

Association of Victimization by Sex among Public Facing Bus and Subway Transit Workers, New York City

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Abstract Federal data indicate that assaults on transit workers resulting in fatalities or hospitalizations tripled between 2008 and 2022. The data indicated a peri-pandemic surge of assault-related fatalities and hospitalizations, but assaults with less dire outcomes were not recorded. In collaboration with the Transport Workers Union, Local 100, we conducted an online survey in late 2023 through early 2024 of New York City public-facing bus and subway workers that focused on their work experiences during the 2020–2023 period of the COVID-19 pandemic. Items for this analysis on victimization included measures of physical and sexual assault/harassment, verbal harassment/intimidation, theft, and demographic characteristics (e.g., sex, race, work division). We estimated separate modified Poisson models for each of the four outcomes, yielding prevalence ratios (PRs) and

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95% confidence intervals (CIs). Potential interactions between variables with strong main effects in the adjusted model were further examined using product terms. Among 1297 respondents, 89.0% reported any victimization; respondents also reported physical assault (48.6%), sexual assault/harassment (6.3%), verbal harassment/intimidation (48.7%), and theft on the transit system (20.6%). Physical assault was significantly more common among women in the bus division compared to female subway workers, male bus workers, and male subway workers (adjusted PR (aPR)=3.54; reference=male subway workers; Wald test $p<.001$). With the same reference group, sexual assault/harassment was more frequently reported among female subway workers (aPR=5.15; Wald test, $p<.001$), but verbal assault/intimidation and experiencing theft were least common among women

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in the bus division (aPR=0.22 and 0.13, respectively; Wald tests, $p<.001$). These data point to the need for greater attention to record and report on victimization against workers in both buses and subway.

Keywords Transit workers · Victimization · Violence · Physical assault · Sexual assault · Sexual harassment · Verbal assault · Intimidation · Theft · Sex · Subway · Bus

Introduction

According to the Urban Institute, major assaults (i.e., events leading to death or injury requiring emergency transport for care) on transit workers tripled between 2008 and 2022, from 168 to 492 annual events nationwide; a sharp spike was observed in the immediate peri-pandemic period [1]. These data from the National Transit Data base (NTD) do not take into account events that are non-fatal or do not require medical transport. Thus, these figures do not include violent acts such as physical assault against transit workers (e.g., hitting, kicking, spitting, threatening with a knife or gun pointing), sexual assault or harassment, verbal harassment, abuse or intimidation, and theft. While there is evidence to assume that these occur frequently [1–8], only limited data on these events are available because they were not required to be reported in the NTD at that time [9]. Moreover, data have been sparse on demographic differences by assault categories other than on worker division (i.e., bus vs. rail). For example, in the 2015 Federal Department of Transportation report on assaults in bus and rail workers, and in a 2024 report on customer assault, sex-based or racial/ethnic-based victimization received only passing mention [10, 11], despite substantial

anecdotal evidence of violence against female transit workers [2, 3]. Therefore, the purpose of this study was to estimate the frequency of assaults against bus and subway transit workers in New York City (NYC), to identify demographic characteristics associated with high frequency of assaults, and to refine recommendations for recording and reporting events so as to reduce the risk of assault in this essential worker population.

Methods

Design

In collaboration with our community partner, the Transport Workers Union (TWU), Local 100, an online, cross-sectional, confidential survey was conducted between December 2023 and February 2024. A link to the self-administered survey, hosted on Qualtrics®, was sent via email by union leadership to a convenience sample of 20,920 members who had verified email addresses (see below).

Recruitment

Email invitations included a brief description of the study, which was designed to assess the potential impact of COVID-19 on the health and well-being of NYC transit workers. Emails to solicit volunteers were sent three times to sample members from a TWU, Local 100 communications email address. The initial email blast was sent on December 15, 2023, followed by a second email on January 2, 2024, and a third and final email on January 22, 2024. Data were collected between December 15, 2023, and February 5, 2024 (7.5 weeks).

Sample

The Metropolitan Transit Authority bus and

subways have 50,639 employees (Alan Saly, MTA, personal communication, July 16, 2024). The TWU, Local 100 has 39,397 members; 20,920 TWU members were emailed an invitation to participate. Inclusion criteria were TWU membership, working in the city's five boroughs, and having a verified email address. The survey was accessed by 2216 individuals; 1676 started it, and 1520 completed it. We restricted the sample for this analysis to

workers whose positions were public-facing and who answered over 90% of questions, resulting in an analytic sample size of 1297.

Data Collection

Pilot testing revealed that the survey took an average time of 15 min to complete. Prior to the start

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of the survey, informed consent was obtained. All participants were assigned a unique code number, and no personal identifying information was collected. After completing the survey, participants could elect to enter a lottery with a chance of 1/50 to win a \$50 gift card. All study procedures had prior review and exemption by the NYU Institutional Review Board.

Questionnaire and Measures

The primary focus of the study was to follow up on issues related to COVID-19 among NYC transit workers, with results of a preliminary survey reported elsewhere [12]. Before recruitment started, items on victimization exposure were included following a local spike in crime on mass transit in NYC [13]. These questions were placed roughly mid-way through the study instrument before the survey was launched.

Socio-demographic measures in this analysis included the following: sex (male vs. female), race (White vs. non-White), ethnicity (Hispanic vs. non Hispanic), education (high school or less vs. 2 or more years of higher education), and marital status (living alone vs. married or cohabitating). Occupational characteristics included self-report of years worked in transit (tenure), which was dichotomized at the median (5 years or less vs. more than 5 years) and division (i.e., bus vs. subway).

Four distinct experiences of criminal victimization were considered as outcome variables. Specifically, respondents were posed the following yes/ no questions: "Have any of the following ever happened to you *at work*? (Select all that apply);" "I

experienced verbal harassment (e.g., offensive language, insults) or intimidation (including threat of physical assault);" "I experienced physical assault (e.g., punching, hitting, spitting, pushing);" "I experienced sexual assault (e.g., touching, groping, forced sexual contact) and/or harassment (e.g., catcalling)." Finally, experiencing theft was ascertained using the item, "I had something stolen from me." The time frame for recall was framed as ever but was implied as earlier questions in the instrument referred to the period between the onset of the COVID-19 pandemic in New York City (March 2020) and the survey, which closed January, 2024.

Statistical Analysis

The univariate distributions of socio-demographic and occupational characteristics of the analytic sample were tabulated, and their bivariate associations with experiences of victimization were examined using relative frequencies. Subsequently, and since outcomes were not rare, we estimated separate modified Poisson models (first unadjusted and then adjusted for all covariates) for each of the four outcomes, yielding prevalence ratios (PRs) and 95% confidence intervals (CIs). Potential interactions between variables exhibiting strong main effects in the adjusted model were further examined using product terms. *p*-values indicating the presence of interaction was determined using Wald tests. All analyses were conducted using Stata/SE 18.0 for Mac®, and statistical significance was evaluated at the two-tailed level of $p < 0.05$ throughout.

Results

Among 1297 public-facing transit worker respondents, 48.0% worked in the subway and 52.0% in the bus division; overall, 59.1% worked 5 years or less. The overall prevalence of any victimization was 89.0%. Table 1 shows cross-tabulations by socio demographic variables for each of the four outcomes, respectively. There were 48.6% who reported physical assault, 6.3% who reported sexual assault, 48.7% who reported verbal harassment, and 20.6% who reported theft. The sample demographics were as follows: 47.0% male, 37.6% White, 77.5% non-Hispanic, 40.9% with high school or less, and 76.8% married or

cohabitating.

Table 2 shows the unadjusted prevalence ratios (PRs) of the main effects model. Physical assault was significantly *more common* among females (PR=2.42), those who worked on buses (PR=2.86) and those who were married or cohabitating (PR=2.23). It was *less common* among workers with more than 5 years tenure (PR=0.46), non-Whites (PR=0.73), and those who were Hispanic (PR=0.60); there was no significant difference by education level. Sexual assault/harassment was also more commonly reported among females (PR=1.87) but differed from physical assault as it was less common among those working in the bus

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Table 1 Cross tabulations between experiences of victimization and socio-demographic variables among public-facing TWU Local 100 respondents, New York City, December 2023 to February 2024

Variables	N	Experienced physical assault	Experienced sexual assault/ harassment	Experienced verbal harassment/ intimidation	Experienced theft
Total	1297	48.6%	6.3%	48.7%	20.6%
Sex					
Male	609	24.6%	4.3%	68.5%	29.9%
Female	688	69.8%	8.0%	31.3%	12.4%
Division					
Subway	623	24.7%	9.3%	69.8%	10.4%
Bus	674	70.6%	3.4%	29.2%	31.6%
Tenure					
≤5 years	764	62.3%	3.5%	33.5%	10.5%
>5 years	528	28.8%	10.2%	70.8%	35.2%
Race					
White	488	58.2%	5.1%	42.6%	18.2%
Non-White	809	42.8%	6.9%	52.4%	22.0%
Ethnicity					
Non-Hispanic/Latino	991	53.8%	5.8%	42.4%	30.0%
Hispanic/Latino	287	32.1%	7.7%	70.4%	17.9%
Education					
HS or less	527	51.0%	4.2%	41.6%	15.0%
2+years of higher education	761	47.3%	7.5%	53.4%	24.3%
Marital status					
Living alone	300	55.9%	13.3%	72.3%	17.7%
Married/Cohab	992	25.0%	4.0%	41.6%	29.7%

division (vs. subway) (PR=0.37) but more common among those working for more than 5 years (PR=2.89) and with more than a high school education (PR=1.79); associations with race and ethnicity were not significant. Verbal harassment or intimidation was *less frequently* reported by females (PR=0.46), those who worked on buses (PR=0.42), and respondents who were married or cohabitating (PR=0.58). Verbal harassment/intimidation was more frequently reported by those who worked more than 5 years in transit

(PR=2.11), who were non-White (PR=1.23) and Hispanic/ Latinx (PR=1.66), and those with more than high school education (PR=1.28). Bivariate analyses indicated that reports of theft were less common among females (PR=0.41), those who worked on buses (PR=0.33), and those who were married/cohabitating (PR=0.60) but more common among those who had worked for more than 5 years (PR=3.36), Hispanic/Latinx (PR=1.68), or who had 2 or more years of education (PR=1.62); there was no significant association with race. Table 2 reports the fully adjusted PRs of the

Compared to male subway workers (reference category), physical abuse was *significantly more common among* women who worked in the bus division (aPR=3.54) and women who worked in the bus division (aPR=1.43); no difference was found in comparison to male bus workers. The highest prevalence of sexual abuse or harassment was found among

highest prevalence of sexual abuse or harassment was found among

Table 2 Unadjusted and main effects multivariable associations (based on modified Poisson regression models) of correlates with experiences of victimization among public-facing TWU Local 100 Respondents, New York City, December 2023 to February 2024

Variables	Experienced	physical assault	Experienced sexual	assault/ harassment	ment/intimidation	Experienced theft	
PR adjusted (95% CI)		PR* unad justed (95% CI)*	PR adjusted (95% CI) ^a PR unad	justed (95% CI) PR adjusted	(95% CI) ^a PR unad justed (95%	CI) PR adjusted (95% CI) ^a	PR unad justed (95% CI)
Male	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Female	2.42 (1.87, 3.13)	Division 1.93 (1.58, 2.44)	1.87 (1.17, 2.99)	3.16 (1.92, 5.20)	0.54 (0.65 (0.54, 0.77)	0.41 (0.32, 0.53)	0.91 (0.69, 1.23)
Subway	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Bus	2.86 (2.38, 3.43)	Tenure 1.90 (1.53, 2.35)	0.37 (0.23, 0.59)	0.58 (0.34, 1.00)	0.58 (0.48, 0.69)	0.33 (0.25, 0.43)	0.66 (0.49, 0.87)
≤5 years	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
>5 years	0.46 (0.38, 0.55)	Race 0.88 (0.70, 1.10)	2.89 (1.82, 4.59)	2.70 (1.59, 4.58)	2.48 (1.45 (1.22, 1.72)	3.36 (2.59, 4.37)	3.02 (2.29, 4.01)
White	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Non-White	0.73 (0.63, 0.86)	Ethnicity 0.89 (0.75, 1.04)	1.35 (0.84, 2.17)	0.90 (0.54, 1.51)	1.45 (1.09 (0.92, 1.30)	1.21 (0.94, 1.56)	1.38 (1.06, 1.79)
Hispanic/ Latino	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Non		/ Latino	(0.48, 0.74)	1.09 (1.33	1.59 (0.95, 2.65)	(1.40, 1.96)	1.46 (1.12, 1.91)
Hispanic	0.60	Education 0.85 (0.67, 1.00)	(0.81, 2.18)	2.65 (1.66	1.45 (1.22, 2.17)	(1.30, 2.17)	1.91 (1.46, 2.51)
HS or less	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
2+years of higher education		Marital status 0.93	(0.79, 1.09)	1.17 (1.09, 1.29)	1.70 (1.03, 2.79)	(1.09, 1.51)	1.51 (1.16, 1.97)
			(0.85, 2.93)	1.28 (1.03, 2.11)			

Living alone (ref) (ref) (ref) (ref) (ref) (ref) (ref) (ref)
 Married (1.76, (1.11, (0.20,
 / Cohab 2.84) 1.86) 0.47)
 2.23 1.44 0.31 0.41

(0.25, (0.49, (0.61, (0.46, (0.60,
 0.68) 0.68) 0.85) 0.77) 1.01)
 0.58 0.72 0.60 0.78

PR prevalence ratio, CI confidence interval

female subway workers (aPR=5.15); no difference was found for female bus workers and male bus workers compared to the reference category. The lowest prevalence of verbal abuse or intimidation was found among women who worked in the bus division (aPR=0.22) compared to male subway workers; no difference was found for the other groups. Similarly, compared to male subway workers, the lowest prevalence of experiencing theft was observed among women who worked in the bus

for the other groups. For all of the above analyses, the Wald test comparing the model with the interaction term with the respective main effects model was highly significant ($p<0.001$), suggesting that these interaction terms improved model fit. When it comes to the adjusted associations with tenure (Table 3), sexual assault or harassment, verbal abuse or intimidation, and experiencing theft were more common among those working 5 or more years

division (aPR=0.13), with no difference detected

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Table 3 Multivariable associations (based on adjusted modified Poisson regression models) of correlates with experiences of victimization, including interaction

between division and sex, among public-facing TWU Local 100 respondents, New York City, December 2023 to February 2024 (N=1297)

Variables Experienced physical assault

PR adj. (95% CI)^a

Division * Sex

Experienced sexual assault/harassment PR adj. (95% CI)^a
 Experienced verbal harassment PR adj. (95% CI)^a

ment/intimidation PR adj. (95% CI)^a
 Experienced theft PR adj. (95% CI)^a

Subway * male (ref) (ref) (ref) (ref) Bus * male 1.35 (0.96, 1.90) 1.58 (0.70, 3.57) 0.97 (0.78, 1.20) 0.88 (0.64, 1.22)
 Subway * female 1.43 (1.03, 1.99) 5.15 (2.73, 9.71) 1.02 (0.83, 1.25) 1.09 (0.81, 1.47) Bus * female 3.54 (2.72, 4.61)
 1.52 (0.65, 3.55) 0.22 (0.16, 0.29) 0.13 (0.07, 0.24) **Tenure**
 ≤5 years (ref) (ref) (ref) (ref) >5 years 0.94 (0.75, 1.19) 2.20 (1.29, 3.74) 1.23 (1.03, 1.45) 1.83 (1.39, 2.41) **Race**
 White (ref) (ref) (ref) (ref) Non-White 0.90 (0.77, 1.06) 0.85 (0.50, 1.43) 1.03 (0.86, 1.22) 0.99 (0.76, 1.30) **Ethnicity**
 Non-Hispanic (ref) (ref) (ref) (ref) Hispanic/Latino 0.92 (0.72, 1.17) 1.36 (0.80, 2.32) 1.24 (1.04, 1.49) 1.25 (0.95, 1.64)
Education
 HS or less (ref) (ref) (ref) (ref) 2+years of higher education 1.01 (0.86, 1.18) 1.65 (1.01, 2.72) 1.20 (1.02, 1.42) 1.48 (1.13, 1.93) **Marital status**
 Married/Cohab (ref) (ref) (ref) (ref) Living alone 0.73 (0.56, 0.95) 2.14 (1.31, 3.51) 1.22 (1.03, 1.46) 1.12 (0.85, 1.46)

Wald test (Interaction vs. main effects model, $p<.001$)

PR prevalence ratio, CI confidence interval

(aPR=0.94).

(aPR=2.20, 1.23, 1.83, respectively) but not among those who experienced physical assault

Discussion

This study, based on data collected within 4 years of the first peak of the COVID-19 pandemic, examined self-reports of victimization among public-facing transit workers in NYC. The overall rate of victimization among transit workers of 89% in this report is notably higher than the 58% previously reported for U.S. health care workers [14].

The major finding was that women had a higher prevalence than men of self-reported physical assault or intimidation and sexual assault. Taking into account the interaction with division, physical assault was more frequently reported by women who worked on buses compared to women working in subways and men working in either division. In contrast, sexual assault or harassment was more prominent among women working in the subway division than women working on buses or men

overall. This is not the image one gleans from incidents reported in the press, which may lead one to conclude that physical assaults are more commonly experienced by among males [4–8]. Dissimilar to physical assault or intimidation and sexual assault or harassment, the prevalence of verbal assault or intimidation was lowest among women who worked on buses. Theft was least likely to be reported by women working on buses (compared to the other three sex/division groups). To date, we have found no report that clearly makes distinctions like these reported here.

While the results by sex and division were adjusted for key confounders, we acknowledge several study limitations. The response rate of the survey was 11%, which is modest [15]. In terms of the study's

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demographic characteristics, female MTA workers were substantially overrepresented (53% vs. 18%, respectively) (A Saly, MTA, personal communication, July 16, 2024), possibly resulting from the well documented higher propensity of women to respond to online surveys [16]. Thus, the results of this study cannot be considered representative of the MTA worker population overall; almost certainly, there is volunteer bias, likely resulting in inflated prevalence figures. Moreover, the study's time frame was during the COVID-19 pandemic, and therefore, certain things may have been recalled differently right after the COVID-19 pandemic. Another limitation pertains to the use of self-reported measures. Finally, this cross-sectional design precludes the ability to ascer

tain causation; only associations can be determined. With these caveats acknowledged, differences in experiences of victimization by race or ethnicity were not observed, except for a marginally higher prevalence of verbal abuse or intimidation among Hispanic workers; however, instances of racial bias have been reported anecdotally [11, 17]. Non-white racial groups were combined as data were statistically similar

for the purposes of this study, which focused on the effects of sex and division. In terms of years on the job, all experiences of victimization except physical abuse were somewhat more common among workers with more than the median number of years working for the MTA. While the parent study was designed primarily to examine transit worker attitudes about COVID-19 in the interval since recognition of onset for the COVID-19 pandemic in NYC (March 2020), we cannot rule out possible “telescoping” of responses among those with longer tenure (length of time working at NYC transit) to reflect possible events before the pandemic [18]. Moreover, participants were reluctant to report age, resulting in high missingness for this variable, so that age was not included in the analysis; however, tenure can be a proxy measure for age [19]. We also found that sexual assault or harassment, verbal abuse or intimidation, and theft but not physical assault were more common among those with 2 or more years of education, which may reflect either that they were more aware or that they experienced it more frequently. In addition, no information on possible causes or triggers of victimization was collected. Findings regarding marital status are of interest in that those living alone reported that they were more likely to have

experienced workplace-associated sexual assault or harassment, but not physical assault; these results are provocative and merit further attention.

Given these limitations, these data suggest a need for greater attention to the collection of more detailed information on victimization in this worker population overall. A special focus should be to understand the prevalence and correlates of victimization of workers, in particular female workers, on both buses and subways. In late 2023, the Federal Transit Administration issued *General Directive Number 24-1, Required Actions Regarding Assaults on Transit Workers* [20], which will hopefully bring more detailed information to refine and support victimization prevention measures for transit workers. For now, the data presented here indicate the need for a more comprehensive and demographically disaggregated data source to refine recommendations for transit worker safety.

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