International Journal of Paramedicine

Published by the National EMS Management Association (USA)

RESEARCH REPORT

# CROSS-SECTIONAL SIX-YEAR RETROSPECTIVE EPIDEMIOLOGICAL ANALYSIS OF 9-1-1 EMS CALLS TO THE EL PASO, TEXAS AND CIUDAD JUÁREZ INTERNATIONAL BORDER CROSSING

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*Recommended Citation*: Baker, S., Baker, R., & Martinez, A. (2024). Cross-sectional six-year retrospective epidemiological analysis of 9-1-1 EMS Calls to the El Paso, Texas and Ciudad Juárez International Border Crossing. *International Journal of Paramedicine*. (7), 72-82. https://doi.org/10.56068/CPIV3712. Retrieved from https://internationaljournalofparamedicine.com/index.php/ijop/article/view/2860.

*Keywords*: prehospital, epidemiology, international border crossing, US-Mexico border, ports of entry, emergency medical services, EMS, paramedicine

*Received*: August 5, 2023
*Revised*: January 14, 2024
*Accepted*: January 14, 2024
*Published*: July 8, 2024

*Funding*: External funding was not used to support this work.

*Declaration of Interests*: The authors have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

*Acknowledgements*: Many thanks to the El Paso Fire Department Chief Killings, Chief Redd, and Paramedic Carrasco for data acquisition.



## ABSTRACT

The El Paso-Juárez metroplex comprises one of the world's busiest international land border crossings. Although prior studies have described prehospital responses along the U.S.-Mexico border, the epidemiology of 9-1-1 calls to the El Paso-Juárez border crossings has not been previously reported. Investigators sought to evaluate responses by emergency medical services at El Paso-Juárez ports of entry.

***Methods***: This cross-sectional, retrospective study evaluates call volume, patient population, patient complaint, diagnosis, and unit out-of-service time at three international bridges in El Paso. The El Paso Fire Department provided data for all encounters between February 2017 and January 2023. This included date, ports of entry, patient demographics, chief complaint, computer-aided dispatch, provider impression (diagnosis), and time out-of-service.

***Results***: Over the study period, 8407 encounters occurred at one of the three El Paso-Juárez ports of entry, averaging 1680 per year or 116 emergency 9-1-1 calls per month. The busiest month was July, with a median of 132 encounters. 45% of calls were at the Paseo Del Norte port of entry. The study population comprised 59% Hispanics, 4129 (49%) male, and 4266 (51%) female, from 0 to 103 years of age. The most common diagnosis included neurological (1908, 22.7%), GI/GU (1,263, 15%), and injury or trauma (1117, 13%). 6420 work hours were spent responding to ports of entry calls, with the average call resulting in a unit out-of-service time of 46 min.

***Conclusion***: By understanding and evaluating the epidemiology of EMS calls at the El Paso-Juarez ports of entry, the researchers hope to improve protocols, optimize training, adjust staffing, and adequately equip emergency medical service personnel to serve these high-traffic areas better.

## INTRODUCTION

The Texas-Mexico border covers 1255 miles. It includes 28 international border crossings and bridges. Seven ports of entry (POE) are available for pedestrians and personal vehicles in the El Paso region. Of those seven ports, three major border crossings are located within El Paso, Texas, the second largest metropolitan area along the United States-Mexico border, second only to San Diego. (United States Department of Transportation, n.d.)

These three ports of entry include the Paseo Del Norte Bridge, the Bridge of the Americas, and the Ysleta Bridge. These POE connect the region's 2.7 million residents living in Ciudad Juárez (Chihuahua, Mexico) and El Paso (Texas, USA). According to the Texas Department of Transportation, in 2019 approximately 3.3 million pedestrians, 7 million passenger vehicles, and 17 thousand buses crossed northbound from Juárez to El Paso through one of these bridges in 2020 (International Trade and Border Planning, n.d.). Approximately 9000 pedestrians, 17,000 passenger vehicles, and 48 buses cross into El Paso daily. The El Paso Fire Department (EPFD) is the only available agency that responds to all 9-1-1 calls at these three ports of entry. With such a significant confluence of people entering the United States at the ports of entry, there is the potential for increased emergency medical services (EMS) involvement and resource utilization. Comparative research has examined the epidemiology of prehospital care provided at the San Diego and Tijuana POE (Farah et al., 2019). Prior studies have not explicitly described the epidemiology of emergency medical services (EMS) response and prehospital care at the El Paso-Juárez International POE. In this cross-sectional study, researchers aimed to describe and investigate the epidemiology of prehospital EMS response provided by emergency medical services at the El Paso-Juárez ports of entry.

## METHODS

### Setting

El Paso is home to approximately 678,000 residents in the westernmost part of Texas (U.S. Census Bureau quickfacts, n.d.). It shares its borders with New Mexico to the west and Mexico to the south. The city has four international POE bridges: the Paseo Del Norte Bridge, also known as the Santa Fe Street Bridge; the Bridge of the Americas; the Ysleta Bridge, also known as the Zaragoza Bridge; and the Good Neighbor Bridge, also known as the Stanton Bridge. This research excludes the Good Neighbor Bridge, a minor POE dedicated solely to southbound traffic traveling from El Paso into Juárez.

The El Paso Regional Communication Center's public safety answering point (PSAP) receives all 9-1-1 calls in the region. The El Paso Fire Department (EPFD) is the single municipal-run fire department that provides paramedic-level care and transportation for all 9-1-1 calls in El Paso. On average, the PSAP center receives 140 monthly calls requesting emergency responses at one of the three POEs. The primary and most frequent source of these calls are individuals requesting assistance either for themselves or others who are with them. Other sources of calls come from Customs and Border Protection (CBP) agents working at the POE. CBP agents receive requests from individuals at the POE or when a Mexican-based ambulance presents at the POE with a patient requiring treatment in the U.S. At present, Mexican ambulances cannot give pre-arrival notification in a coordinated manner. Mexican ambulances arrive at the POE where CBP will activate 9-1-1 then EPFD can evaluate and transfer the patient to a U.S. hospital (Salgado, et al, 2017).

### Patient Selection

The El Paso Fire Department supplied de-identified, retrospective electronic data generated for all patient encounters at the three POE between February 2017 and January 2023. The six-year time frame reflects EPFD's initiation of its electronic patient care program ImageTrend™. The data included the date the call was placed, POE, an initial computer-aided dispatch (CAD) complaint, patient age, gender, race (if noted), stated complaint,

provider impression (diagnosis), transport code, and responding unit time-out-of-service. Data on who contacted 9-1-1 or how the patient presented to the POE was not documented. Though CAD diagnoses are discussed, this study's diagnosis classifications were based on provider impressions, not CAD or patient-stated complaints. Data were analyzed using Microsoft Excel.

The Texas Tech University Health Science Center's institutional review board (IRB) assessed the study. It determined that the study design was exempt from further review as the data used in the study did not contain any identifiable patient information (IRB # E22085).

**RESULTS**

During the six-year study period, 8407 prehospital fire department EMS encounters occurred at one of the three El Paso-Juárez POE, averaging 116 monthly calls or 1401 per year. Of these encounters, the busiest year was 2021, with 1557 encounters, and the slowest year was 2017, with 1241 encounters (Figure 1). During the study period, July was the busiest month, with a median of 132 encounters, and April was the slowest, with a median of 105 encounters (Figure 2). Thursdays were the busiest day of the week (Figure 3).

Of the 8407 calls, 3796 (45%) took place at the Paseo Del Norte POE, 3077 (37%) at the Bridge of the Americas POE, and 1534 (18%) at the Ysleta POE. The study population consisted of 4129 (49%) males, 4266 (51%) females, and 12 encounters with unrecorded or unknown genders. Patients' ages ranged from 0 to 103 years, including 31 newborn deliveries, with an average patient age of 42.4 years. A population pyramid of age and sex distribution demonstrates that women between the ages of 16 to 25 were the most prevalent age and sex encountered during the study period (Figure 4).

The PSAP initiated an emergent lights and sirens response 8367 times, representing 99.5% of all responses to a POE, while only 1137 patients were transported with lights

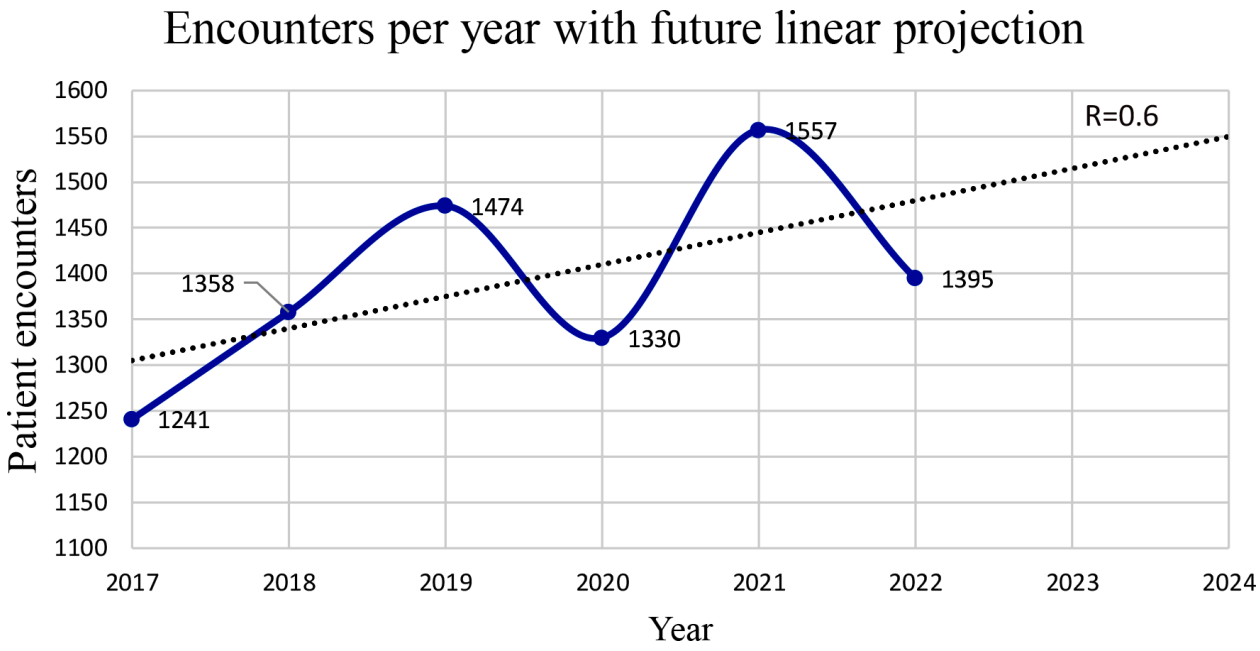


*Figure 1*: Encounters Per Year.

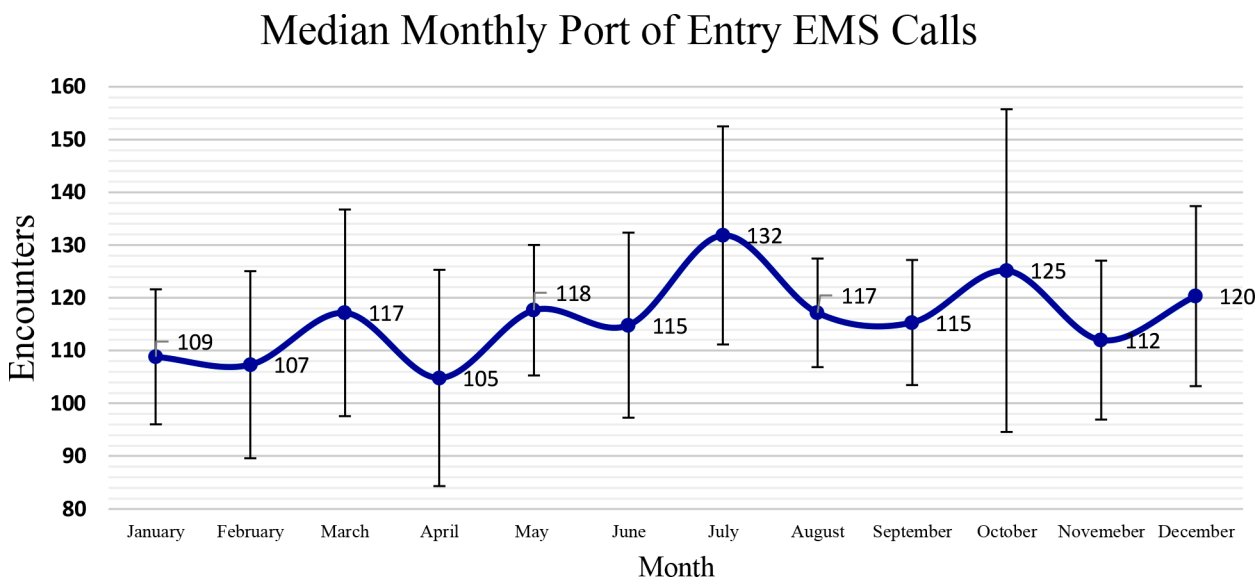


*Figure 2*: Median Monthly Encounters.

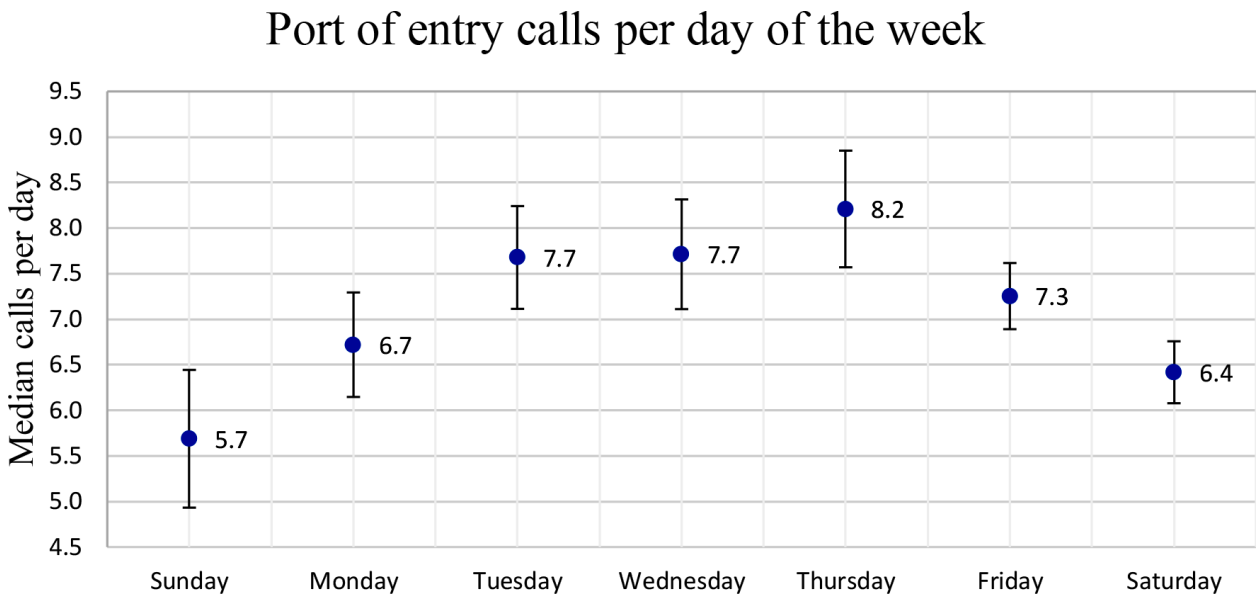


*Figure 3*: Average Call Per Day.

and sirens from the POE to a hospital, representing 13.5% of patient transports. A PSAP computer-aided dispatch complaint of "sick person" accounted for 2295 (27%) of all complaints. The remaining four most frequent PSAP CAD complaints account for 62.3% of all CAD complaints and include abdominal pain, pregnancy/childbirth, breathing problems, and chest pain.

When examining EMS diagnoses rather than CAD complaints, weakness was the most frequent diagnosis with 988 (11.8%), followed by abdominal pain with 873 (10.4%) of the 8407 patient encounters. Non-traumatic pain accounts for 761 (9.1%), and OB-contractions account for 464 (5.5%) patient encounters. There were 220 (2.6%) encounters with no diagnosis listed. All diagnoses were grouped into one of thirteen categories based on organ systems or complaint type to better understand and evaluate the data. These categories

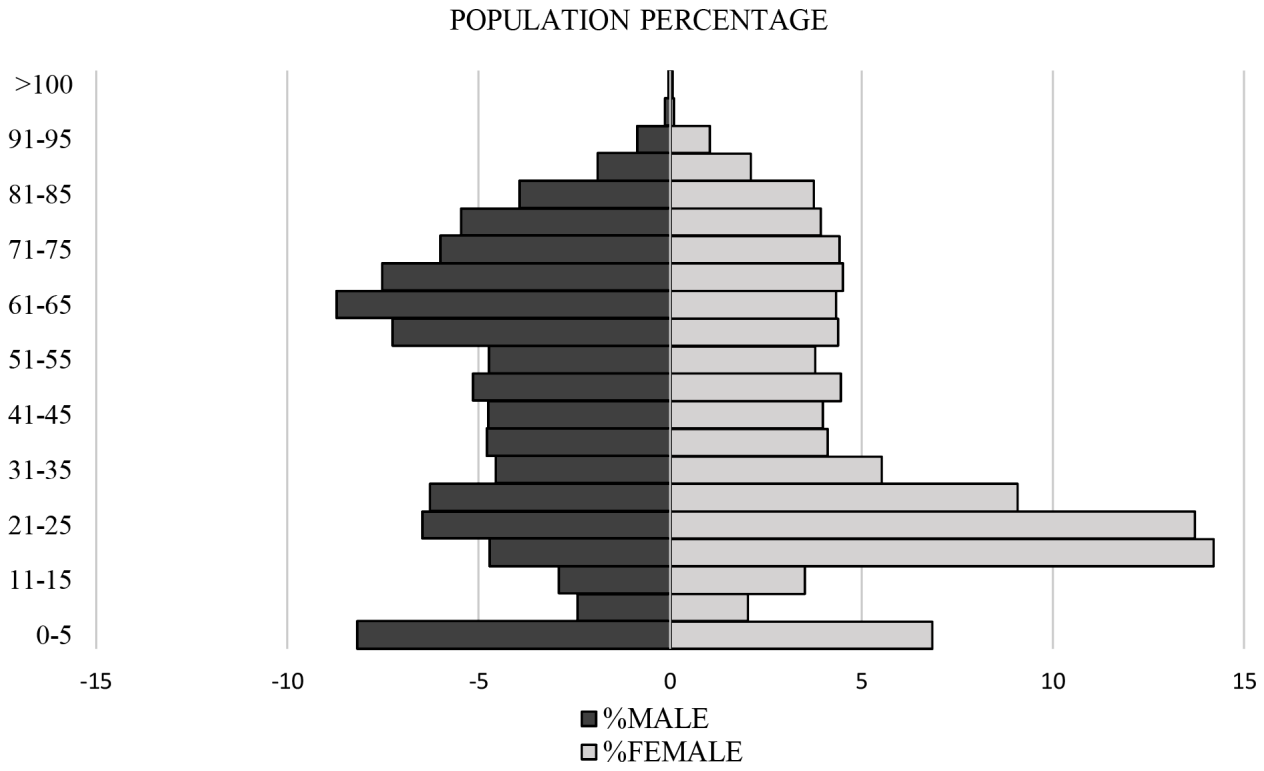


*Figure 4*: Population breakdown by sex and age.

included infectious, non-traumatic pain, endocrine, ENT, GI/GU, neurological, environmental, substance abuse/behavioral, cardiovascular, injury/trauma/burns, obstetrics/newborn care, respiratory, and "other." When grouped into these categories, neurological diagnoses were the most prevalent, accounting for 1908 (22.7%) of all encounters. The neurologic group included the diagnosis of weakness, seizures, stroke, syncope, headache, and altered mental status. GI/GU complaints were the second most prevalent diagnosis, accounting for 1263 (15%) encounters, and included generalized abdominal pain, constipation, diarrhea, melena, hematemesis, nausea/vomiting, pelvic pain, vaginal bleeding, and foreign bodies. The third most common category was injury or trauma, with 1117 (13%) encounters, including trauma and burns. Other common categories included non-traumatic pain with 761 (9.1%), OB with 709 (8.4%), and cardiovascular and respiratory complaints with 529 (6.3%) and 542 (5.4%) encounters, respectively (Table 1 and Figure 5).

The proportion of Hispanic or Latino patients documented was 59.8% (5030), although this number is likely significantly higher given that the race or ethnicity of 3140 patients (37.3%) was not recorded or left blank in the electronic

| **Neurological** | **1908 (22.7%)** |
|---|---|
| Neuro - Seizure, Status Epilepticus | 194 |
| Neuro - Headache, Migraine | 153 |
| Neuro - TIA, Stroke, Hemiplegia, Paraplegia, Quadriplegia | 140 |
| Neuro - Unconscious | 130 |
| Syncope - Syncopal Episode (or near) | 57 |
| Neuro - Neuro Problem Not Otherwise Listed | 46 |
| Neuro - Vertigo | 19 |
| Neuro - Altered Mental Status | 181 |
| Weakness, Malaise | 988 |
| **GI/GU** | **1263 (15%)** |
| GI/GU - GI, GERD, Abdominal pain, appendicitis | 873 |
| GI/GU - Constipation, diarrhea | 36 |
| GI Bleed - Melena, Hematemesis, Nausea/vomiting | 202 |
| GI/GU - Foreign Body Genitourinary Tract | 10 |
| GI/GU - Vaginal Bleeding, Pelvic pain GU not otherwise listed | 142 |

*Table 1.* Encounters by Category.

patient record. The remaining 237 (2.8%) patients were listed as Black, White, Asian, Pacific Islander, or Native American.

Of the total calls, 13% were classified as trauma. Males accounted for a greater proportion of trauma calls at 61%, while females accounted for 39%. For medical calls, females represented 54% of the patients and males accounted for 46% of the medical patients.

Throughout the study, 6420 hours were spent responding to POE calls, with the average call resulting in a 46-minute ambulance unit outage. The El Paso Fire Department spent a median of 90 monthly hours on POE response and transport, corresponding to a unit hour utilization (UHU) of 0.161 (SD 0.01). Considering task time, the UHU decreases to a median of 0.124 (SD 0.008), indicating that 16.1% of calls and 12.4% of the unit's in-service time would be spent responding and transporting from a U.S. entry point to a local hospital if only one 24-hour ambulance was responding to the POE. It is important to note the relative proximity of the three POE to the two closest hospitals, including the region's Level 1 trauma center. Depending on the POE, the distance to a hospital can range from 1 to 11 miles, effectively decreasing unit outages.

The U.S. POE were closed to non-essential travel during the COVID-19 pandemic from March 2020 until September 2021. Despite this, the POE continued to operate 24 hours per day, seven days per week. The median number of calls performed monthly during the pandemic closure was 116 (SD 26), while the median number of calls performed monthly during the two years prior to the closure and one year after reopening

| **Injury/trauma/burns** | **1117 (13%)** |
|---|---|
| Injury - Lower extremity | 297 |
| Injury - Upper extremity | 187 |
| Injury - Head, Neck, Face | 328 |
| Injury - Thorax, Abdomen Pelvis | 151 |
| Injury/Burns- first, second or third | 29 |
| Injury - Not Otherwise Listed | 125 |
| **Pain (non-traumatic)** | **761 (9.1%)** |
| Pain - (Non-traumatic) | 761 |
| **OB/newborn care** | **740 (8.8%)** |
| OB- OB/GYN Complaint Not Otherwise Listed | 97 |
| OB - Preterm Labor with Delivery, complicated/uncomplicated | 105 |
| OB - Contractions | 464 |
| OB - Spontaneous Abortion (Miscarriage) | 42 |
| OB - Obstetric Trauma | 1 |
| OB - Newborn Care | 31 |
| **Respiratory** | **542 (6.5%)** |
| Respiratory - Arrest/Apnea | 15 |
| Respiratory - Asthma, COPD, Pulmonary edema, pneumothorax | 308 |
| Respiratory - FB, Smoke Inhalation, Not Otherwise Listed | 219 |
| **Cardiovascular** | **529 (6.3%)** |
| CV - Pulmonary Embolism | 4 |
| CV - Chest Pain - Angina, MI, STEMI, Presumed Cardiac | 325 |
| CV - Cardiac Arrhythmia/Dysrhythmia, CHF | 54 |
| CV - DOS/Obvious Death | 5 |
| CV - Cardiac Arrest | 46 |
| CV - Hypertension/hypotension | 92 |
| CV - Abdominal Aortic Aneurysm | 3 |
| **Substance Abuse/Behavioral** | **501 (6%)** |
| Abuse of Substance | 32 |
| Abuse of Alcohol or withdrawal | 90 |
| Behavioral - Anxiety/Depression | 289 |
| Behavioral - Suicidal/Homicidal Ideation/Attempt | 17 |
| Behavioral - Hallucination - Auditory/Visual | 7 |
| Behavioral - Disorientation/hostel/violent/strange behavior | 55 |
| Behavioral - Mental Disorder Not Otherwise Listed | 11 |
| **Infectious** | **435 (5.2%)** |
| Infectious - Encephalitis, Encephalomyelitis, Meningitis | 6 |
| Infectious - Sepsis | 51 |
| Infectious - SARS, Influenza, RSV, Pneumonia, Covid, etc. | 205 |
| Fever | 173 |
| **Endocrine** | **189 (2.3%)** |
| Endocrine - Hypoglycemia | 64 |
| Endocrine - Hyperglycemia | 117 |
| Endocrine - Disorder - Other | 8 |

*Table 1 (continued).* Encounters by Category.

was 119 (SD 16), representing only three fewer calls per month during the COVID closure. During the 19 months of the COVID-related border closure, the average monthly time spent on POE calls was 90 hours, compared to 92 hours in the years before and after the COVID closure.

| | |
|---|---|
| **Other** | **130 (1.6%)** |
| Not Applicable | 1 |
| Anemia (other) | 10 |
| Cancer (other) | 26 |
| Maltreatment - Adult or child Physical Abuse, Rape Suspected | 6 |
| Allergic Reaction | 38 |
| Bleeding or Hematoma Post Procedure/Medical Device | 19 |
| Congenital Deformity (other) | 1 |
| Dehydration (environmental heat emergency) | 15 |
| Mobility - Reduced/bedridden | 14 |
| **Environmental** | **56 (.7%)** |
| Environment - Heat Stroke/Exhaustion | 14 |
| Environment - Toxic Exposure, Poisoning | 30 |
| Environment - Stings/Venomous Bites | 9 |
| Environment - Hypothermia | 2 |
| Environment - Electrocution | 1 |
| **ENT** | **16 (.2%)** |
| ENT - non-traumatic | 16 |
| **No diagnosis** | **220** |

*Table 1 (continued).* Encounters by Category.

## DISCUSSION

This is the first investigation into the epidemiology of 9-1-1 EMS responses and prehospital care at the U.S.-Mexico border at the El Paso-Juárez POE. Previous research has described the epidemiology of 9-1-1 medical responses by EMS at the San Diego-Tijuana POE (Farah et al., 2019). An earlier study by Baker described the care provided by the U.S. Border Patrol (USBP) in the El Paso sector (Baker, 2017). In that study, Baker described encounters made solely by USBP EMS agents along the border, not at the POE, which U.S. Customs is responsible for. Patients were frequently discovered by USBP agents attempting to cross the desert into the United States, scaling or falling from fences, or having been involved in a motor vehicle crash. This may explain why 42% of USBP EMS calls in that study were traumatic, a stark contrast to this and other studies looking at the epidemiology of calls along the U.S.-Mexico border POE.

The study population presenting to the El Paso POE comprised roughly equal numbers of males and females at 49.1% and 50.6%, respectively. Women aged 21 to 30 accounted for 22.8% of all female encounters, while females under 20 accounted for an additional 26.6%. The male population had a much more even age distribution, with the most significant proportion belonging to those between 61 and 70 years old (16.8%), nearly twice that of the female population in the same age group (8.9%). 13.2% of the male population were between the ages of 21 and 30, and 18.8% were less than 20.

The most common diagnoses were neurologic, which included weakness, GI/GU, and traumatic pain/burns which was the same as seen in the San Diego study. Both studies showed similar rates of cardiac complaints at 6.3% in San Diego and 6.9% in El Paso. Other differences between the two study locations include increased O.B. encounters at the El Paso POE (8.8% compared to 5.5% at San Diego) and increased substance abuse and psychological encounters at 6% compared to 3.3% in the San Diego study.

Though it was not a leading diagnosis, it is important to recognize the high number of infectious disease diagnoses and how this may be due to the emergence of COVID during the study period. The San Diego-Tijuana POE saw a significantly higher proportion of respiratory complaints, with 11.1% of all encounters being respiratory versus 6.5%

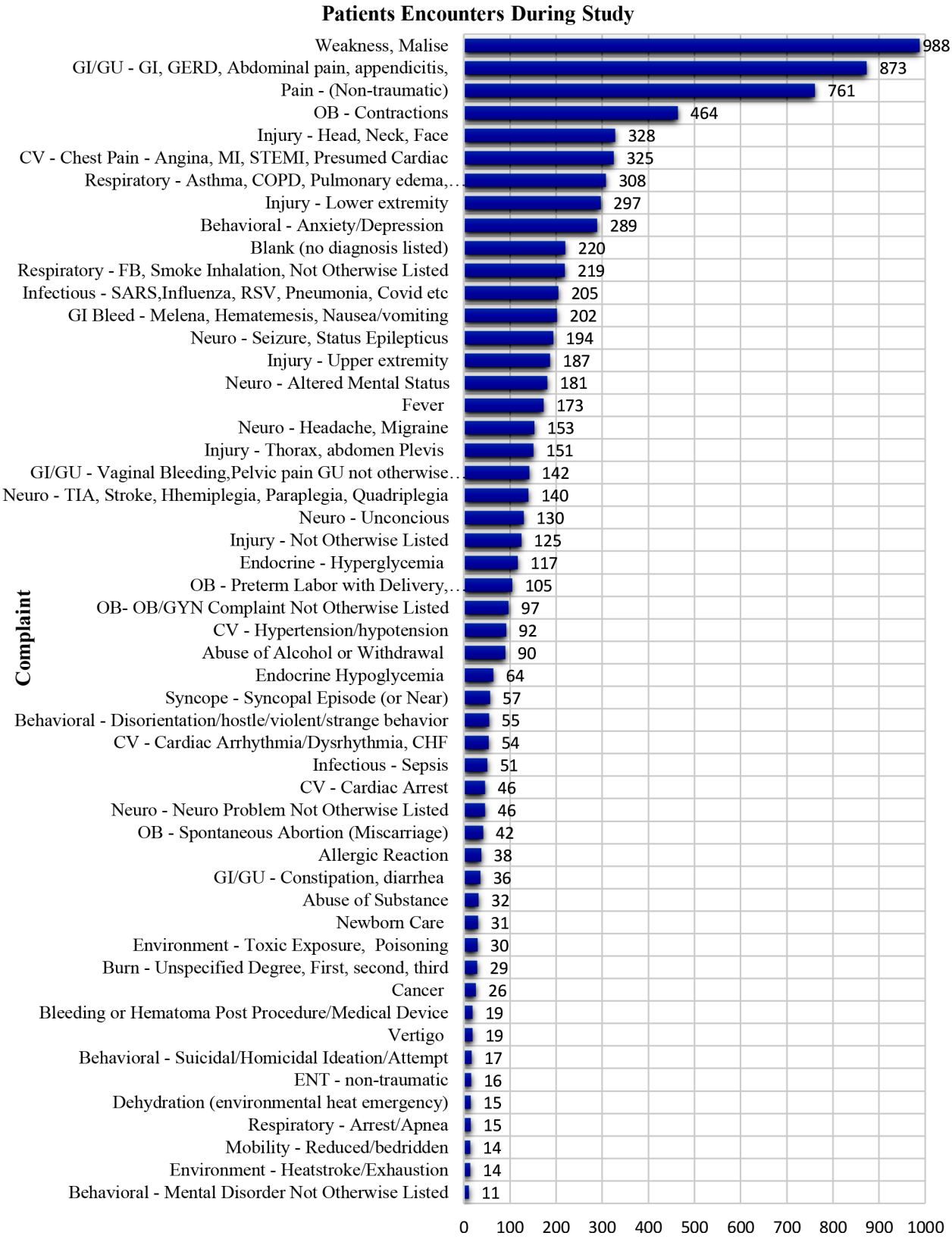


*Figure 5.* Diagnosis in Order of Frequency (Top 80%).

in El Paso-Juárez. The El Paso-Juárez POE saw higher rates of infectious complaints at 5.2% compared to San Diego-Tijuana at 1.9%. The increased difference in the diagnosis of infection could be due to coding variation or due to the time frame in which this study was conducted. This study was conducted between 2017 and 2023, with the first COVID diagnosis occurring in 2019 and the disease's peak prevalence between 2020 and 2021 (Centers for Disease Control and Prevention, 2023).

When we observed the number of EMS responses to the POE during the COVID-19 pandemic, the temporary border closure had little impact on the median number of calls performed by EPFD, but more variability was seen in the monthly call volume. The monthly EMS hours spent on POE calls were not significantly impacted either.

More current considerations for infectious diseases have become an issue as migrants cross into the U.S. at the El Paso POE. The movement of people across the U.S.-Mexico border, whether it be for leisure, work, or asylum-seeking purposes, may contribute to encounters of infectious diseases. Migrants, often coming from resource-constrained regions with inadequate healthcare, may unknowingly carry infectious diseases and introduce them into the United States or destination country (Greenaway & Castelli, 2019).

In recent years, the influx of migrants from Central and South America has coincided with a surge of illnesses such as tuberculosis and malaria (Agudelo Higuita et al., 2023; Centers for Disease Control and Prevention, 2023; Curry et al., 2022; Greenaway et al., 2011). EMS units that respond to the POE should have additional protocols and personal protection equipment (PPE) specific for suspected infectious and communicable diseases. EMS personnel may also require additional training to identify and treat patients with suspected infectious diseases properly.

The most common ethnicity in the study was Hispanic or Latino, and the most common language spoken by patients was Spanish. Individuals may have limited or no proficiency in English and these linguistic barriers can impair communication of medical needs and history, leading to inaccurate diagnoses and improper treatment. This has never been more significant than since the mass influx of persons who are crossing into Texas. Many of these individuals are from Central and South America and often speak an unfamiliar dialect of Spanish or other native languages. To address these linguistic challenges, various measures could be implemented at border crossings to ensure efficient EMS care despite language barriers. One solution is to include multilingual staff or translators who can assist in communications between medical professionals and patients. Having trained interpreters proficient in different languages available at POE can help the communication gap, facilitating the accurate understanding of medical issues. Additionally, technological advancements can play a significant role in overcoming language barriers in emergency medical situations. Integrating translation tools, virtual interpreters, voice recognition software, or even handheld devices capable of real-time translation could greatly enhance communication between healthcare providers and patients at POE.

The number of encounters has been increasing throughout the six-year study period. The linear regression model predicts the number of EMS responses to the POE is expected to increase by approximately 50 calls per year in 2023 and 2024. The gradual predicted increase in patient encounter volume can aid future staffing plans, resource allocation, and equipment purchasing.

Given the patient arrival distribution is highest during the week specifically on Thursday, and highest during July, staffing and ambulance models can adjust to increase unit availabilities on the busiest days and at the busiest POE.

Although not specifically addressed in the data, some patients arrive in a foreign ambulance with unfamiliar equipment and medications. EMS units responding to the POE should be familiar with comparable medications and alternate infusions or equipment that the patient may be receiving. EMS units should be ready to provide the appropriate substitute to optimize patient care. A patient may arrive in a foreign ambulance or with equipment that may not be able to transfer into a United States ambulance, such as a pediatric isolette. In these cases, a clear policy should allow the foreign ambulance to be escorted to a United States hospital. This transfer can be extremely complicated, requiring knowledge of local, state, and federal laws. A coordinated multiagency agreement between agencies is recommended to address and solve these issues.

## LIMITATIONS

Our study has several limitations, including its retrospective design and the potential for data entry errors on ImageTrend TM, which may result in some vital information not being included or not attainable. It may also result in unintended biases, errors, or incorrect data in reporting and collection. While our study examines three of the most heavily trafficked international bridges in El Paso, it only includes some entry points in Texas. Consequently, our study's results may differ from those of other border regions or cities. This study did not include medical services provided by other agencies or law enforcement, such as the U.S. Customs and Border Patrol. Another factor that should be considered is that the COVID pandemic may have affected border crossings and medical encounters during the study period. The U.S.-Mexico border was closed for 19 months between March 2020- November 2021 (Travel restrictions - fact sheet, 2021).

## CONCLUSION

This was the first study evaluating the epidemiology of EMS response, specifically at the El Paso-Juarez POE. By understanding and evaluating the epidemiology of call volume, patient diagnosis, unit out-of-service time, and future predictions, the researchers hope to provide EMS agencies that respond to these and other POS, with information needed to improve protocols, optimize training, adjust staffing, eliminate language barriers and adequately equip EMS personnel to serve these high-traffic areas better.

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