Washington State Health Care Encounters Involving a Public Transit Facility in 2021

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14. ABSTRACT
The Washington State Department of Health Rapid Health Information Network (RHINO) program staff, with the support of a grant from the Washington Traffic Safety Commission, conducted an exploratory analysis of health care encounters that included a mention of a public transit facility. To investigate the context and nature of the injuries, RHINO rapid health encounter data were analyzed using a text mining approach to find the most common words found in these visit records, and the top diagnosis codes were calculated. The report summarizes our findings from health encounters in Washington that occurred in 2021.

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Health Care Encounters Involving a Public Transit Facility – Washington State 2021

For the Washington State Traffic Safety Commission

By The Rapid Health Information Network Team of the Washington State Department of Health

Contents

Public transit facilities have been identified as an area lacking quality injury data, specifically in stakeholder feedback from the Cooper Jones Active Transportation Safety Council given to the Washington Traffic Safety Commission. The Rapid Health Information Network (RHINO) collects near real-time health encounter data that could potentially meet this need. Washington state law requires emergency departments (EDs) to report each health care visit to Washington Department of Health in a timely fashion, usually within 24 hours. In 2021, 96 out of 101 emergency departments reported emergency department visits consistently. Data include categorical data such as gender, race, ethnicity, and age as well as free-text information such as triage note narratives. The RHINO program collects and analyzes this data in a system called ESSENCE (Electronic Surveillance System for the Early Notification of Community-Based Epidemics). Here, we analyze the healthcare encounter data available in ESSENCE.

The Washington State Department of Health RHINO team performed an exploratory analysis of RHINO health encounter data to find what types of public transit related injuries (or health conditions faced in these settings) occur in transit facilities. To do this, the RHINO team searched all Washington state health care visits available in ESSENCE for key words “Bus Stop”, “Bus Station”, “Train Stop” or “Train Station” in the chief complaint and triage notes free-text fields. These fields are valuable sources of narrative information that often contain context on the conditions that led to the health care encounter. We also searched for discharge diagnosis codes indicating injury to a bus occupant (excluding those in motor vehicle crashes)[1]. Discharge diagnoses are a more definitive source of information about the specific health conditions a patient was treated for but can sometimes miss the context or cause of the injury or other reason for visit. We chose to analyze 2021 as it is the most recent full year of data but acknowledge that transit ridership and usage patterns may not fully represent past years due to the COVID-19 pandemic.

To better elucidate the severity of injuries associated with transit facilities, we separated visits by whether the patient was seen only in the emergency department (“not severe”) versus those that resulted in a hospitalization or death (“severe”). Using this query, we flagged 1,986 not-severe public transit-associated incidents across Washington in 2021. This is 0.09% of statewide not-severe incidents that year. An additional

[1] ICD-10 code V74-V79

178 public transit-associated incidents were severe (0.04% of statewide severe visits), including 10 deaths (0.04% of statewide deaths at a health care facility in RHINO data in 2021).

Time Trends

Monthly counts of emergency department visits do not show a strong seasonal trend. Figure 1 shows all possible public transit-associated injuries (severe and not-severe) seen in any Washington facility reporting to ESSENCE. Figure 2 shows a comparison of not-severe (dark blue) versus severe encounters resulting in hospitalization (light blue).

Figure 1. Monthly Count of Visits Associated with Public Transit Facilities, Washington 2021

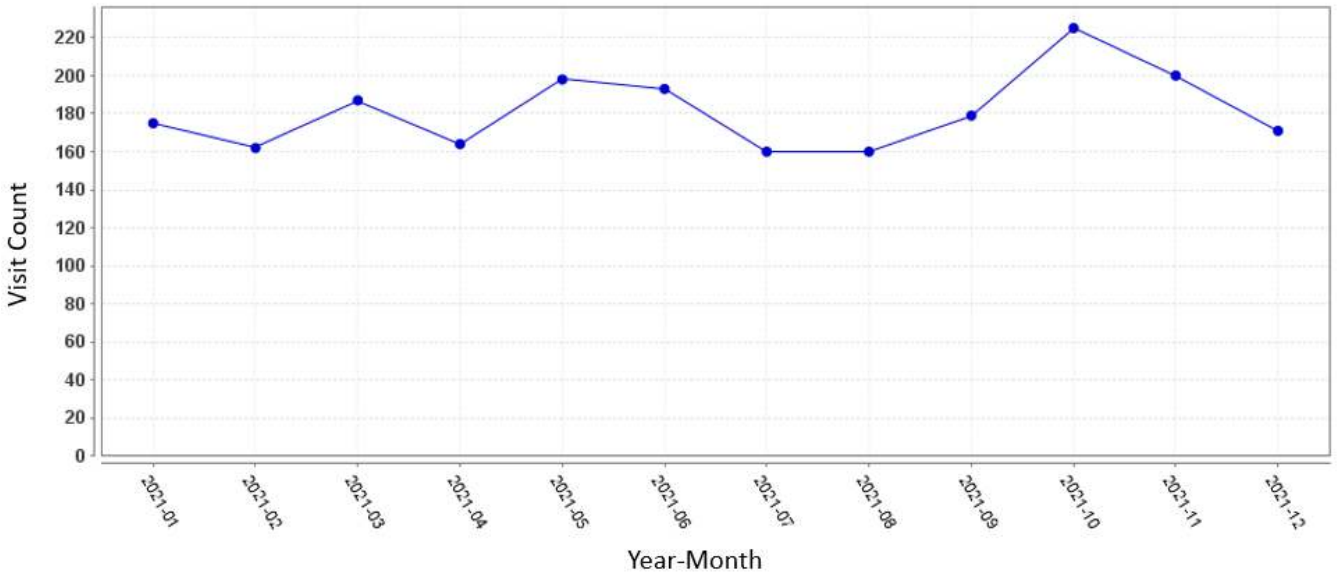
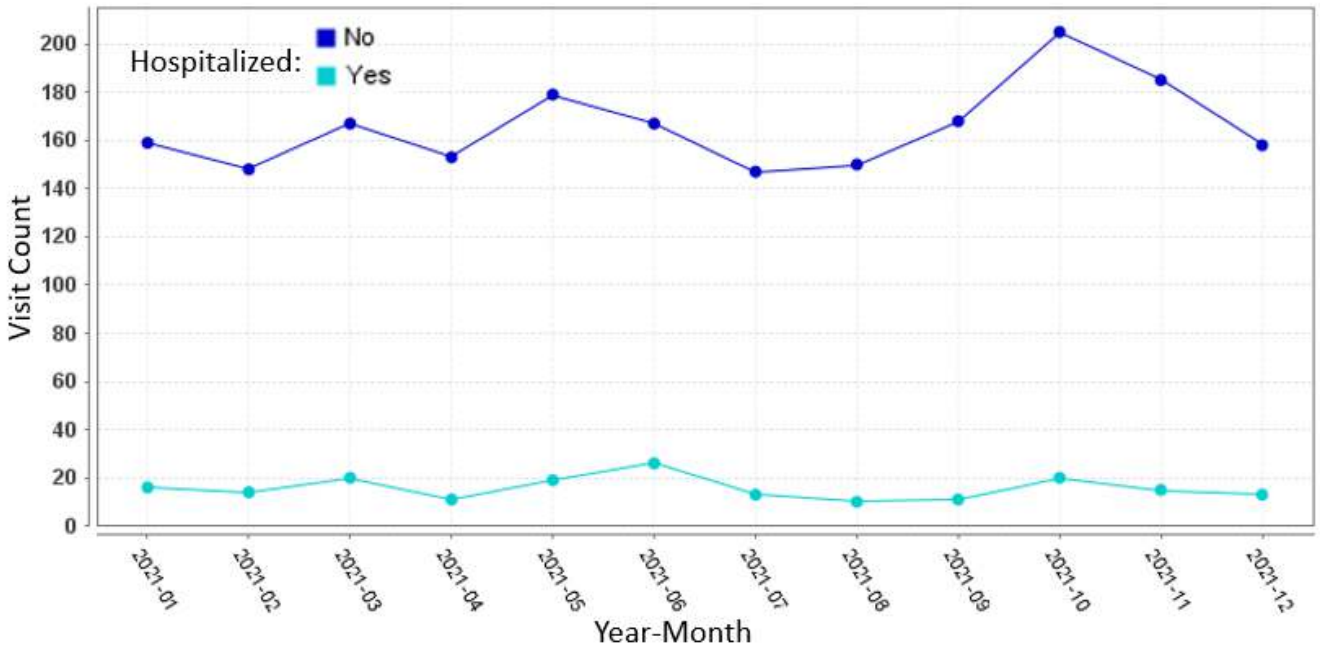


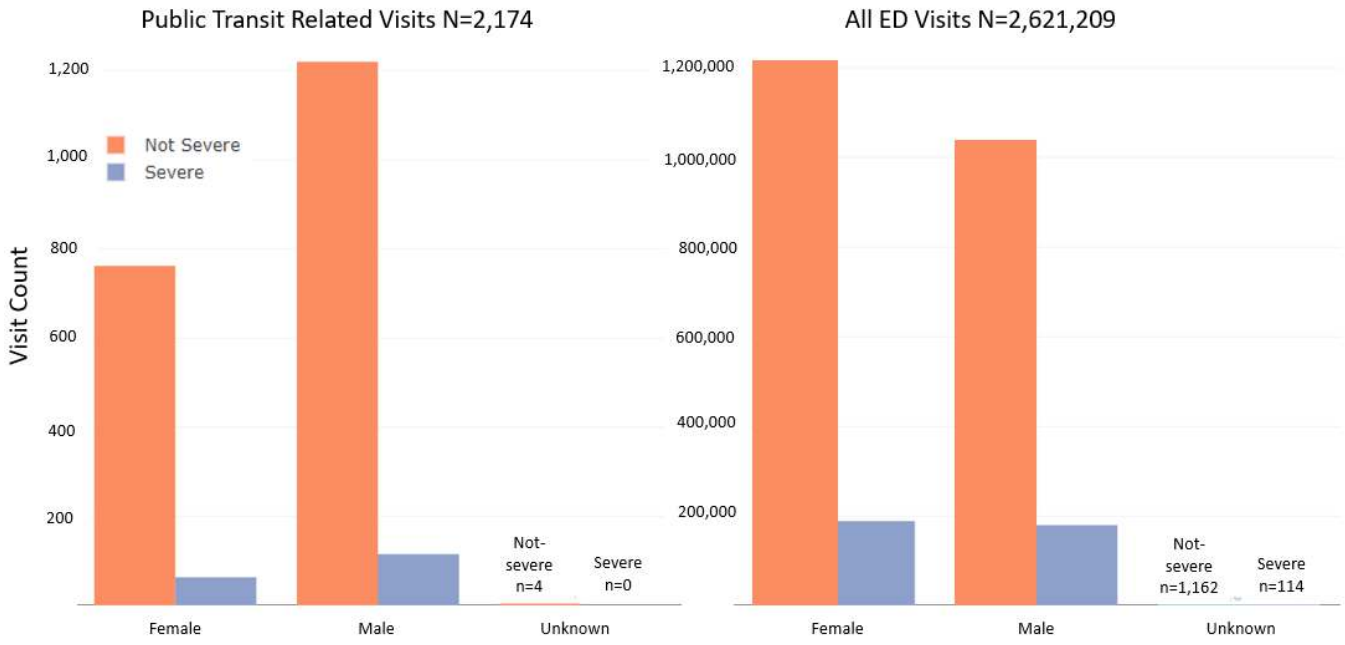
Figure 2. Monthly Count of Visits Associated with Public Transit Facilities divided by Hospitalization Status, Washington 2021



Demographics

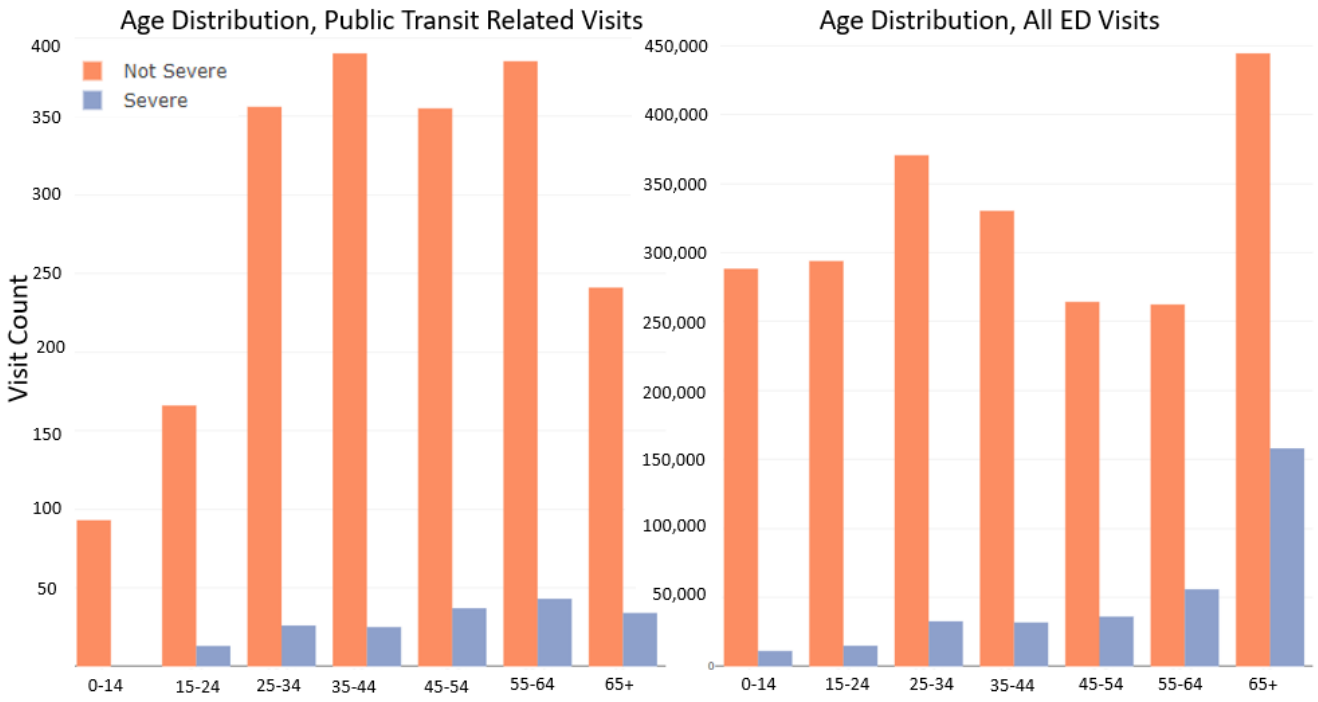
The demographic breakdowns reveal some notable distinctions from the numbers for hospital visits for any reason. Men accounted for more visits than women in both severity categories of public transit related visits (61% of not severe visits, and 65% of severe visits), but fewer visits than women when looking at visits for any reason (46% of all not-severe ED visits, and 49% of all severe ED visits, Figure 3). Each demographic figure shows "not severe" visits in orange and "severe" visits in blue, with transit facility related visits on the left half, all ED visits on the right half, and y-axis differences between halves to account for the different totals of each query.

Figure 3. Sex Distribution of Public Transit Related Visits, and All Emergency Department Visits, Washington 2021



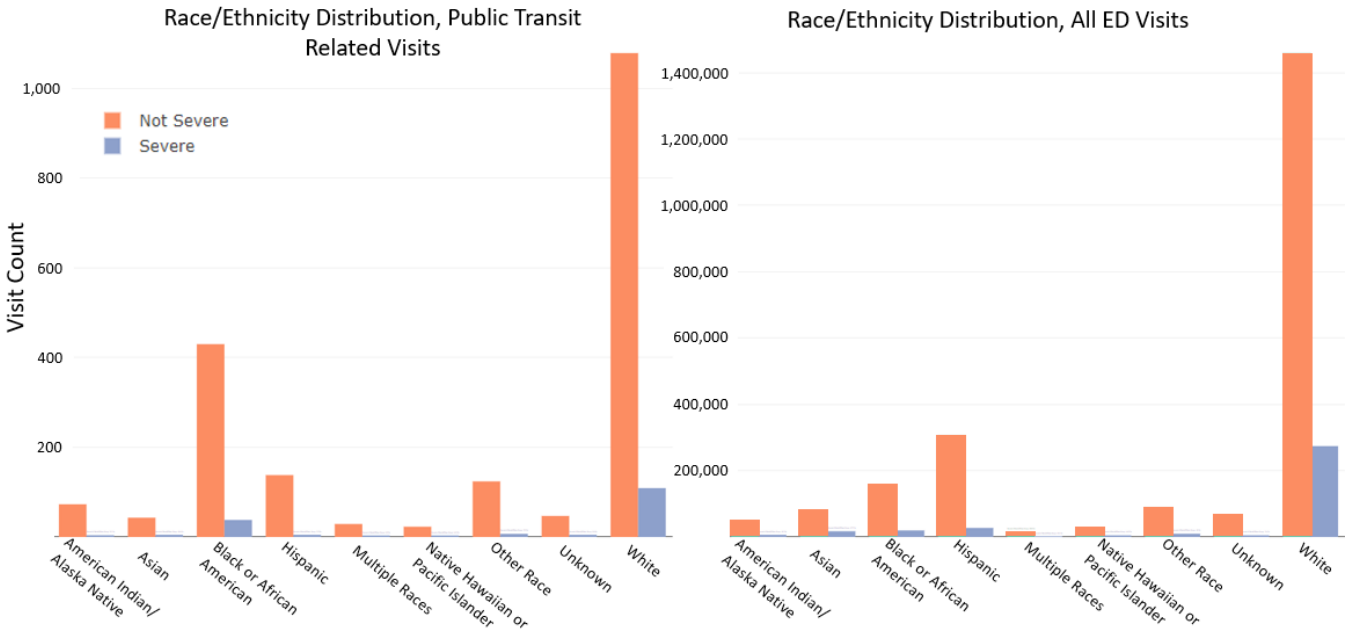
The age distribution of visits captured by the public transit facility query skewed toward the middle age groups (25-64) more heavily than the visits for any reason (Figure 4). Trends in severe visits related to public transit facilities show that older individuals are more likely to have a health encounter result in a hospitalization, with the peak age range being the 55-64 group. This differs from all ED visits, where the 65+ age group saw nearly triple the hospitalizations as the 55-64 group.

Figure 4. Age Distribution of Public Transit Related Visits, and All Emergency Department Visits, Washington 2021



In 2021, visit counts by race/ethnicity show some remarkable distinctions from all visits (Figure 5). Black of African American patients accounted for 3.2 times the percentage visits captured by the query (21.5%) than for all ED visits (6.7%). American Indian/Alaskan Native patients showed a 75% increase in the rate of public transit facility related visits (3.5% of visits) compared to the statewide percentage seen for any reason (2.0%). Departing from this trend, those of Hispanic ethnicity were seen 48% less often in the public transit query (6.6% of visits) than in all ED visits by nearly half (12.7% of all visits).

Figure 5. Race and Ethnicity Distribution of Public Transit Related Visits, and All Emergency Department Visits, Washington 2021



Free-Text Analysis

To uncover trends within the visits, a text mining method[2] was used to find the most commonly occurring terms found in the text-containing fields of in the ESSENCE data. Single words, as well as groups of two and three words together were also checked for more frequent use among these visits, with the results shown in Table 1. Text mining of chief complaints and triage notes revealed visits from both severity groups frequently had intoxication/alcohol involvement, and mental health related terms. "Fall" and "crash" related terms were present in both groups, but the severe visits showed a higher number of combinations of these terms in conjunction with factors that could complicate an injury, such as "cold exposure", "diabetes", "cardiac arrest". We next took a look at Discharge Diagnosis field to see if they could further inform the context of injuries that were suggested by the free-text field analysis.

Table 1. Frequently Used Terms Found in Public Transit Related Visits, Washington 2021

Not-Severe Visit Terms			
Alcohol	Altered	Bus	ETOH
Fall	Injury	Intoxication	Mental
Pain	Unspecified	Alcohol Intoxication	Altered Mental
Bus Stop	Chest Pain	Mental Health	Mental Status
Motor Vehicle	Uncomplicated HCC	Vehicle Crash	Abuse Uncomplicated HCC
Altered Mental Status	Dry Pain Controlled	Mental Health Evaluation	Mental Status Unspecified
Intoxication Uncomplicated HCC	Motor Vehicle Crash	Motor Vehicle Accident	
Severe Visit Terms			
Altered	Arrest	Breath	Cardiac
Cold	CPR	Diabetes	EMS
EMS	ETOH	Exposure	Fall
Foot	Ground	Head	Mental
Pain	Shortness	Trauma	Abdominal Pain
Absent Pulses	Achieved Lung	Agitation Continue	Airway Protection
Albuterol Atrovent	Altered Mental	Bus Station	Bus Stop
Cardiac Arrest	Chest Pain	Cold Exposure	Diabetes Mellitus
EMS Trauma	Encounter Trauma	Fall Altered	Fall Hypothermia
Foot Ulcer	Ground Level	Head Initial	Leg Pain
Level Fall	Mental Health	Mental Status	PD Involv
Absent Pulses Shockable	Achieved Lung Sounds	Airway Protection OG	Post Cardiac Arrest
Altered Mental Status	Ambulance Post Cardiac	Amiodarone PEA ROSC	Cold Exposure Initial
EMS Trauma Fall	ETOH PD Involved	Fall Altered Mental	Fall Hypothermia Cold
Ground Level Fall	Head Initial Encounter	Hypothermia Cold Exposure	Level Fall Hypothermia
Mental Health Evaluation	Mental Health Unspecified	Modified MVC West	MVC West Pierce
Albuterol Atrovent Solumedrol	Status Epilepticus HCC	Type Diabetes Mellitus	

[2] TF-IDF: Term Frequency – Inverse Document Frequency method was used

Discharge Diagnosis Frequencies

To see what types of diagnoses were most common for patients with a public transit facility, we calculated the diagnosis codes that occurred most frequently on their own, as well as the top combinations of two and three codes.

Nicotine dependence and other lifestyle-related health conditions including hypertension, homelessness, alcohol/stimulant were common among each method of counting, whether single codes or in conjunction with others.

For this analysis, we looked at all visits captured by the public transit facility in aggregate. A subset analysis by severity, similar to the free-text analysis, could give further insight into what types of injuries are sustained in public transit facilities.

Table 2. Discharge Diagnosis Frequencies for all Public Transit Query Visits (no severity stratification), Washington 2021

Most Common	Single Diagnosis Code			
1	f17210	Nicotine dependence, cigarettes, uncomplicated		
2	z20822	Contact with and (suspected) exposure to COVID-19		
3	z79899	Other long term (current) drug therapy		
4	i10	Essential (primary) hypertension		
5	z590	Homelessness		
6	f10920	with intoxication, uncomplicated		
7	f1510	Other stimulant abuse, uncomplicated		
8	z87891	Personal history of nicotine dependence		
9	f17200	Nicotine dependence		
10	r45851	Suicidal ideations		
Most Common	**Co-Occurring Diagnosis Codes**			
1	f17210	Nicotine dependence, cigarettes, uncomplicated	z79899	Other long term (current) drug therapy
2	i10	Essential (primary) hypertension	f17210	Nicotine dependence, cigarettes, uncomplicated
3	f17210	Nicotine dependence, cigarettes, uncomplicated	z20822	Contact with and (suspected) exposure to COVID-19
4	z7982	Long term (current) use of aspirin	z79899	Other long term (current) drug therapy
5	f10920	with intoxication, uncomplicated	f10120	Alcohol abuse with intoxication, uncomplicated
6	f10920	with intoxication, uncomplicated	f10129	Alcohol abuse with intoxication, unspecified
7	z20822	Contact with and (suspected) exposure to COVID-19	z79899	Other long term (current) drug therapy
8	e119	Type 2 diabetes mellitus without complications	i10	Essential (primary) hypertension
9	i10	Essential (primary) hypertension	e119	Type 2 diabetes mellitus without complications

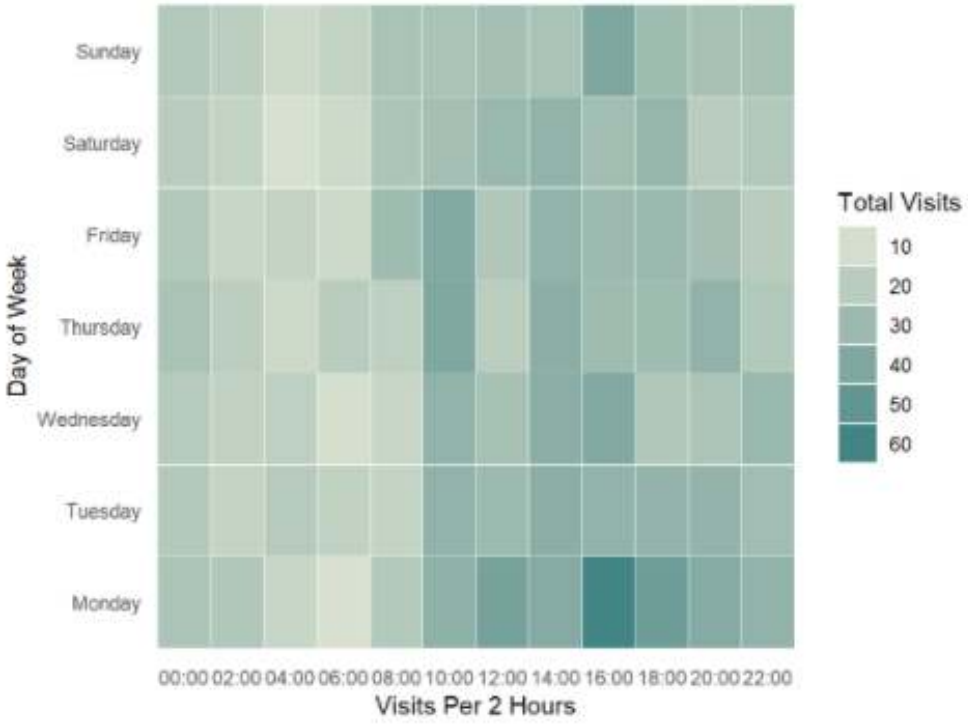
Table 2 (continued)

Most Common	Groups of Three Co-Occurring Diagnosis Codes					
1	i10	Essential (primary) hypertension	f17210	Nicotine dependence, cigarettes, uncomplicated	z79899	Other long term (current) drug therapy
2	y9389	Activity specified, NEC (not elsewhere classified)	y92411	Interstate highway as the place of occurrence of the external cause	y990	Civilian activity done for income or pay
3	v7988	(passenger) injured in other specified transport accidents	y9389	Activity specified, NEC (not elsewhere classified)	y92411	Interstate highway as the place of occurrence of the external cause
4	f329	Major depressive disorder, single episode, unspecified	f17210	Nicotine dependence, cigarettes, uncomplicated	x79899	Other long term (current) drug therapy
5	f17210	Nicotine dependence, cigarettes, uncomplicated	z20822	Contact with and (suspected) exposure to COVID-19	z590	Homelessness
6	i10	Essential (primary) hypertension	z87891	Personal history of nicotine dependence	z79899	Other long term (current) drug therapy
7	f419	Anxiety disorder, unspecified	f329	Major depressive disorder, single episode, unspecified	f17210	Nicotine dependence, cigarettes, uncomplicated
8	f17210	Nicotine dependence, cigarettes, uncomplicated	z79899	Other long term (current) drug therapy	z20822	(suspected) exposure to COVID-19
9	f17210	Nicotine dependence, cigarettes, uncomplicated	z7982	Long term (current) use of aspirin	z79899	Other long term (current) drug therapy

Day of Week Trends

To investigate whether time of day, or day of the week potentially influences the likelihood of an ED visit related to a public transit facility, we plotted a heat map showing the total number of visits that occurred in each two-hour window of each day of the week for the 2021 study period (**Figure 6**). Darker colors indicate periods of time that had more visits. Mondays in 2021 appear to have had the most visits captured by our public transit facility query. A particularly dark segment at 4 PM on Monday suggests this could be an area for further investigation that could potentially lead to targeted interventions to prevent those visits.

Figure 6. Visits by Day of the Week, 2 Hour Periods, Washington 2021



Limitations

RHINO health encounter data is limited in the ability to pinpoint location details on where patients may have sustained an injury. The location of the visit is always known, but patients could potentially be transported great distances to reach care. Contextual data within the free-text and discharge diagnosis fields can suggest the place of injury, but other sources of data may offer better specifics on locations that see the most injuries. Future projects, including the linkage RHINO data with WEMSIS data may help to fill this gap.