood of being exposed to sexual violence. In our sample, riders declaring being victims of sexual violence in transit also wished for increased formal social control (police patrol, security guards) and showed greater concern with antisocial behavior in these environments, in particular with the presence of drunk people at the stations, than the rest of the sample. The presence of drunk people at the stations and surrounding areas has a low explanatory power in modeling the variation of individual's victimization in terms of nonverbal sexual violence. Those who complained about this problem are 1.7 times more likely to have experienced verbal sexual violence and, more significantly, are twice as likely to declare being victims of physical violence. Similarly, students that wished for increased formal social control at the stations are more likely to have been sexual victimized than other students in the sample (1.4 times more likely for nonverbal and verbal violence and 1.5 times more likely for physical sexual violence).

Riders that expressed concern with antisocial behavior in transit environments, such as the presence of drunk people at the stations, are almost twice as likely to declare that they experienced nonverbal sexual violence. However, such concerns with antisocial behavior in transit do

not explain variations in individual's victimization for verbal and physical violence among students taking rail-bound public transportation.

Among the riders' individual characteristics, gender is still a powerful explanatory factor for experience of sexual violence, but this differs by the type of violence (Table 2). Women are 3.5 times more likely than men to declare that they have experienced verbal sexual violence, compared with five times more likely for nonverbal and more than seven times more likely for physical sexual violence. Younger riders are three times more likely than other travelers to be at risk of nonverbal sexual violence and twice as likely to suffer verbal sexual violence. Respondents that are born in Sweden are twice as likely to declare that they have experienced verbal and physical sexual violence than respondents born abroad, while place of birth (in or outside Sweden) has a smaller explanatory value for nonverbal sexual violence. Previous victimization of property crimes relates to an increased likelihood of sexual victimization for nonverbal or physical sexual violence, but no increase in likelihood of experiencing verbal sexual violence.

CONCLUSION

Discussion of the Results

Sexual violence is common in transit environments. About 45% of respondents declare being victimized in public transportation in the previous three years, more often during the trip than at the station or on the way to/from the station. Verbal sexual harassment (e.g., catcalling, obscene language) is more common in our sample than physical (e.g., touching, groping) or nonverbal (e.g., unwanted sexual looks or gestures) sexual violence. Sexual violence is gendered (women being more at risk, corroborating the gender hypothesis), but gender is not the only factor affecting young riders' victimization as stated by *the intersectionality hypothesis*. Younger women, native-born riders, frequent users, those taking long trips and those previously victimized (by property crimes) are more at risk for sexual violence than other riders using rail-bound public transportation. Contrary to what was previously found in the literature, ethnic minorities and the LGBTQI group do not run higher risk for sexual violence than the rest of the sample, mostly likely because this group is underrepresented in this sample.

Most of the sexual violence was experienced during the trip (in the wagon), followed by events taking place at the station and finally, by events happening on the way to or from the station. Similar results were found in international literature (e.g., Natajara et al., 2017), and confirm our *the spatio-temporal hypothesis* and the importance of design and safety conditions of the wagons.

The quality of transit environments and, in particular, transportation nodes, such as stations or bus stops, has a significant effect in the occurrence of sexual violence (see also, Gardner et al., 2017; Gekoski et al., 2015). Sexual violence happen more often in settings and contexts where overall victimization (and poor social control) are normalized and morally accepted. Note that women who were at least once victimized by sexual violence have already being a victim of a property crime before, which indicates the types of neighbourhood and socio-economic contexts they are exposed on a daily basis.

The impact of the station's environment varies on sexual violence and such effect differs by the type of sexual violence. Tables 1 and 2 shows that variables indicating physical environmental attributes (e.g., isolated station, dirty conditions, illumination) were not as important as the social ones (e.g., drunk people, panhandling) to explain the variation of sexual violence among young riders. These riders are the ones that are exposed to (and show concerns with) poor maintenance of these environments (dirty stations) and wish for increased formal and informal social control (more presence of police patrol, security guards). These confirm the two last hypotheses (*environmental and social control hypotheses*) that stated that indications of poor maintenance, social

disturbance (presence of drunk people, anti-social behavior) capture a much broader range of social problems (Skogan, 1996) that most likely go beyond the stations themselves, as they promote the notion that “no one is in charge,” where acts of sexual violence may occur and are normalized in that ecological context.

Physical and verbal sexual violence are more dependent on the quality of the social environment than the more frequent types of sexual offenses are. Trying to untangle these casual mechanisms is a difficult task since transit environments are peculiar places; they converge people and also disperse them. Despite the fact that other passengers are around when a sexual assault occurs, they might not be aware or be willing (or might not be able) to intervene since they are on the move (Ceccato & Haining, 2004). This is also the case with security guards or safety hosts since they move around constantly within the transit system (from platforms to entrances but also from stations to stations and in between transportation modes), which makes guardianship difficult.

Conclusions and Recommendations

This study provides an examination of the factors influencing sexual victimization among young riders (university students) in rail-bound public transportation in Stockholm, Sweden. We have added to the present literature by analyzing a large sample of university students in a Scandinavian city, splitting by types of sexual violence and characteristics of transit environments. We found that while characteristics such as gender, age, frequency of transit use, previous victimization—alone or combined—influence patterns of sexual violence, the physical and social environment of the stations shows also an independent impact on the likelihood of sexual violence—such an affect, however, depends on the type of sexual violence. These findings indicate that the combination of individual and situational conditions of sexual violence increase our understanding of why transit environments is a hot spot of sexual violence, and why university students, in particular, young women run higher risks than other riders for this type of criminal victimization. Principles of environmental criminology that combine information of young riders’ routine activity and features of the environment of transit environments—as it was done in this study—can be useful to tackle sexual violence in rail-bound public transportation, an environment crucial for their mobility in a daily basis.

The novelty of this study is 3-fold. The analysis breaks down sexual violence into three main groups: verbal, non-verbal and physical, and is based on a recently available dataset collected in Stockholm as the study case and as part of a global investigation together with other cities by researchers from six continents: Africa, Asia, Australia/Oceania, Europe, North America, and South America. The second novelty is that the study focuses on young people’s safety through intersectional lens. This is important because they appear to be the primary victims of physical sexual harassment (Ceccato & Paz, 2017; Vaughan, 2017) but still there are variations by ethnicity and other individual characteristics, dimensions that are not well developed or understood in the international literature (De Coster & Heimer, 2017). They also declare varied levels of perceived safety depending on the transport mode or time of the day (Wiebe et al., 2014). They are one of the most active segments of the population, which has special daily and nocturnal routine activities. Typically, university students in Sweden in particular are “transit captives” which means that because they have fewer resources and lower car ownership rates than the general public, they may have to rely on public transportation more than many other riders do. Finally, with this study, we exemplify the perspectives of criminology and architecture to add to the intersectional literature with a quantitative take, which is uncommon but welcomed by the international literature (Daly, 2010) within the field of feminist criminology.

This study has two important theoretical contributions related to the use of principles of environmental criminology in conjunction with intersectional approach to safety of individuals’

characteristics of young riders. Although not all principles of environmental criminology are important to assess safety in these settings, they support the understanding of the nature of the situational conditions of sexual violence in transit settings when young riders are around. A way forward to improve this analytical model is to further explore the impact of young riders' life styles (their agency) on their routine activity, use of public transportation and sexual victimization. This study indicates the advantages of considering the role of transport nodes as place of convergence and a risky facility for young riders, in particular for women. There is also a need to better develop the concept of territoriality in transit environments in relation to responsibilities and obligations. Stations are privately owned, yet they are public places. A station as a public space means that access to it is a lawful right but in reality there is an ambiguity in ownership, responsibility, and use of its environment that plays negatively against daily users of these settings. This ambiguity extends to immediate vicinities of a station, and if a rape happens in these environments. The responsibility for safety in the station's surroundings is a *gray zone* that lacks consensus. Unclear assignment of tasks and lack of cooperation between public and private stakeholders creates a gray zone in which few actors are willing to take charge of safety problems or share costs beyond their predefined roles.

Many of our findings indicate that a particular group of women (younger, native-born riders, frequent users, those taking long trips, and those previously victimized by property crimes) is more at target for this sexual crime than other riders are and have therefore distinct safety demands in using public transport. These results have practical implications. Current transportation agencies and the municipality can no longer afford to implement gender neutral mobility policies. Moreover, professionals must be aware that risk for sexual victimization is not homogeneously distributed among female riders and neither across the environments of rail-bound public transportation. Efforts to define particular interventions must be sensitive to other dimensions than riders' gender, know exactly where and when physical sexual violence occurs and improve those environments. In this process, it is essential to incorporate the voices and views of those who are more at target of this criminal offense. Young riders' views on these matters should be solicited through consultation and be an integral part of mobility policy. On the long run, more women also need to be recruited to work in transport agencies in every area (often a male dominant environment), from design through to services delivery (Rivera, 2007).

Physical and verbal sexual violence tend to be more linked to social conditions of rail-bound environments than other types of sexual violence are. In particular, we know that some of these environments are characterized by low social control and poor maintenance and that more sexual violence happens more on the trains, stations than on the way to/from them. These findings call also for a specific, tailored set of measures against sexual violence that target accepted norms of behavior that are normalized in some of these transit settings. They can also involve preventive measures that tackle sexual violence by improving formal and informal social control at stations and on the trains by establishing a pre-determined minimum number of guards, by creating campaigns to encourage other passengers to report sexual violence and highlight inappropriateness of certain types of behavior.

What should be done to respond to sexual transit crime? It is fundamental that legislators and the criminal justice system take the problem of sexual victimization in public spaces seriously. Only a few countries have started enacting legislation specifically focusing on sexual harassment and designating strict penalties for them. When legislation is in place, very often the range of sexual crimes included is limited (Ceccato and Loukaitou-Sideris, 2020). Transport operators, in particular, should consider women's safety in public transportation as an individual right, by taking differences in women's needs into account when providing transportation services. Proposals could involve short term measures (for instance, changes in the transit environment) as well as long-term investments to foster cooperation between actors (transport operators, security experts,

police, and municipalities) responsible to deliver a safe trip from door-to-door. In practice, this would mean that the department for transport (or its equivalent) would take the responsibility for liaising with law enforcement to ensure women and other targeted groups with adequate protection (Tripathi et al., 2017).

In terms of policies that can help minimize the risk of sexual victimization, there are many examples. A relatively simple measure of “on-demand stops,” especially at night, that has been tried in certain cities in Europe and elsewhere, lets passengers disembark from the bus at places closer to their destination than the bus stop, thus helping reduce the risk of stalking. Other measures could involve public outreach campaigns at social and print media and signage on buses and trains against sexual harassment, easy protocol for reporting harassment incidents, strict penalties for perpetrators, improve transit frequency during rush hour to reduce vehicle overcrowding, transit staff training. Among the short term measures devoted to this particular Scandinavian case, interventions should include instating prevention measures that take into account people’s daily routine activities and different types of sexual offenses (verbal, non-verbal and physical). They may also involve the design of harassment-free environments, well-guarded streets, and pedestrian walkways, strengthening social control and management in transport nodes and on the way to them (well-lit, well-maintained routes on the way to/from transport bus stops/stations), in addition to testing technological solutions, such as real time digital tables, CCTVs, and apps at particular hotspots of sexual victimization.

While this study is of limited generalisability as the sample is limited to young riders who are university students and dominated by native-born Swedes, it could serve as the basis for a large-scale study of sexual victimization within public transport involving other age groups. The evidence presented here shows the importance to consider evidence on intersectionality of victimization to better tailor sexual assault prevention. Data permitting, future research should aim at gathering evidence about victimization among gay and transgender persons—a group that is often a target of sexual violence (Gekoski et al., 2015) but in this study the sample was not representative. Future studies should explore potential interactions between individual and situational conditions in transit environments as a modeling strategy.

Despite these limitations, this article offers a systematic report on young riders’ experiences of sexual victimization in relation to the environments of rail-bound public transportation in a Scandinavian capital—an analysis that was lacking in the international literature. This provides an important increased understanding of sexual violence among the group that is often a target: young women. With increased understanding of how individual and transit environment factors are influential over young women’s risks for sexual violence while on the move, it is our hope that prevention efforts can become more focused and more successful in the future.

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