Healthcare Equity Analysis Report

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American Medical Response, Clark County

City of Vancouver, WA

Vancouver Fire Department

Healthcare
Equity
Group

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Executive Summary

In the fall of 2019 the City of Vancouver (CoV), Vancouver Fire Department (VFD), and American Medical Response Clark County, WA (AMR) initiated a long-term process to better understand the equity within their emergency medical services and take actions to reduce identified inequities.

1. Organizational Review – an assessment of internal systems, policies, and organizational practices to identify gaps and opportunities to provide an environment where equity in performance can be better understood and modified.
2. Equity Benchmarking - a series of benchmark analyses at VFD and AMR to evaluate equity in EMS treatments. The first two EMS treatments selected for analysis were:
    a. Pain Management
    b. Cardiac Chest Pain

Organizational Review

The internal review focuses on departments at both VFD and AMR that have a direct impact on improving the visibility and treatment equity of EMS care within the City of Vancouver. Recommendations resulting from this review include:

Quality Reporting

1. Develop aggregate process-of-care reporting to improve visibility to system performance.
2. Disaggregate process-of-care reports by vulnerable patient categories.
3. Establish the capability to consistently report on the impact of training resources on system performance improvements.
4. Increase the robustness of the performance reporting capabilities within VFD and AMR to reduce reliance on outsourcing.

Training

1. When choosing training topics, prioritize current process-of-care system performance deficiencies rather than continuing education requirements.
2. Utilize aggregate process-of-care performance analysis for individual providers to improve effectiveness of training resources instead of assigning all training topics to all providers.

Community Education and Outreach

1. Encourage a strategic and proactive approach that:
    a. objectively identifies the communities most in need,
    b. aligns with organizations already working to improve the health/healthcare of the targeted communities,
    c. promotes the role EMS plays in helping to reduce health disparities, and
    d. develops the capabilities to track the effectiveness (e.g. improved community health, increased appropriate EMS utilization, etc.) of the resources applied to the effort rather than reporting on volume of effort.

Language and Interpretation Practices

1. Establish a policy or practice guideline for treating Limited English Proficiency (LEP) patients that addresses crew on-scene performance expectations, charting requirements, appropriate interpreter selection and consent obtainment.
2. Evaluate the barriers to the unused interpreter solution currently in place.
3. Conduct training and quality assurance reporting on LEP patient interactions.

Data Collection and Management

1. Revise demographic data collection to be consistent between VFD and AMR.
2. Utilize more inclusive variables, values, and charting controls for the collection of race, ethnicity, sex, gender, and pronouns.

Equity Benchmarking

Treatment Equity Analysis for Pain Management

1. Asian patients were 29% less likely, and Hispanic patients were 23% less likely to receive a pain assessment when compared to clinically comparable White patients.
2. Hispanic patients were 35% less likely to receive pain medications, even with documented moderate to severe pain, when compared to clinically comparable White patients.
3. Poor patients (as determined by insurance status) and elderly patients on Medicare were less likely to receive a pain assessment, less likely to receive pain medications, and less likely to have their pain reduced at the conclusion of EMS care when compared to clinically comparable patients with private insurance.

Treatment Equity Analysis for Cardiac Chest Pain

1. Many racial minority categories, when compared to White patients, with cardiac chest pain were less likely to receive many of the EMS protocol treatments.
    a. Black patients were 66% less likely to receive an IV or an IO at any point during EMS treatment.
    b. Asian patients were 68% less likely to have their pain assessed at any point during EMS treatment.
    c. "Other" race (likely non-White) patients were 42% less likely to receive a 12-lead, 33% less likely to receive an IV or an IO, and 46% less likely to have their pain assessed at any point during EMS treatment.
2. Female patients, when compared to male patients, were more likely to receive a reduced level of EMS treatment for cardiac chest pain.
    a. Female patients were 29% less likely to receive a 12-lead ECG, and when they did receive a 12-lead, they were 27% less likely to receive one within 10 minutes of EMS arrival on-scene.
    b. Female patients were 21% less likely to receive nitroglycerin during EMS medical treatment despite being in documented pain and without charted contraindications.

Introduction

In medicine, clinically irrelevant factors, such as a patient's race, can affect the quality of medical treatment, independent of the medical provider's awareness of this influence. In the United States, racial/ethnic minorities are more likely to receive lower quality medical care across many areas of medicine when compared with White patients.[1, 2, 3] Although there are a few exceptions,[4,5] an abundance of studies have documented evidence describing the presence and severity of racial/ethnic treatment disparities in various specialties of medical practice (e.g. emergency medicine, cardiology, and oncology). However, racial/ethnic treatment disparities in the field of Emergency Medical Services (EMS) remains relatively less examined than other fields of medicine.[6]

Recent research in emergency medical services (EMS) conducted by us and others has shown that racial minorities receive a lower quality of treatment when compared to White patients.[7, 8, 9]

The mechanisms by which these disparities are affected are complex, have a number of contributors, and are deeply embedded in our society. Additionally, they may vary by system, by region, by organizational culture, and over time.

Equity in healthcare is the absence of systematic disparities in the access and quality of healthcare between groups who have different levels of social advantage. In this context the term "social" is used to refer to factors that are societally generated or relevant, including race, gender, geographic location, and socioeconomic status (SES).[10]

In order to demonstrate a commitment to equity, individuals, organizations, and communities must engage in internal evaluations to examine existing disparities and their underlying mechanisms. If an organization lacks the capacity for such awareness it will be ineffective in making sustained and meaningful improvements. Given the complexity of institutional and individual discrimination and bias that impact medical treatments, changes to a variety of departments and practices are generally necessary to effect long-term and meaningful improvement.

In 2019 the City of Vancouver (CoV), the Vancouver Fire Department (VFD) and American Medical Response Clark County (AMR) partnered with the Healthcare Equity Group to engage staff at all three organizations and conduct an internal assessment to identify current areas of concern, and to make recommendations to improve organizational

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[1] Smedley B, Stith AY, Nelson AR, eds. Committee on Understanding and Eliminating Racial and Ethnic Disparities in Health Care, Board on Health Sciences Policy, Institute of Medicine. Unequal treatment: confronting racial and ethnic disparities in health care. Washington, DC: National Academics Press; 2003.
[2] Agency of Healthcare Research and Quality (AHRQ). 2015 National Healthcare Quality and Disparities Report and 5th Anniversary Update on the National Quality Strategy. Rockville, MD: AHRQ; 2016.
[3] Institute of Medicine. Emergency Medical Services: At the Crossroads. 2007. doi:10.17226/11629.
[4] Nafiu OO, Chimbira WT, Stewart M, et al. Racial differences in the pain management of children recovering from anesthesia. Paediatr Anaesth. 2017;27:760–767.
[5] Fuentes EF, Kohn MA, Neighbor ML. Lack of association between patient ethnicity or race and fracture analgesia. Acad Emerg Med. 2002;9:910–915.
[6] Committee on the Future of Emergency Care in the United States Health System, Board on Health Care Services, Institute of Medicine. Emergency Medical Services: at the Crossroads. Washington, DC: The National Academies Press; 2006.
[7] Young MF, Hern HG, Alter HJ, et al. Racial differences in receiving morphine among prehospital patients with blunt trauma. J Emerg Med. 2013;45:46–52.
[8] Hewes HA, Dai M, Mann NC, et al. Prehospital pain management: disparity by age and race. Prehospital Emerg Care. 2017;3127
[9] Kennel J, Withers E, Parsons N, Woo H. Racial/Ethnic Disparities in Pain Treatment: Evidence from Oregon Emergency Medical Services Agencies. *Med Care*. 2019;(September):1-6.
[10] Institute of Medicine (US) Committee on Quality of Health Care in America. Crossing the Quality Chasm: A New Health System for the 21st Century. Washington (DC): National Academies Press (US); 2001. 2, Improving the 21st-century Health Care System.

visibility to equity challenges and further develop the internal capacities in each organization to address inequities as they are discovered.

The following report presents the findings from a review of the current operations in place at VFD and AMR for charting and data collection, quality assurance and quality reporting, EMS training, and community outreach and education. For each area of operations, organizational challenges are identified, and recommendations are presented to improve each organizations' visibility to differences in the quality of treatments being provided to vulnerable patients and the effectiveness of interventions and practices designed to reduce these disparities.

Finally, detailed equity analyses are presented for two EMS treatments (cardiac chest pain and pain management) using medical charts from VFD and AMR. These analyses utilize quantitative strategies which can be applied to a variety of medical treatments and the results of the analyses provide a benchmark analysis to assist in evaluating the efficacy of future interventions and programs.

Section 1

Organizational Review

Across the US, the field of EMS is transitioning from a public safety domain to a recognized provider of healthcare services to the community. There are many important organizational steps to effectively make this transition and VFD and AMR have been successfully engaging in many of them, including using trained and dedicated paramedic providers on every patient encounter, operating with very progressive EMS protocols that allow these providers to function at the highest level of their certification, as well as a dedicated and actively involved Medical Program Director (MPD) office that clearly takes pride in providing medical direction and oversight to the local EMS community.

However, there are a number of organizational areas that require changes and improvements to help transition the operations and culture of VFD and AMR to become more efficient providers of healthcare services focused on improving the health of all of their constituents.

Quality Reporting

The ability of an organization to evaluate the degree to which healthcare services being provided are consistently high-quality for all patients requires a robust continuous quality improvement (CQI) operation. The current CQI operations at VFD and AMR present opportunities to improve each organization's ability to more effectively improve the equity of their healthcare service delivery.

The performance reporting process for EMS activities in Vancouver is guided by several resources, including the Washington State Department of Health EMS System Key Performance Indicators[11] (KPIs), the City of Vancouver Ambulance Contract, and direction and oversight from the MPD office. While there are many performance areas for an EMS organization to be proficient in to consistently deliver effective healthcare for the City of Vancouver (operational, financial, clinical, etc.), this review is restricted to the clinical performance reporting in an effort to evaluate and mitigate treatment disparities.

Predominant use of single chart reviews

For the Vancouver EMS system, the majority of the quality analysis reporting is currently conducted one medical chart at a time. This includes call data provided by AMR on cardiac arrests, CVAs[12], CPAP procedures, chest decompression procedures, cricothyrotomy procedures, endotracheal intubation procedures, rapid sequence intubation procedure, trauma system entries, STEMIs, and medical aircraft utilizations. While this type of single-chart analysis is a critical component of an effective quality assurance program and should be continued, it does not provide an effective method to objectively measure or provide visibility to overall system performance over time or to evaluate trends in performance that may be difficult to distinguish with single-chart analysis.

[11] https://www.doh.wa.gov/Portals/1/Documents/Pubs/530183January2017.pdf
[12] For a list of abbreviations used in this report, see the Appendix.

The Washington State Department of Health EMS System has recommended KPIs to support aggregate performance analysis, but the effectiveness of these recommendations is restricted due to a number of challenges. The recommendations:

- do not include disaggregated reporting of KPI performance by patient race;
- are limited to only seven call types and one procedure, with very few KPIs for each;
- are restricted to procedures with evidence of clinical effectiveness, and thus represent a small subset of treatment protocols and medical procedures executed; and
- are restricted to procedures with WEMSIS data availability, an unnecessary limitation for agencies like VFD and AMR when working with internal data systems (ESO and MEDS).

Limited process-of-care reporting

In order to effectively monitor the overall performance of an EMS system both outcome analysis and process analysis must be performed.

Outcome Analysis

The effectiveness of EMS treatments can be evaluated in many ways, including assessing patient outcome after EMS treatment. Unfortunately, for many emergency conditions, EMS treatments have a small or unknown relationship to improving and/or contributing to a patient's health outcome. Treatment protocols remove the necessity for each EMS provider to review the latest medical research and make a personal determination on appropriate treatment. Instead, through the development of EMS treatment plans, the Medial Director and the agency leadership choose the most effective treatment protocol, or standard of care, for each emergency condition.

Process Analysis

Process reports focus on the performance of EMS crews in delivering a protocol independent of patient outcome.

Example: Cardiac Arrest

For cardiac arrest, evaluating ROSC rates on large populations can be an effective an outcome measure. However, achieving ROSC in a cardiac arrest patient may have very little to do with the EMS team's performance and instead is often influenced by the patients pre-existing medical conditions, bystander CPR, early use of an AED, etc. In this example, if only patient outcome reports are communicated, without aggregate process-of-care reports, visibility to the quality of treatment being provided is lost.

Currently VFD and AMR consistently produce several patient outcome reports for cardiac arrest, STEMI, and stroke patients and provide call data to the MPD office on a number of other call types, including patients in severe respiratory distress and trauma entry patients. Further data is provided on patients who receive certain procedures including CPAP, RSI and ETT. However, in each of these cases where data is provided, there is no consistent aggregate reporting performed that would inform all parties involved (MPD, VFD, AMR, and CoV) on the treatment performance of the system. Without this type of reporting, there is a blind spot in determining if crews are meeting

performance expectations, and whether or not treatments are being performed consistently between different populations in Vancouver.

Importantly, inequities in outcomes are influenced by a network of social determinants of health that EMS crews will have limited influence over, while for treatment or process-of-care inequities each agency has a much greater level of influence to improve.

The effectiveness of training efforts on improving system performance is largely unknown

Currently, there is no systematic and consistent performance reporting that provides feedback on the effectiveness of resources spent on EMS clinical training efforts.

This is an organizational deficit that limits the ability to learn and grow from experimentation, and without the organizational mechanisms to improve the accountability of training resources, the strategic asset that the training department represents is reduced to reporting on efforts versus results.

Outsourcing of quality reporting

Currently, the quality performance reporting process consists of the individual agencies (VFD and AMR) providing PCR data (or data access) on select call types to the MPD office, which is responsible for determining if the EMS agency is clinically performing according to expectations. This structure places each EMS agency at a strategic organizational disadvantage in that it places the capacity to evaluate performance outside of their agency. This structure distances VFD and AMR from an intimate understanding of their contribution to system performance and limits their ability to be nimble and experiment in an effort to improve system performance.

While both the MPD office and the CoV require data and reports to be provided, they do not restrict an agency from performing their own performance reports so that they are able to better understand their own clinical performance. When asked how they know if their EMS crews are clinically performing according to protocols, both VFD and AMR reported that they don't have a good understanding of system performance and share the perception that this is the responsibility of the MPD office.

Having this capability present within each agency would provide the ability to establish additional strategic clinical performance objectives that the MPD office doesn't have the bandwidth or ability to support. It would also reduce a power differential where one party has the capabilities (data and skill sets) to determine if success was achieved and instead encourage a relationship where collaborative performance evaluation decisions can be made.

Performance reporting does not allow focus on vulnerable populations

Within existing patient outcome reports all system performance reports should be stratified, or broken out, by the vulnerable populations of concern. Currently, all performance reports that are completed are reported in aggregate that does not provide visibility to possible variations in performance levels.

Recommendations

1. Build and execute consistent periodic aggregate process-of-care reports, beginning with the Time Life Critical (TLC) call types as well as the critical procedures where reporting data is already provided. Expand the list of variables evaluated to include data on race, insurance status, and weight in addition to the data elements needed to report on treatment performance.
    a. For example, in the equity analysis for cardiac chest pain performance presented in Section 3 of this report the following protocol-driven treatment criteria were analyzed:
        i. Was a 12-lead performed?
        ii. Was a 12-lead performed within 10 minutes of arrival?
        iii. Were at least two pain assessments performed?
        iv. Was an IV or IO attempted?
        v. Was ASA administered, unless contraindicated?
        vi. Was an NTG administered to patients in pain, unless contraindicated?
        vii. Was Fentanyl administered to patients in pain, unless contraindicated?
        viii. Was a STEMI alert performed when a STEMI was diagnosed?
        ix. Was the patient transported CODE if an AMI was suspected?

2. Stratify aggregated process of care reports by "social categories." Begin by simply grouping the performance report by race, gender, insurance status, and obesity status. As the organizations' statistical skill sets increase, begin to introduce statistical controls in an attempt to better isolate variables to provide improved visibility to the relationship between a patient's social characteristics and the treatment they receive.
3. Develop training effectiveness reporting. Start small, possibly with major training events only, and build "before" and "after" performance reports that are designed to measure field performance changes based on the training efforts provided. Over time institutional knowledge will improve and each agency will be able to more precisely understand what type of training works best for different types of performance challenges and how often certain training topics need to be repeated.
4. Increase performance reporting capabilities within each agency. All of the recommendations above will require an increase in the robustness of both the data environments as well as the ability to turn raw data into meaningful and actionable performance knowledge. Having each agency be intimately familiar with their field performance and the inherent data and charting limitations will provide a strategic increase in agency capabilities, allowing for improved decision making in many areas including training, budgetary planning, new equipment planning, hiring, etc.

Training

Training Topic Selection

Currently, training topics are primarily determined through the MPD office in consultation with the State of Washington and agency leadership and executed through the Paramedic Continual Education Program (PCEP). This

approach produces two primary challenges as it relates to utilizing the training department to improve the equity of treatment within the EMS system:

1. Currently the selection of EMS clinical training topics appears to be primarily, although not exclusively, driven by the continuing education (CE) requirements required for an EMS provider to be re-certified with an EMS license. While it is important to make sure the current EMS workforce is able to maintain their credentials, the continuing education requirements as determined by the state may not reflect the current local EMS performance challenges.
2. A further challenge in prioritizing CE requirements in determining training topics is that it overlooks individual performance variation by having all providers train on all CE topics. Utilizing training resources in a 'one size fits all' fashion is an inefficient training method when compared to an approach that recognizes individual performance variation and utilizes a more targeted approach to provide a more efficient and simplified training curriculum to individuals based on demonstrated needs.

Assessment

As mentioned above, the training department does not have the capabilities to consistently determine if its efforts are improving system performance. This places the training department at an organizational disadvantage as it is not able to report on its effectiveness but instead is limited to reporting a list of the training efforts conducted.

Recommendations:

1. Choose training topics based more on system performance deficits than CE needs. Once process-of-care reports are established, utilize this strategic organizational asset to guide allocation of training resources.
2. Collaborate with the quality reporting teams to improve the training department's capability to more directly link training resources to system improvement outcomes.
3. Increase the reporting granularity to provide employee level (or team, or station) reporting to support training to EMS providers that need the training (due to lack of opportunity to practice, poor performance, CE needs, etc.) instead of inefficiently providing all training to all providers regardless of need.

Community Education and Outreach

While there are considerable efforts and resources being dedicated to community outreach and education at AMR, VFD has chosen to not allocate significant resources in this area. In our review of these departments several challenges became apparent that have an impact on the vulnerable populations being served in the Vancouver community:

1. Like many EMS agencies that have community education and outreach departments, there is a lack of a strategic plan that clearly links efforts in these areas with the overall mission of the organization and the City. Without an understanding of where the most critical needs are in the community, resources and personnel time are often directed towards momentum from past program participation and/or to those most able to effectively request resources instead of those in greatest need.
2. Again, like their peer agencies, AMR and VFD do not have an effective way to measure the success of their efforts in community education and outreach. Currently, assessment in these areas is restricted to a listing

of events and the number of community members who had an interaction with an AMR or VFD staff member. This effort-based reporting approach leaves the department vulnerable as a perceived cost center instead of being viewed as a strategic asset that can demonstrate how its efforts improve the health and healthcare of the community.

Recommendations:

1. Perform a comprehensive community needs assessment that seeks to evaluate the most critical health and healthcare disadvantages in the Vancouver population.
2. Seek to partner and align resources with health and healthcare organizations that are already working to improve the health or healthcare of the most vulnerable communities in Vancouver.
3. Where applicable, seek to understand where EMS can contribute to improving the health or healthcare of these populations.
4. Based on the needs and communities identified above, work to develop the ability to report on the effectiveness of department efforts. As an example, in many communities racial minorities are less likely to call 911 during medical or traumatic emergencies. In partnership with local hospitals, an examination of the routes through which different patients engage emergency medical treatment in Vancouver can be evaluated. Once current conditions have been identified, work to reach out to impacted communities to learn more about the reasons, and work with community members to remove barriers to engaging 911 during medical emergencies.

Language and Interpretation Management

Patients who do not speak English or prefer not to speak English in medical situations, referred to as Limited English Proficiency (LEP) patients, are particularly susceptible to being undertreated, both in EMS and within healthcare more broadly. This is a significant issue for racial minority patients as they are much more likely to also be LEP patients. Many EMS organizations are ill-equipped to effectively manage the barriers to providing effective and equitable health care for LEP patients. For VFD and AMR this has led to a number of organizational challenges, including:

1. Neither VFD nor AMR currently have charting standards specific to LEP patients. Without a structure to allow crews to easily chart that a patient is LEP and the associated interpreter interactions, the agency is unable to understand the size of LEP patient population or report on the quality of EMS treatment for these patients.
2. AMR has an interpreter phone line that is provided to crews to use as well as a cell phone in the ambulance, however the service was not utilized during 2018 or 2019. CoV also has an interpreter phone line, which was only used 8 times in 2019.
3. There is currently no policy at either agency regarding performance expectations when encountering an LEP patient. Without policies in place, crews do not have guidance on the appropriate selection and consent of a medical interpreter (including the use of children or EMS personnel as interpreters), which presents significant issues for patient care and liability.

Recommendations

1. Establish a policy or practice guideline that, at minimum, specifies:
    a. Charting expectations when treating an LEP patient
        i. Patient consent regarding the use and selection of an interpreter
    b. Guidelines on the use of an interpreter, including:
        i. Who is an appropriate interpreter (use of minors, EMS crew members, bystanders, etc.)
        ii. Obtaining consent of the interpreter
        iii. Exceptions during emergent patient conditions
2. Evaluate the current challenges associated with utilization of the current language interpreter line.
3. Conduct training on the unique needs for this patient population, and on EMS crew performance, practice, and charting expectations.

Data Collection and Management

> "The ability of hospitals, health plans, and other healthcare organizations to identify and address racial and ethnic disparities hinges on their capacity to collect information about their patients' race, ethnicity, and language proficiency."[13]

Demographic data can be surprisingly complex and nuanced. Race, gender, ethnicity, and other categories that are defined socially and culturally are in constant evolution as our communities and self-identities change. The words used to describe these identities can become associated with complicated histories and experiences that further modify their use and meaning.

The ability of healthcare providers to be informed by a patient's sex, gender, and preferred pronouns accurately is critical to providing high-quality patient centered care. We also know that highlighting race, gender, and other socially charged identifiers can magnify social-psychological impacts of stereotypes.[14]

Having comprehensive, valid, and reliable charting data for both the patient demographic characteristics as well as the medical care that is provided is a foundational component to building an environment where quality and equity of care can be evaluated. At the same time, we should expect demographic categories to continue to evolve and change over time. The most successful approach to demographic data collection is one that recognizes this and is most receptive to the needs of our population as well as best practices in data management and analysis.

Currently VFD and AMR crew members enter PCR data in two independent charting systems (ESO and MEDS) which both have a number of challenges related to collecting patient demographic data.

[13] Healthcare Disparities Measurement, Weissman et al. 2011

[14] Stereotype Threat and the Intellectual Test Performance of African Americans, Claude Steele and Joshua Aronson. Journal of Personality and Social Psychology 1995

Race and Ethnicity

Race and ethnicity are terms that relate to societal, cultural, and historical ideas about heritage, skin/hair/eye color, geography, language, and even religion. It is important to note that while our societal structures and biases of race and ethnicity have led to serious differences in risk factors for a variety of medical conditions, there are no medically relevant differences between people of different race/ethnicity identities.

Sometimes a distinction is made between a race and an ethnicity. While this may be relevant for some contexts, there is no single definition of either term. Current best practice is to allow identification with multiple categories that could be considered race, ethnicity, or both, and to not force a distinction between race and ethnicity.

Gender

Gender is a term used to describe societally relevant characteristics that relate to masculinity, femininity, some combination of both, or neither.

Sex

Sex is generally used to describe an individual's chromosomal genetics. It is important to note that while chromosomal genetics are most often associated with the presence or absence of different genitalia and/or sex organs, this is not always the case and these characteristics may change over time without medical intervention.

Transgender

Transgender is an umbrella term that refers to people whose gender identity, expression or behavior is different from those typically associated with their assigned sex at birth. Other identities considered to fall under this umbrella can include non-binary, gender fluid, and genderqueer – as well as many more.

Pronouns

A patient's preferred pronouns may be independent of their sex or gender. There are a wide range of pronouns that may be preferred, including she/her/hers, he/him/his, or they/them/theirs, and different pronouns may be preferred in different contexts.

Race and Ethnicity

Currently, VFD and AMR charting systems do not require a value to be recorded for patient race. Both AMR and VFD charts limit entries to one value for race, and VFD charts allow one (optional) entry for ethnicity. Between 2015 and 2019, 42% of VFD charts and 98% of AMR charts had a value for race, and 24% of VFD charts contained values for ethnicity (based on PCRs from pain management and cardiac chest pain received for analysis).

Each charting system uses different allowable values:

AMR	VFD	
Race	Race	Ethnicity
American Indian	American Indian or Alaska Native	
Arab or Middle Eastern		
Asian	Asian	
Black or African American	Black or African American	
Black/African American		
Caucasian		
Hispanic or Latino	Hispanic or Latino	Hispanic or Latino
		Not Hispanic or Latino
Native Hawaiian	Native Hawaiian or Other Pacific Islander	
Pacific Islander		
Other Race	Other Race	
White	White	
Unknown	Unknown	
Not Applicable		
Not Known		
Not recorded		
Not Reporting		
NULL		

Challenges

There are several challenges with the ways in which race data is currently being collected at both agencies:

1. Because race is not a required field, EMS crew members are able to complete PCRs without collecting a value for patient race. The risk of missing data is well demonstrated in the present case, as the majority of VFD patients do not have race represented. This lack of reporting produces a significant blind spot in evaluating quality and equity of treatment.
2. While allowing only a single race value has been the convention in many industries for the past few decades, it is no longer the accepted practice among modern healthcare providers, as well as the Federal Office of Management and Budget office, which establishes the race values for the US Census, and recognizes that individuals may identify with multiple racial categories.
3. Categories such as "other" and "unknown" may be interpreted in a variety of ways without clear and easily accessible definitions.

4. Several categories are duplicated within a single charting system (e.g. "Black or African American" and "Black/African American"; "White" and "Caucasian"; "Unknown" and "Not Known"), several categories do not have matching categories (e.g. "Arab or Middle Eastern" is an option only in AMR charts), and several categories have ambiguous definitions or distinctions (e.g. "NULL" and "Not Reporting").
5. It is currently unknown if the race value that is charted within either the VFD and AMR datasets is determined with or without the consultation of the patient.
6. The values of Hispanic or Latino value are collected as both a race value and an ethnicity value.

Gender and Sex

Both VFD and AMR charts require one of the following values to be selected on each patient chart:

- Male
- Female
- Not Reported
- Unknown

The AMR charting system defines this variable as "Sex" while VFD defines it as "Gender."

Currently, VFD's charting environment asks for gender, but not the patient's sex or preferred pronouns. We suspect the collection of gender data by VFD crews is more likely data on the patient's sex. AMR charting system currently asks for patient sex, but not gender or preferred pronouns.

Individual Treatment Refusals

One of the ways in which treatment disparities may manifest is through the refusal process of individual treatments. In these situations, the EMS provider may offer certain treatments per protocol but the patient, for a variety of reasons, may refuse individual treatments but not refuse the totality of EMS treatment. There is currently no reliable method to capture when this individual refusal process takes place in the PCR. Further, it's likely there is no practice guidelines, training, or reporting to support the consistent use of this refusal process.

Recommendations

1. Distinguish between demographic data determined by the EMS provider, and data provided by the patient, only one of which is required to be populated in order to complete the PCR, but allow both to be collected:
    a. Demographic data as determined by the EMS provider
        i. This data would be filled in when it is inappropriate (training required) for the EMS provider to ask the patient (unconscious, altered, etc.).
    b. Demographic data as determined by the patient
        i. This data would be filled in when the patient describes which categories they most identify with.
        ii. Only collect demographic data from patient at the end of the patient interaction when possible.
2. Use the same demographic data collection categories and options on both VFD and AMR charting systems

3. Allow multiple options to be selected for all demographic data categories.
4. With engagement from the local community, determine a more comprehensive and reflective demographic data collection process. Consider utilizing categories that would allow cross-comparison with 2020 Census Data. This evaluation should include, at a minimum, data strategies for race/ethnicity, gender, sex, transgender status, and pronouns.
5. Introduce the data fields necessary to allow an EMS provider the ability to indicate that an individual treatment was offered and refused by the patient.

Example Demographic Data Collection

How do you identify your race and/or ethnicity? (select all that apply, adding additional self-described categories as needed)

- ☐ African
- ☐ Alaska Native
- ☐ American Indian, Native American
- ☐ Asian
- ☐ Asian American
- ☐ Asian Indian
- ☐ Black, African American
- ☐ Chamorro
- ☐ Chicana, Chicano, Chicanx
- ☐ Chinese
- ☐ Cuban
- ☐ Filipino
- ☐ Hispanic
- ☐ Japanese
- ☐ Korean
- ☐ Latino, Latina, Latinx
- ☐ Mexican
- ☐ Native Hawaiian
- ☐ Pacific Islander
- ☐ Puerto Rican
- ☐ Samoan
- ☐ Vietnamese
- ☐ White, Caucasian
- ☐ _____
- ☐ _____
- ☐ Prefer not to answer

How do you identify your gender? (select all that apply, adding additional self-described categories as needed)

- ☐ Female
- ☐ Male
- ☐ Non-binary
- ☐ _____
- ☐ Prefer not to answer

Do you identify as transgender? (select all that apply, adding additional self-described responses as needed)

- ☐ Yes
- ☐ No
- ☐ _____
- ☐ Prefer not to answer

If you would like to inform us of your personal pronouns, please indicate them below: (select all that apply, adding additional self-described responses as needed)

- ☐ she/her/hers
- ☐ he/him/his
- ☐ they/them/theirs
- ☐ _____

Race and gender questions and categories adapted from questionnaires and recommendations from the Human Rights Campaign, the 2020 Census, the Disparities Solutions Center, the US Department of Health and Human Services office of Minority Health, and the APA Standards for Non-Biased Language.

Section 2

Pain Management Treatment Equity Analysis

Painful emergencies represent one of the most common reasons for initiating an EMS response through the 911 system. Several published studies, including one of our own, have found convincing evidence indicating racial minorities receive a lower quality of treatment, compared to White patients, when being treated by EMS crews for a variety of painful medical and traumatic conditions.[15, 16, 17]

First, Young et al[14] investigated the use of morphine in blunt trauma calls for adults in a single EMS system in Contra Costa County, CA, and found that Black patients were half as likely to receive morphine compared with White patients when a pain score was documented. This finding is consistent with evidence of racial/ethnic treatment disparities found in previous studies of emergency department pain treatment.[18, 19, 20]

More recently, considering patient race/ethnicity as a risk factor in select traumatic injuries (fracture, burns, and penetrating trauma), Hewes and colleagues found that all racial/ethnic minority adult patients received pain medications less often than White patients after controlling for the presence of pain as a documented symptom. Further, they found evidence that children (less than 15 years of age) who were charted as racial/ethnic minorities received pain medications less often, with 10.9% of Black children receiving pain medications compared with 25% of White children.[15]

Finally, our study, recently published in the journal Medical Care, analyzed PCRs from Oregon EMS agencies and found that Hispanic patients and Asian patients were less likely to receive a pain assessment compared with White patients. Additionally, we found evidence that patients from all racial and ethnic minority groups were less likely to receive pain medications compared with White patients when receiving treatment from EMS providers for traumatic injuries.[16]

In 2019, the CoV, VFD, and AMR in Clark County initiated an analysis to determine if EMS treatments for painful emergencies varied by a patient's race, gender, SES, or obesity status in the City of Vancouver. The results of this investigation are described below.

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[15] Young MF, Hern HG, Alter HJ, et al. Racial differences in receiving morphine among prehospital patients with blunt trauma. J Emerg Med. 2013;45:46–52.
[16] Hewes HA, Dai M, Mann NC, et al. Prehospital pain management: disparity by age and race. Prehospital Emerg Care. 2017;3127:1–9.
[17] Kennel J, Withers E, Parsons N, Woo H. Racial/Ethnic Disparities in Pain Treatment: Evidence from Oregon Emergency Medical Services Agencies. *Med Care*. 2019;(September):1-6.
[18] Todd KH. Ethnicity as a risk factor for inadequate emergency department analgesia. JAMA J Am Med Assoc. 1993;269:1537–1539.
[19] Todd KH, Deaton C, D'adamo AP, et al. Ethnicity and analgesic practice. Ann Emerg Med. 1999;35:11–16.
[20] Mills AM, Shofer FS, Boulis AK, et al. Racial disparity in analgesic treatment for ED patients with abdominal or back pain. Am J Emerg Med. 2011;29:752–756.

Dataset

Inclusions

PCRs with a primary impression of either atraumatic pain or a traumatic injury occurring between January 1, 2015 and December 31, 2019 were selected from the data available in the Meds EMS charting system for AMR. VFD PCRs were linked to AMR PCRs via the Event ID. Where an AMR and VFD PCR was identified for a single incident, they were merged to create a single incident PCR resulting in 18,028 total PCRs; 15,515 (86%) with AMR PCR data only, and 2,513 (14%) with AMR and VFD PCR data.

Exclusions

Several exclusion criteria were applied in order to isolate PCRs for patients who were clinically equivalent in terms of their appropriateness to receive pain management per Clark county protocols. First, pediatric patients (< 18 years of age) were excluded as were any incident addresses with a city listed that was not Vancouver. Next, PCRs with an indication of alerted mental status (AMS), identified either through a secondary impression of AMS or a charted Glasgow Coma Scale (GCS) of < 14 were excluded. Next, PCRs that documented patient allergies of Ketorolac, Fentanyl, Ketamine, Morphine, or "pain medications" were also excluded. Finally, PCRs that resulted from interfacility or scheduled ambulance transports were excluded as this analysis was primarily focused on PCRs generated for patient interactions resulting from 911-initiated calls. The final analytical sample resulted in 18,028 PCRs, of which VFD had a PCR in 2,513 cases.

Methodology

Predictor Variables

For this analysis the primary variables of interest are the patient's "social" characteristics, including race, gender, socio-economic, and obesity status. A single race value was derived after evaluating the charted race values from both the AMR and VFD PCRs, resulting in the following race categories: White, Black, Asian, Hispanic, Other, Unknown, and "Discordant" (defined below). Race values in the "Other" category include "American Indian," "Arab or Middle Eastern," "Native Hawaiian," "Pacific Islander," and "Other Race." The "Discordant" race category included 23 PCRs (0.1% of the total sample) where VFD and AMR race values were in direct and specific conflict (e.g. for a single call, one record indicated White and the other record indicated Black). In cases where a specific race value (e.g. Asian or Black) was in conflict with a race value of "Other," the more specific race value was maintained. A gender variable was created with values of "Male," "Female," and "Discordant" where disagreement existed between VFD and AMR PCRs. In order to be able to test for the effects of treatment differences for obese patients a new variable was created using the Centers for Disease Control (CDC) guidelines for obesity. While 99% of the PCRs in the sample had a weight value, patient height is not captured in the PCR, preventing an accurate calculation of body mass index (BMI). As a proxy for BMI, a new variable was created to identify records for severely obese patients, using the CDC definitions for males and females of average heights (> 270 lbs. for males (5'9") and > 232 lbs. for an average height female (5'4").

This analysis utilized the patient's health insurance category as a proxy for the patient's socio-economic status (SES), which is a method used in other areas of healthcare research.[21] Patient insurance information was captured in an

[21] Ver Ploeg M, Perrin E, eds. National Research Council (US) Panel on DHHS Collection of Race and Ethnic Data: Appendix C, Recommendations on the Use of Socioeconomic Position Indicators to Better Understand Racial Inequalities in Health. Eliminating Health Disparities: Measurement and Data Needs. Washington, DC: The National Academy Press; 2004.

open text field in AMR PCRs that allowed multiple entries per PCR (maximum of seven in this sample). Each PCR was assigned a single insurance status based on the patient's 'highest' level of insurance in the following hierarchy: Private, Medicare, Medicaid, Other Government, No Insurance, and Unknown insurance.

Control Variables

Several control variables, which can influence EMS treatments, were incorporated in the analysis in an effort to isolate and remove any control variable effects from the effects the primary predictor variables had on the outcome variables. These control variables included the patient's age (in years), the category of primary impression (traumatic injury, abdominal pain, back and body pain, and pain management), and the patient's first documented pain score value (0-10).

Outcome Variables

Analyzing pain management in the EMS setting provides the ability to review several process measures of treatment (IV, medication administration, etc.), as well as an outcome measure of EMS care (pain reduction). The following primary process of care variables were selected based on the treatments recommended in the Clark County pain management protocols and delimited with binary values (yes/no): if two pain assessment scores were collected, if IV or IO access was attempted, and if a pain medication was administered. The reduction of a patient's pain score by at least one point on (the pain scale of 0-10) was also captured as a binary outcome variable.

Analysis

The statistical analysis was performed in three steps. First, a bivariate descriptive analysis was performed on both the demographic and clinical characteristics of the sample population. Next, several adjusted multivariable logistic regression models were created for each pain management process measure of care (pain assessment, IV or IO administration, pain medication administration) to investigate the influence the patient's social characteristics (race, gender, SES, obesity) had on their treatments while controlling for treatment variations due to age, pain location, and the patient's pain score. Finally, another adjusted multivariable logistic regression model was created to investigate if a patient's social characteristics had a relationship with the outcome of care treatment measure (reduction in pain).

Results

Descriptive Results

Tables 2 and 3 provide a demographic and clinical review of the PCRs included in the pain management analysis. General items to note include:

- The final analytical sample contained 18,028 PCRs, 86% of which contained PCR data from AMR only and 14% contained a consolidated PCR containing both AMR and VFD treatment elements.
- 99.5% charts in the sample had a non-null patient race value and 81% were characterized as White patients, 3% as Black patients, 3% as Hispanic patients, 1% as Asian patients, 10% as Other, 1% as unknown, and 0.13% were categorized as a patient with a discordant race value (unresolved conflict in race values between AMR and VFD PCR).

- The majority of the overall sample had a primary impression of Traumatic Injury (69%) with general consistency by race.
- The majority of the overall sample was female (57%), with some variation by race. A minority of Black patients were female (48%) and Hispanic patients had an equal proportion of both genders.
- Both obesity patterns and health insurance patterns mirror the trends found more generally in the US: Black patients had a higher proportion of obesity, and several minority groups had a larger proportion of patients without private health insurance when compared to White patients.

Table 2: Demographics of Atraumatic Pain and Trauamtic Injury Patients by Race (2015-2019)

	All		White		Black		Hispanic		Asian		Other		Unknown		Discordant	
	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
Total		18,028	81%	14,670	3%	519	3%	610	1%	226	10%	1,877	1%	103	0%	23
EMS Team																
AMR only	86%	15,515	86%	12,655	88%	459	90%	549	87%	196	84%	1,578	76%	78	0%	0
AMR & VFD	14%	2,513	14%	2,015	12%	60	10%	61	13%	30	16%	299	24%	25	100%	23
Primary Impressions																
Traumatic Injury	59%	10,698	60%	8,784	51%	263	65%	395	64%	145	55%	1,037	59%	61	57%	13
Abdominal Pain	18%	3,318	18%	2,593	26%	137	16%	95	20%	45	22%	422	20%	21	22%	5
Back or Body Pain	18%	3,279	18%	2,667	21%	109	16%	95	12%	26	19%	358	18%	19	22%	5
Pain Management	4%	733	4%	626	2%	10	4%	25	4%	10	3%	60	2%	2	0%	0
Gender		18,015		14,667		519		609		226		1,876		95		23
Male	43%	7,752	42%	6,218	52%	268	50%	302	37%	83	44%	834	41%	39	35%	8
Female	57%	10,180	57%	8,386	48%	249	50%	307	63%	142	55%	1,027	59%	56	57%	13
Discordant	0%	83	0%	63	0%	2	0%	-	0%	1	1%	15	0%	0	9%	2
Severe Obesity	10%	1,790	10%	1,435	20%	103	10%	60	3%	7	9%	171	13%	12	9%	2
Male	8%	582	8%	468	14%	38	7%	20	1%	1	6%	50	10%	4	13%	1
Female	12%	1,208	12%	967	26%	65	13%	40	4%	6	12%	121	14%	8	8%	1
Insurance																
Private	19%	3,479	20%	2,925	17%	86	14%	83	16%	36	18%	333	16%	16	0%	0
Medicare	26%	4,705	29%	4,182	10%	54	7%	42	15%	35	20%	368	22%	23	4%	1
Medicaid	13%	2,378	13%	1,931	22%	112	14%	84	12%	26	11%	214	10%	10	4%	1
Other Gov't	2%	330	2%	283	2%	12	0%	2	0%	0	2%	33	0%	0	0%	0
No Insurance	21%	3,759	18%	2,658	25%	131	45%	277	31%	69	31%	587	23%	24	57%	13
Unknown	19%	3,377	18%	2,691	24%	124	20%	122	27%	60	18%	342	29%	30	35%	8

Table 3: Descriptive Review of EMS Pain Treatment Elements for Atraumatic Pain and Trauamtic Injuries by Race (2015-2019)

	All		White		Black		Hispanic		Asian		Other		Unknown		Discordant	
	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
Total		18,028	81%	14,670	3%	519	1%	226	3%	610	10%	1,877	1%	103	0%	23
Pain Assessment																
At least one pain score	70%	12,581	71%	10,390	71%	368	63%	143	68%	413	63%	1,184	61%	63	87%	20
Two pain scores	69%	12,486	70%	10,320	70%	365	62%	140	67%	411	62%	1,167	61%	63	87%	20
Category of First Pain Score																
no pain	9%	1,119	9%	954	7%	26	13%	18	7%	30	7%	87	6%	4	0%	0
mild	13%	1,658	14%	1,417	10%	35	15%	21	11%	47	11%	131	11%	7	0%	0
moderate	23%	2,915	23%	2,419	16%	59	27%	38	28%	114	23%	269	22%	14	10%	2
severe	54%	6,794	54%	5,530	67%	245	45%	63	54%	220	58%	680	60%	38	90%	18
IV/IO Attempted	40%	7,177	39%	5,769	38%	197	45%	101	42%	254	43%	815	27%	28	57%	13
Pain Medication Admin	19%	3,443	19%	2,857	18%	91	16%	37	15%	91	19%	349	8%	8	43%	10

Statistical Results

Several statistical models were developed to investigate EMS treatment disparities for each major pain management treatment element including:

1. Pain Assessment – This dichotomous measure captured whether or not at least two pain assessment scores where collected during EMS treatment. A statistical model was built to analyze the relationship between this measure and our predictor variables by each category of primary impression. Table 4 provides a summary of the significant findings of the models, and Tables 8,10,12,14, and 16 provide the full model results in the Appendix.
2. IV or IO attempt – This dichotomous measure captured whether or not an IV or IO was attempted during EMS treatment. One statistical model was built to analyze this measure using the entire sample of PCRs, and a second model was built to analyze this measure using only patients who were in severe pain on their first pain score for each primary impression category. Table 5 provides a summary of the significant findings of the models, and Tables 8-17 provide the full model results in the Appendix.
3. Pain Medication - This dichotomous measure captured whether or not any pain medications were administered during EMS treatment. One statistical model was built to analyze this measure using the entire sample of PCRs, and a second model was built to analyze this measure using only patients who were in severe pain on their first pain score for each primary impression category. Table 6 provides a summary of the significant findings of the models, and Tables 8-17 provide the full model results in the Appendix.
4. Pain Reduction - This dichotomous measure captured whether or not the PCR showed evidence that the patient had a reduction in their reported pain level during EMS treatment. One statistical model was built to analyze this measure using the entire sample of PCRs, and a second model was built to analyze this measure using only patients who were in severe pain on their first pain score for each primary impression category. Table 7 provides a summary of the significant findings of the models, and Tables 8-17 provide the full model results in the Appendix.

Pain Assessment

Table 4

Treatment Disparities by Race

- Across all primary impressions, Asian patients were 29% less likely (LL), and Hispanic patients were 23% less likely to receive a pain assessment when compared to White patients.
- There was no evidence of differences in pain assessment for Black patients when compared to White patients while adjusting for gender, insurance status, obesity status, primary impression, and patient age.
- For patients with primary impressions of back or body pain, Asian patients were 93% less likely to have their pain assessed when compared to White patients (adjusted).

Treatment Disparities by Gender

- Across all primary impressions, female patients were 20% more likely than male patients to receive a pain assessment while adjusting for race, insurance status, obesity status, primary impression, and patient age.
- For patients with primary impressions of traumatic injuries, female patients were 220% more likely to have their pain assessed when compared to male patients (adjusted).

Treatment Disparities by SES

- All patients without private insurance, with the exception of "Other Government" insurance, were less likely to receive a pain assessment (adjusted) including patients with Medicare (14% LL), patients with Medicaid (35% LL), patients without insurance (16% LL), and patients with unknown insurance (53% LL).
- Patients with Medicare (57% LL) and Medicaid (68% LL) who had a primary impression of pain management were particularly less likely to receive a pain assessment when compared to patients with private insurance (adjusted).

Treatment Disparities by Obesity Status

- Across all primary impressions, severely obese patients were 23% more likely to receive a pain assessment when compared to non-severely obese patients (adjusted).

Table 4: Adjusted Odds Ratio Summary of Pain Assessment by Primary Impression Categories

Regressor	*All Cases*	*Trauma*	*Ab Pain*	*Back and Body Pain*	*Pain Mgmt*
White (referent)					
Black	-	-	-	-	-
Asian	0.71*	-	-	0.07*	-
Hispanic	0.77**	-	-	-	-
Other	0.62***	-	-	0.14***	0.28***
Unknown	-	-	-	-	-
Discordant minority	-	-	-	-	-
Male (referent)					
Female	1.20***	2.22**	-	-	-
Private (referent)					
Medicare	0.86**	-	-	-	0.43*
Medicaid	0.65***	-	-	-	0.32*
Other Government		-	-	-	-
No Insurance	0.84**	-	-	-	-
Unknown	0.47***	-	-	-	-
Severely Obese	1.23**	-	-	-	-
Traumatic Injury (referent)					
Abdominal Pain	2.29***	na	na	na	na
Back or Body Pain	2.42***	na	na	na	na
Pain Management	5.00***	na	na	na	na

Note: B = logistic regression coefficient and OR=odds ratio
* p< .05, ** p< .01, *** p< .001
Patient age not shown but included in adjustments

IV or IO Attempts

Table 5

Treatment Disparities by Race

- There was no evidence of differences in the occurrence of IV or IO procedures by race within the sample (adjusted).

Treatment Disparities by Gender

- Across the full sample, female patients were 22% more likely to receive an IV or IO. However, female patients who were in moderate to severe pain were 12% less likely to receive an IV or IO compared to male patients (adjusted).

Treatment Disparities by SES

- Patients without insurance were 22% more likely to receive an IV or IO when compared to patients with private insurance (adjusted). However, patients with most other insurance categories were less likely to receive an IV or IO (Medicare 18% LL, Medicaid 35% LL) and these disparities persisted for these patients even when the PCR documented that they had moderate to severe pain (adjusted).

Treatment Disparities by Obesity

- Patients categorized as severely obese were 20% less likely to have an IV or IO attempted compared to patients who were not considered severely obese, and 22% less likely if they were in severe pain (adjusted).

Treatment Disparities by Call Type

- Patients with abdominal pain were almost three times more likely, when compared to a patient suffering a traumatic injury, to receive an IV or IO. However, patients suffering from back or body pain (51% LL) or engaged EMS for pain management (96% LL) were much less likely to receive an IV or IO (adjusted).

Table 5: Adjusted Odds Ratio Summary of IV or IO Administration by Primary Impression Categories

	All Cases		*Trauma*		*Ab Pain*		*Back and Body Pain*		*Pain Mgmt*	
Regressor	*All*	*Mod-Severe*	*All*	*Mod-Severe*	*All*	*Mod-Severe*	*All*	*Mod-Severe*	*All*	*Mod-Severe*
White (referent)										
Black	-	-	-	-	-	-	-	-	-	-
Asian	-	-	-	-	-	-	-	-	-	-
Hispanic	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-
Unknown	0.56*	0.34**	0.32*	0.3*	0.35*	0.35*	-	-	-	-
Discordant minority	-	-	-	-	-	-	-	-	-	-
Male (referent)										
Female	1.22***	0.88**	0.77***	0.75***	-	-	-	-	-	-
Private (referent)										
Medicare	0.82***	0.86*	0.85*	0.78*	-	-	-	-	-	-
Medicaid	0.65***	0.62***	0.64***	0.6***	0.69**	0.72*	0.57***	0.59**	-	-
Other Government	-	-	-	-	-	-	-	-	-	-
No Insurance	1.22***	-	1.23*	-	-	-	-	-	-	-
Unknown	0.37***	0.63***	0.52***	0.57***	0.67**	0.73*	0.68*	0.65*	5.28**	-
Severely Obese	-	-	0.8*	0.78*	-	-	-	-	-	-
Traumatic Injury (referent)										
Abdominal Pain	2.95***	1.88***	na	na	na	na	na	na	na	na
Back or Body Pain	0.49***	0.28***	na	na	na	na	na	na	na	na
Pain Management	0.04***	0.03***	na	na	na	na	na	na	na	na

Note: only odds ratio shown in summary

* p< .05, ** p< .01, *** p< .001

Patient age and first pain score not shown but included in adjustments - see full regression tables for detail

Pain Medication Administration

Table 6

Treatment Disparities by Race

- Across all primary impressions, Hispanic patients were 35% less likely to receive pain medications when compared to White patients. This effect was unchanged when the sample was limited to patients in moderate or severe pain (adjusted).
- Hispanic patients were 43% less likely to receive pain medications for traumatic injuries and 48% less likely to receive pain medications for abdominal pain when compared to White patients (adjusted).

- Black patients were 37% less likely to receive pain medications for traumatic injuries when compared to White patients. This was true for all cases of traumatic injuries as well as when the sample was limited to patients with traumatic injuries who were also in moderate or severe pain (adjusted).

Treatment Disparities by Gender

- Across all primary impressions, female patients were 22% more likely to receive pain medications when compared to male patients. However, in the cases of patients in back or body pain, females were 25% less likely to receive pain medications when compared to male patients (adjusted).

Treatment Disparities by SES

- All patients with non-private insurance, except those with "other government insurance," were less likely to receive pain medication, including patients with Medicare (25% LL), Medicaid (48% LL), and patients without insurance (67% LL).

Treatment Disparities by Call Type

- Across all primary impressions, patients with abdominal pain (42% ML) and those requiring pain management (59% ML) were more likely to receive pain medications when compared to patients with traumatic injuries (adjusted). However, patients with "back" or "body" pain were 27% less likely to receive pain medications when compared to traumatic injuries (adjusted).

Table 6: Adjusted Odds Ratio Summary of Pain Medication Administration by Primary Impression Categories

	All Cases		*Trauma*		*Ab Pain*		*Back and Body Pain*		*Pain Mgmt*	
Regressor	*All*	*Mod-Severe*	*All*	*Mod-Severe*	*All*	*Mod-Severe*	*All*	*Mod-Severe*	*All*	*Mod-Severe*
White (referent)										
Black	-	-	0.63*	0.63*	-	-	-	-	-	-
Asian	-	-	-	-	-	-	-	-	-	-
Hispanic	0.65***	0.65**	0.57**	0.58**	0.52*	0.53*	-	-	-	-
Other	-	-	-	-	0.66**	0.67**	-	-	-	-
Unknown	0.33**	0.27**	-	-	0.1*	0.1*	-	-	-	-
Discordant minority	4.09**	-	-	-	-	-	-	-	-	-
Male (referent)										
Female	1.22***	-	-	-	-	-	0.75**	0.75*	-	-
Private (referent)										
Medicare	0.75***	0.72***	0.73**	0.72**	0.72*	0.71*	0.66**	0.65*	-	-
Medicaid	0.52***	0.44***	0.41***	0.40***	0.50***	0.48***	0.42***	0.43***	-	-
Other Government	-	-	-	-	-	-	-	-	-	-
No Insurance	0.84**	0.77**	0.80*	-	0.70*	0.69*	-	-	-	-
Unknown	0.43***	0.61***	0.61***	0.62***	0.62**	0.61**	0.6**	0.57**	-	-
Severely Obese	-	-	-	-	-	-	-	-	-	-
Traumatic Injury (referent)										
Abdominal Pain	1.42***	0.57***	na	na	na	na	na	na	na	na
Back or Body Pain	0.73***	0.25***	na	na	na	na	na	na	na	na
Pain Management	1.59***	1.96***	na	na	na	na	na	na	na	na

Note: only odds ratio shown in summary

* p< .05, ** p< .01, *** p< .001

Patient age and first pain score not shown but included in adjustments - see full regression tables for detail

Pain Reduction

Table 7

Treatment Disparities by Race

- There was no evidence of differences in pain reduction by race within the sample (adjusted).

Treatment Disparities by Gender

- Female patients were 14% more likely to have their pain levels reduced by one or more points during EMS treatment when compared to male patients.

Treatment Disparities by SES

- Compared to patients with private insurance, patients with Medicare (15% LL), Medicaid (40% LL), no insurance (22% LL), and unknown insurance (43% LL) were all less likely to have their pain reduced by one or more points during the EMS encounter (adjusted).

Differences by Call Type

- Patients with abdominal pain were 47% less likely to have a reduction in pain levels by one or more points when compared to traumatic injury patients. However, patients with moderate to severe abdominal pain were only 14% less likely to have their pain reduced compared to patients in traumatic pain (adjusted).
- Patients with primary impressions of Pain Management who were in moderate to severe pain were 72% more likely to have a reduction in pain by one or more points when compared to patients with Traumatic Injuries (adjusted).
- Patients with a primary impression of "back" or "body" pain were 12% LL to have their pain reduced, and 53% less likely to have their pain reduced if they were in moderate to severe pain, when compared to patients with Traumatic Injuries (adjusted).

Table 7: Adjusted Odds Ratio Summary of Pain Reduction by Primary Impression Categories

	All Cases		*Trauma*		*Ab Pain*		*Back and Body Pain*		*Pain Mgmt*	
Regressor	*All*	*Mod-Severe*	*All*	*Mod-Severe*	*All*	*Mod-Severe*	*All*	*Mod-Severe*	*All*	*Mod-Severe*
White (referent)										
Black	-	-	-	-	-	-	-	-	-	-
Asian	-	-	-	-	-	-	-	-	-	-
Hispanic	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	0.61**	0.59**	-	-
Unknown	0.51*	0.44*	-	-	0.27*	0.27*	-	-	-	-
Discordant minority	-	-	-	-	-	-	-	-	-	-
Male (referent)										
Female	1.14**	-	-	-	-	-	0.78**	0.77**	-	-
Private (referent)										
Medicare	0.85**	0.85*	0.51***	0.48***	-	-	0.77*	-	-	-
Medicaid	0.60***	0.51***	-	-	0.58***	0.58***	0.52***	0.50***	0.33*	0.38*
Other Government	-	-	0.70***	0.70***	-	-	-	-	-	-
No Insurance	0.78***	0.74***	0.65***	0.65***	0.73*	0.72*	-	-	-	-
Unknown	0.57***	0.63***	-	-	0.69**	0.70*	0.65**	0.59**	-	-
Severely Obese	-	-	-	-	-	-	-	-	-	-
Traumatic Injury (referent)										
Abdominal Pain	1.47***	0.86**	na	na	na	na	na	na	na	na
Back or Body Pain	0.88*	0.47***	na	na	na	na	na	na	na	na
Pain Management	-	1.72***	na	na	na	na	na	na	na	na

Note: only odds ratio shown in summary

* p< .05, ** p< .01, *** p< .001

Patient age and first pain score not shown but included in adjustments - see full regression tables for detail

Summary

While there will always be natural variation in EMS treatments to account for individual patient preferences, this analysis indicates that there are systematic differences in process and outcome based on a patient's social characteristics. Importantly, these characteristics are not medically relevant. This analysis finds that EMS treatments for patients in pain varies by a patient's race, gender, and SES.

More specifically, regarding differences in treatment and outcome by race, Asian patients were 29% less likely and Hispanic patients were 23% less likely to receive a pain assessment when compared to White patients. Further, Hispanic patients were also 35% less likely to receive pain medications, an effect that persisted even for Hispanic patients with documented moderate or severe pain.

Regarding gender, female patients were 20% more likely to receive a pain assessment and much more likely (220%) to receive a pain assessment during a traumatic injury. Female patients were also 22% more likely to receive an IV or and IO but were less likely (12%) to receive one when in moderate to severe pain or with a primary impression of a traumatic injury (23% LL, and 25% LL if in moderate to severe pain). Female patients were also 22% more likely to receive pain medications, however they were 25% less likely to receive pain medications if their primary impression was "back" or "body" pain. Finally, as a whole, female patients in pain were 14% more likely to report at least a one-point reduction in pain score during EMS treatments than men, however, female patients were 22% less likely to report a reduction in pain score during an EMS encounter for "back" or "body" pain.

Regarding socioeconomic status, results indicate that patients in a lower socio-economic position are more likely to receive a lower quality of EMS treatment. With one noted exception, poor patients and/or elderly patients who engage EMS for medical treatment for painful emergencies are significantly less likely to receive a pain assessment, are less likely to receive an IV or IO (with the exception of patients without insurance), are less likely to receive pain medications, and are less likely to have their pain levels reduced during EMS care.

And finally, when compared to non-severely obese patients, severely obese patients were 23% more likely to receive a pain assessment and were 20% less likely to have an IV or IO attempted in the setting of a traumatic injury.

Limitations

There are several limitations to this analysis. First, this analysis is based on the EMS provider's medical chart and may not accurately reflect the treatments provided on scene. Next, the electronic medical chart does not provide a consistent mechanism to capture treatments offered and refused, and some EMS medical providers may not consistently chart refused treatments completely. In addition, a patient's socio-economic status is a complex characteristic that health insurance status is unlikely to comprehensively capture. Further, using the CDC guidelines and assuming an average height to determine obesity status is a crude proxy meant only to provide an indication of possible treatment differences.

Section 3

Chest Pain Treatment Equity Analysis

Situations where a medical provider has broad clinical discretion have been shown to demonstrate increased levels of bias in provider treatment.[22, 23, 24, 25] While EMS treatment protocols of pain management are a good example of high-discretion protocols, this analysis investigated the relatively low-discretion protocols for treating patients with cardiac chest pain.

In 2019, the City of Vancouver, Vancouver Fire Department, and American Medical Response in Clark County initiated an analysis to determine if EMS treatments for cardiac chest pain varied by a patient's race, gender, SES, or obesity status in the City of Vancouver. The results of this investigation are described below.

Dataset

Inclusions and Exclusions

Patient Care Records (PCRs) with a primary impression of Cardiac (Acute MI, Chest Pain, or Other) and/or containing a STEMI flag occurring between January 1, 2016 through December 31, 2019 were selected from the data available in the Meds EMS charting system for AMR Clark County, resulting in 7,691 PCRs. Next, PCRs were matched to VFD incident numbers which resulted in 3,942 VFD incident IDs, of which 43% (1,685) contained a VFD PCR.

PCRs for patient interactions without a city address of Vancouver and those for interfacility and scheduled transports were excluded, suppressing 2,503 PCRs. The final resulting analytical sample contained 5,188 PCRs, 68% of which contained PCR data from AMR only and 32% contained a consolidated PCR containing both AMR and VFD treatment elements.

[22] Mort EA, Weissman JS, Epstein AM. Physician Discretion and Racial Variation in the Use of Surgical Procedures. *Arch Intern Med.* 1994;154:761-767.
[23] Bloche MG. Race and discretion in American medicine. *Yale J Health Policy Law Ethics.* 2001;1:95-131.
[24] Gittelsohn AM, Halpern J, Sanchez RL. Income, race, and surgery in Maryland. *Am J Public Health.* 1991;81(11):1435-1441. doi:10.2105/AJPH.81.11.1435
[25] Kressin NR, Petersen LA. Racial Differences in the Use of Invasive Cardiovascular Procedures: Review of the Literature and Prescription for Future Research. *Ann Intern Med.* 2001;135:352-366.

Methodology

Predictor Variables

For this analysis the primary variables of interest are the patient's "social" characteristics, including race, gender, socio-economic, and obesity status. A single race value was derived after evaluating the charted race values from both the AMR and VFD PCRs, resulting in the following race categories: White, Black, Asian, Hispanic, Other, Unknown, and "Discordant" (defined below). Race values included in the "Other" category include "American Indian," "Arab or Middle Eastern," "Native Hawaiian," "Pacific Islander," and "Other Race." The "Discordant" race category included 85 PCRs (1.6% of the total sample) where VFD and AMR race values were in direct and specific conflict (e.g. White and Black). In cases where a specific race value (e.g. Asian or Black) was in conflict with a race value of "Other," the more specific race value was maintained. A gender variable was created with values of "Male," "Female," and "Discordant" where disagreement existed between VFD and AMR PCRs. In order to be able to test for the effects of treatment differences for obese patients a new variable was created using the CDC guidelines for obesity. While 99% of the PCRs in the sample had a weight value, patient height is not captured in the PCR. The CDC guidelines define weights of > 270 lbs. to be severely obese for an average height male (5'9") and > 232 lbs. for an average height female (5'4").

This analysis utilized the patient's health insurance category as a proxy for the patient's socio-economic status (SES), which is a method used in other areas of healthcare research.[26] Patient insurance information was captured in an open text field in AMR PCRs that allowed multiple entries per PCR (maximum of seven in this sample). Each PCR was assigned a single insurance status based on the patient's 'highest' level of insurance in the following hierarchy: Private, Medicare, Medicaid, Other Government, No Insurance, and Unknown insurance.

Outcome Variables

A dichotomous variable was created to indicate if a 12-lead was charted as performed on each PCR. An additional dichotomous variable, "12-lead < 10 min," was created to capture if a 12-lead was performed within the 10 min goal indicated in the Clark County EMS treatment protocols. The "12-lead < 10 min" value was determined by calculating the difference between the earliest "At Patient Side" time stamp to the 12-lead time stamp. Where an at patient side time was not recorded, the on-scene time was used.

The patient's charted pain values were codified in several categories. A new dichotomous pain assessment variable was created to indicate if a patient had a pain score charted or not. A new series of continuous and categorical variables were created that captured the patient's first and last pain score as well as the patient's first and last pain score category as described in the EMS treatment protocols of "no pain" (0), "mild pain" (1-3), "moderate pain" (4-6), and "severe pain" (7-10). Finally, new variables were created to capture if a patient's pain levels had changed after receiving EMS treatments, either as a pain score value change and/or a pain category change when comparing the first pain score with the last pain score recorded.

[26] Ver Ploeg M, Perrin E, eds. National Research Council (US) Panel on DHHS Collection of Race and Ethnic Data: Appendix C, Recommendations on the Use of Socioeconomic Position Indicators to Better Understand Racial Inequalities in Health. Eliminating Health Disparities: Measurement and Data Needs. Washington, DC: The National Academy Press; 2004.

A new dichotomous variable was created to indicate if either an IV or IO had been attempted at any point during the call by either VFD or AMR crew members.

A number of new variables were created to capture if patients were eligible to take the specified medications recommended in the setting of cardiac chest pain, including aspirin (ASA), nitroglycerin (NTG), and Fentanyl. An ASA variable was coded to indicate if a patient did not have charted contraindications for ASA including allergy, active GI bleed, and/or severe liver failure, and if ASA was administered. Patients who were in the sample that did not have any systolic blood pressure values < 100, did not have a charted allergy to NTG, and did not report that they had taken Sildenafil, Viagra, Cialis, and/or Levitra were noted as being eligible to receive NTG. PCRs that indicated that at least one dose of NTG was administered were also noted. Any PCR that indicated that the patient did not have an allergy to fentanyl, morphine, opioids were noted, as well as the patients who received fentanyl.

Analysis

The statistical analysis was performed in four steps. First, bivariate descriptive analysis was performed on both the demographic and clinical characteristics of the sample population (Tables 8 and 9). Next, regression models were built to review EMS cardiac chest pain treatments on the entire sample (Table 10) as well as the subset of patients believed by the EMS crew members to be having an Acute MI (Table 11). Finally, a logistic regression model was built to analyze a patient's likelihood of having their pain reduced during EMS treatment was also performed (Table 12).

Results

Sample demographics

- A total of 5,188 PCRs were included in this analysis after applying both inclusion and exclusion criteria described above. VFD contributed PCRs in 32% of cases (n= 1,685)
- 81% of the PCRs included in the sample contained the primary impression of Cardiac Chest Pain and 6% indicated Acute MIs

Table 8 presents demographic findings for patients included in the sample. Highlights of the patient demographics include:

- The vast majority (95%) of patients in the sample were >= 35 years of age
- Females were more represented compared to males overall (52% vs 48%), however Black and Asian patients had a larger proportion of males to females.
- The proportion of patients with severe obesity was consistently distributed in males across patient race (~ 10%), however severe obesity in female patients varied by patient race from 16% in White female patients to a high of 23% in Black female patients.

Table 9 presents the descriptive bivariate results of the clinical elements included in the analysis by patient race. Highlights of the clinical characteristics include:

- 92% of the sample received a 12-lead, 69% of which did so in 10 minutes or less

- 76% of the sample had a documented pain score with some variation by patient race noted (59% for Asian patients)
- 88% of patients with at least one pain score documented expressed that they were in some level of pain
- 42% of the sample with pain scores were in severe pain (7-10) with Black patients with having the largest proportion of patients with severe pain (57%)

Table 8: Cardiac Chest Pain Patient Descriptive Demographics by Race

	All		White		Black		Hispanic		Asian		Other		Unknown		Discordant	
	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
Total		5,188	80%	4,137	5%	266	2%	111	1%	75	9%	480	1%	34	2%	85
AMR Only	68%	3,503	68%	2,817	69%	184	60%	67	80%	60	74%	353	65%	22	0%	-
AMR & VFD	32%	1,685	32%	1,320	31%	82	40%	44	20%	15	26%	127	35%	12	100%	85
Primary Impression																
Acute MI	6%	329	6%	261	5%	13	11%	12	11%	8	6%	29	0%	0	7%	6
Cardiac Chest Pain	81%	4,206	81%	3,351	84%	224	77%	86	69%	52	81%	389	88%	30	87%	74
Cardiac, Other	13%	653	13%	525	11%	29	12%	13	20%	15	13%	62	12%	4	6%	5
Patient age		5,182		4,134		266		111		75		480		31		85
<35	5%	281	5%	201	8%	21	18%	20	4%	3	6%	30	6%	2	5%	4
>= 35	95%	4,901	95%	3,933	92%	245	82%	91	96%	72	94%	450	94%	29	95%	81
Gender		5,188		4,137		266		111		75		480		34		85
Male	48%	2,473	47%	1,924	61%	162	44%	49	56%	42	49%	234	47%	16	54%	46
Female	52%	2,673	53%	2,180	39%	104	55%	61	44%	33	51%	243	44%	15	44%	37
Other	1%	40	1%	33	0%	0	1%	1	0%	0	1%	3	3%	1	2%	2
Unknown	0%	2	0%	0	0%	0	0%	0	0%	0	0%	0	6%	2	0%	0
Obesity																
Male		2,458		1,914		162		49		40		232		16		45
Not Severely Obese	89%	2,193	89%	1,702	90%	145	90%	44	100%	40	91%	210	81%	13	87%	39
Severely Obese	11%	265	11%	212	10%	17	10%	5	0%	0	9%	22	19%	3	13%	6
Female		2,657		2,172		102		58		33		241		14		37
Not Severely Obese	84%	2,222	84%	1,824	77%	79	78%	45	97%	32	82%	197	93%	13	86%	32
Severely Obese	16%	435	16%	348	23%	23	22%	13	3%	1	18%	44	7%	1	14%	5
Insurance		5,188		4,137		266		111		75		480		34		85
Private	29%	1,495	30%	1,240	16%	43	21%	23	40%	30	27%	129	32%	11	22%	19
Medicaid	8%	439	8%	334	16%	43	10%	11	5%	4	7%	35	3%	1	13%	11
Medicare	26%	1,343	27%	1,135	18%	47	15%	17	19%	14	21%	101	26%	9	24%	20
Other Gov't	3%	153	3%	127	3%	9	0%	0	4%	3	3%	14	0%	0	0%	0
No Insurance	19%	965	17%	707	20%	54	38%	42	17%	13	25%	119	24%	8	26%	22
Missing	4%	200	4%	156	3%	7	3%	3	3%	2	6%	28	6%	2	2%	2
Other Insurance	11%	593	11%	438	24%	63	14%	15	12%	9	11%	54	9%	3	13%	11

Table 9: Cardiac Chest Pain Clinical Procedures by Race

	All		White		Black		Hispanic		Asian		Other		Unknown		Discordant	
	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
Total		5,188		4,137		266		111		75		480		34		85
12 Lead	92%	4,793	93%	3,849	93%	248	90%	100	88%	66	89%	425	82%	28	91%	77
No 12 Lead	8%	395	7%	288	7%	18	10%	11	12%	9	11%	55	18%	6	9%	8
12 Lead time stamp		4,653		3,741		244		96		63		411		27		71
12 Lead within 10 min	69%	3,192	70%	2,602	65%	159	68%	65	70%	44	62%	256	70%	19	66%	47
12 Lead not within 10 m	31%	1,461	30%	1,139	35%	85	32%	31	30%	19	38%	155	30%	8	34%	24
Pain Assessment		5,188		4,137		266		111		75		480		34		85
Recorded	76%	3,918	77%	3,192	78%	207	72%	80	59%	44	65%	310	68%	23	73%	62
Not Recorded	24%	1,270	23%	945	22%	59	28%	31	41%	31	35%	170	32%	11	27%	23
Category of First Pain Score		3,925		3,196		207		82		44		311		23		62
no pain	12%	460	12%	388	10%	20	5%	4	7%	3	12%	36	17%	4	8%	5
mild	14%	548	15%	466	8%	16	12%	10	18%	8	12%	37	22%	5	10%	6
moderate	32%	1,260	32%	1,035	25%	52	43%	35	36%	16	30%	92	22%	5	40%	25
severe	42%	1,657	41%	1,307	57%	119	40%	33	39%	17	47%	146	39%	9	42%	26
Category of Last Pain Score		3,614		2,950		184		78		41		283		22		56
no pain	22%	810	23%	676	17%	31	12%	9	34%	14	19%	54	41%	9	30%	17
mild	26%	949	27%	791	16%	30	33%	26	27%	11	25%	71	36%	8	21%	12
moderate	28%	1,018	28%	818	29%	53	28%	22	22%	9	35%	100	5%	1	27%	15
severe	23%	837	23%	665	38%	70	27%	21	17%	7	20%	58	18%	4	21%	12
IV/IO		5,188		4,137		266		111		75		480		34		85
no	13%	695	12%	510	20%	54	15%	17	16%	12	18%	87	21%	7	9%	8
yes	87%	4,493	88%	3,627	80%	212	85%	94	84%	63	82%	393	79%	27	91%	77
ASA		5,175		4,126		265		111		75		480		34		84
no	41%	2,110	40%	1,654	41%	108	33%	37	51%	38	48%	229	53%	18	31%	26
yes	59%	3,065	60%	2,472	59%	157	67%	74	49%	37	52%	251	47%	16	69%	58
NTG		5,188		4,137		266		111		75		480		34		85
no	56%	2,905	55%	2,284	59%	156	53%	59	67%	50	60%	290	56%	19	55%	47
yes	44%	2,283	45%	1,853	41%	110	47%	52	33%	25	40%	190	44%	15	45%	38
Fentanyl		5,153		4,114		265		108		75		476		34		81
no	90%	4,614	89%	3,681	88%	232	89%	96	85%	64	91%	435	100%	34	89%	72
yes	10%	539	11%	433	12%	33	11%	12	15%	11	9%	41	0%	-	11%	9
STEMI		5,188		4,137		266		111		75		480		34		85
no	93%	4,820	93%	3,851	95%	252	88%	98	85%	64	93%	444	97%	33	92%	78
yes	7%	368	7%	286	5%	14	12%	13	15%	11	8%	36	3%	1	8%	7
Code 3 transport		5,188		4,137		266		111		75		480		34		85
no	83%	4,302	83%	3,445	82%	219	74%	82	76%	57	84%	404	85%	29	78%	66
yes	17%	886	17%	692	18%	47	26%	29	24%	18	16%	76	15%	5	22%	19

Statistical Analysis

Results from the adjusted multivariable logistic regression models that investigated the likelihood of a patient receiving EMS treatments for cardiac chest pain found the following:

Cardiac Chest Pain Results (Table 10):

Treatment Disparities by Race

Adjusting for treatment differences by patient gender, patient insurance status, and obesity status:

- Patients with a race charted as "Other" were 42% less likely (LL) to receive a 12-lead during EMS treatment when compared to White patients.

- Black patients and patients with a race charted as "Other" were less likely to receive an IV or an IO during EMS treatment (66% LL and 33% LL, respectively) when compared to White patients.
- Asian patients and patients with a race charted as "Other" were less likely to have their pain assessed during EMS treatments (68% LL and 46% LL) when compared to White patients.
- Patients with a race charted as "Other" were 25% less likely to receive ASA during EMS medical treatment when compared to White patients.
- Asian patients who were in pain were four times more likely (ML) to receive fentanyl when compared to White patients who were in pain.

Treatment Disparities by Gender

Adjusting for treatment differences by patient race, patient insurance status, and obesity status:

- Female patients, compared to male patients, were 29% less likely to receive a 12-lead ECG during treatment, and when they did receive a 12-lead, female patients were 27% less likely to receive one within 10 minutes of EMS arrival on-scene.
- Female patients, compared to male patients, were 16% less likely to receive ASA during EMS medical treatment.
- Female patients, compared to male patients, were 21% less likely to receive NTG during EMS medical treatment when in pain and without charted contraindications.

Treatment Disparities by Insurance Status

Adjusting for treatment differences by patient race, patient gender, and obesity status:

- Medicare patients, compared to patients with private insurance, were 19% less likely to receive a 12-lead within 10 minutes of EMS arriving on-scene.
- Patients without health insurance, compared to patients with private health insurance, were 58% more likely to receive fentanyl during EMS medical treatment.

Treatment Disparities by Obesity Status

Adjusting for treatment differences by patient race, patient gender, and patient insurance status:

- Patients considered severely obese, compared to patients who are not severely obese, were 29% more likely to have their pain assessed during EMS treatment.
- Patients considered severely obese, compared to patients who are not severely obese, were 19% less likely to receive NTG when in pain and without charted contraindications during EMS medical treatment.

Table 10: Adjusted Multivariable Logistic Regressions of Patient Demographics on Cardiac Chest Pain Treatments

	12-Lead			*12-Lead < 10 min*			*IV or IO*			*Pain Assessment*			*ASA Admin*			*NTG*			*Fentanyl*		
Regressor	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*
White (referent)																					
Black	-0.105	0.9	(0.55 - 1.49)	-0.225	0.8	(0.6 - 1.06)	-0.819	0.44***	(0.31 - 0.62)	-0.019	0.98	(0.72 - 1.33)	-0.120	0.89	(0.68 - 1.15)	-0.167	0.85	(0.62 - 1.15)	0.431	1.54	(0.93 - 2.56)
Hispanic	-0.286	0.75	(0.37 - 1.51)	-0.021	0.98	(0.63 - 1.52)	-0.269	0.76	(0.41 - 1.41)	-0.257	0.77	(0.5 - 1.2)	0.325	1.38	(0.91 - 2.11)	0.056	1.06	(0.67 - 1.68)	-0.119	0.89	(0.4 - 1.99)
Asian	-0.590	0.55	(0.26 - 1.18)	-0.080	0.92	(0.53 - 1.6)	-0.409	0.66	(0.33 - 1.35)	-0.867	0.42***	(0.26 - 0.68)	-0.422	0.66	(0.41 - 1.05)	-0.542	0.58	(0.31 - 1.09)	1.383	3.99*	(1.32 - 12.07
Other	-0.548	0.58**	(0.42 - 0.79)	-0.368	0.69**	(0.56 - 0.86)	-0.398	0.67**	(0.5 - 0.9)	-0.614	0.54***	(0.44 - 0.66)	-0.283	0.75**	(0.62 - 0.92)	-0.036	0.97	(0.75 - 1.25)	-0.291	0.75	(0.46 - 1.21)
Unknown	-0.838	0.43	(0.15 - 1.25)	0.031	1.03	(0.45 - 2.37)	-0.458	0.63	(0.22 - 1.83)	-0.251	0.78	(0.35 - 1.75)	-0.448	0.64	(0.31 - 1.3)	0.600	1.82	(0.65 - 5.09)	Insufficient sample size		
Discordant minority	-0.311	0.73	(0.33 - 1.61)	-0.169	0.84	(0.51 - 1.39)	0.361	1.44	(0.58 - 3.52)	-0.256	0.77	(0.47 - 1.27)	0.375	1.46	(0.9 - 2.37)	-0.152	0.86	(0.51 - 1.46)	-0.003	1	(0.36 - 2.75)
Male (referent)																					
Female	-0.349	0.71**	(0.57 - 0.88)	-0.310	0.73***	(0.65 - 0.84)	-0.095	0.91	(0.75 - 1.1)	-0.043	0.96	(0.84 - 1.09)	-0.176	0.84**	(0.75 - 0.94)	-0.237	0.79**	(0.69 - 0.91)	-0.245	0.78	(0.61 - 1.01)
Other	0.884	2.42	(0.33 - 17.8)	-0.090	0.91	(0.45 - 1.87)	Insufficient sample size			0.778	2.18	(0.85 - 5.61)	0.098	1.1	(0.56 - 2.17)	-0.176	0.84	(0.4 - 1.77)	0.256	1.29	(0.34 - 4.97)
Private (referent)																					
Medicaid	-0.053	0.95	(0.62 - 1.44)	-0.155	0.86	(0.67 - 1.09)	-0.005	1	(0.7 - 1.41)	0.136	1.15	(0.88 - 1.49)	0.197	1.22	(0.97 - 1.53)	-0.213	0.81	(0.63 - 1.04)	-0.319	0.73	(0.44 - 1.19)
Medicare	-0.119	0.89	(0.67 - 1.18)	-0.208	0.81*	(0.69 - 0.96)	0.201	1.22	(0.95 - 1.58)	-0.112	0.89	(0.75 - 1.06)	-0.048	0.95	(0.82 - 1.11)	-0.102	0.9	(0.75 - 1.09)	-0.164	0.85	(0.61 - 1.19)
Other Government	-0.291	0.75	(0.4 - 1.41)	-0.238	0.79	(0.54 - 1.16)	-0.397	0.67	(0.41 - 1.1)	-0.195	0.82	(0.56 - 1.21)	-0.104	0.9	(0.64 - 1.27)	-0.178	0.84	(0.54 - 1.29)	0.164	1.18	(0.57 - 2.44)
No Insurance	0.082	1.09	(0.78 - 1.51)	-0.115	0.89	(0.74 - 1.08)	-0.020	0.98	(0.75 - 1.28)	0.161	1.17	(0.96 - 1.43)	0.112	1.12	(0.95 - 1.33)	-0.058	0.94	(0.77 - 1.16)	0.454	1.58**	(1.13 - 2.2)
Other	0.391	1.48	(0.97 - 2.26)	-0.096	0.91	(0.73 - 1.13)	0.253	1.29	(0.92 - 1.8)	0.126	1.13	(0.9 - 1.43)	0.216	1.24*	(1.02 - 1.52)	-0.061	0.94	(0.75 - 1.19)	-0.353	0.7***	(0.45 - 1.09)
Not Severely Obese (referent)																					
Severely Obese	-0.093	0.91	(0.68 - 1.23)	-0.164	0.85	(0.71 - 1.02)	-0.238	0.79	(0.61 - 1.02)	0.253	1.29*	(1.05 - 1.57)	0.080	1.08	(0.92 - 1.28)	-0.207	0.81*	(0.67 - 0.98)	-0.024	0.98	(0.68 - 1.41)
Constant		2.528			0.783			1.93			1.142			0.386			0.321			-1.389	
Number of Cases		5,155			5,155			5,155			5,155			5,142			3,456			1,664	
-2 log likelihood		2,650			5,692			3,190			5,583			6,637			4,597			1,626	
Pseudo R2 (Nagelkerke)		0.032			0.230			0.270			0.034			0.077			0.040			0.350	

Note: B = logistic regression coefficient and OR=odds ratio
* p< .05, ** p< .01, *** p< .001

Table 11: Adjusted Multivariable Logistic Regressions of Patient Demographics on Cardiac Chest Pain Treatments for Acute MI Patients

	12-Lead < 10 min			*IV or IO*			*Pain Assessment*			*ASA Admin*			*NTG*			*Fentanyl*		
Regressor	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*
White (referent)																		
Black	-1.389	0.25*	(0.09 - 0.73)	Insufficient sample size			0.403	1.5	(0.41 - 5.47)	0.351	1.42	(0.43 - 4.67)	1.095	2.99	(0.57 - 15.67)	-0.417	0.66	(0.12 - 3.5)
Hispanic	0.528	1.7	(0.47 - 6.19)	Insufficient sample size			0.665	1.95	(0.43 - 8.87)	Insufficient sample size			1.195	3.3	(0.7 - 15.53)	-0.819	0.44	(0.1 - 1.96)
Asian	-0.455	0.63	(0.2 - 2.03)	-0.481	0.62	(0.07 - 5.22)	-0.202	0.82	(0.25 - 2.73)	-0.528	0.59	(0.19 - 1.8)	0.118	1.13	(0.27 - 4.77)	-1.289	0.28	(0.03 - 2.89)
Other	-0.372	0.69	(0.34 - 1.41)	-0.558	0.57	(0.16 - 2.12)	-0.657	0.52	(0.25 - 1.06)	-0.047	0.95	(0.45 - 2.03)	-0.411	0.66	(0.27 - 1.66)	-0.221	0.80	(0.19 - 3.47)
Unknown	Insufficient sample size			Insufficient sample size			Insufficient sample size			Insufficient sample size			Insufficient sample size			Insufficient sample size		
Discordant minority	Insufficient sample size			Insufficient sample size			0.010	1.01	(0.2 - 5.12)	1.018	2.77	(0.33 - 23.12)	-0.880	0.42	(0.09 - 1.98)	Insufficient sample size		
Male (referent)																		
Female	-0.214	0.81	(0.52 - 1.27)	-0.268	0.77	(0.31 - 1.87)	0.179	1.2	(0.74 - 1.94)	-0.062	0.94	(0.6 - 1.48)	-0.284	0.75	(0.45 - 1.28)	-0.411	0.66	(0.34 - 1.31)
Other	0.668	1.95	(0.22 - 17.26)	Insufficient sample size			0.505	1.66	(0.19 - 14.77)	0.613	1.85	(0.21 - 16.38)	-1.396	0.25	(0.02 - 2.89)	Insufficient sample size		
Private (referent)																		
Medicaid	-0.562	0.57	(0.2 - 1.65)	0.361	1.44	(0.15 - 13.85)	-0.445	0.64	(0.21 - 2)	0.491	1.63	(0.43 - 6.18)	-0.781	0.46	(0.13 - 1.58)	1.177	3.25	(0.44 - 24.23)
Medicare	-0.268	0.77	(0.41 - 1.41)	0.745	2.11	(0.54 - 8.29)	-0.522	0.59	(0.31 - 1.12)	-0.702	0.5*	(0.27 - 0.9)	0.146	1.16	(0.55 - 2.43)	0.287	1.33	(0.54 - 3.31)
Other Government	-0.834	0.43	(0.11 - 1.78)	Insufficient sample size			-1.082	0.34	(0.08 - 1.4)	0.190	1.21	(0.23 - 6.33)	-0.641	0.53	(0.07 - 4.09)	Insufficient sample size		
No Insurance	-0.276	0.76	(0.44 - 1.32)	0.307	1.36	(0.47 - 3.92)	-0.146	0.86	(0.48 - 1.55)	-0.056	0.95	(0.54 - 1.66)	0.083	1.09	(0.58 - 2.04)	0.602	1.83	(0.82 - 4.07)
Other	-0.126	0.88	(0.4 - 1.95)	-0.008	0.99	(0.24 - 4.11)	-0.231	0.79	(0.34 - 1.85)	-0.695	0.5	(0.23 - 1.07)	-0.553	0.58	(0.23 - 1.41)	0.374	1.45	(0.40- 5.32)
Not Severely Obese (referent)																		
Severely Obese	-0.356	0.7	(0.29 - 1.69)	-1.295	0.27	(0.07 - 1.09)	0.123	1.13	(0.43 - 3)	-0.419	0.66	(0.27 - 1.6)	-0.439	0.64	(0.24 - 1.73)	-0.657	0.52	(0.12 - 2.25)
Constant		0.817			2.853			1.148			0.935			0.569			0.025	
Number of Cases		421			440			440			440			285			162	
-2 log likelihood		497			163			472			493			358			207	
Pseudo R2 (Nagelkerke)		0.071			0.149			0.046			0.095			0.066			0.130	

Note: B = logistic regression coefficient and OR=odds ratio
* p< .05, ** p< .01, *** p< .001

Acute MI Results (Table 11):

- Black patients, when compared to White patients, who were believed by the EMS provider to be having an Acute MI were 75% less likely to receive a 12-lead within 10 minutes of EMS arrival.

Pain Reduction for Cardiac Chest Pain Results (Table 12):

- Patients with Medicaid and patients without insurance, compared to patients with private insurance, were less likely (48% LL and 30% LL, respectively) to report any reduction in their pain levels while receiving EMS treatment.
- Patients considered severely obese, compared to patients not severely obese, were 30% less likely to report any reduction in their pain levels while receiving EMS treatment.

Table 12: Pain Score Reductions for Cardiac Chest Pain Patients

	Pain Point Reduction		
Regressor	*B*	*OR*	*CI 95%*
White (referent)			
Black	-0.221	0.8	(0.58 - 1.11)
Hispanic	-0.261	0.77	(0.48 - 1.23)
Asian	0.113	1.12	(0.56 - 2.24)
Other	0.126	1.13	(0.86 - 1.49)
Unknown	0.672	1.96	(0.64 - 6.00)
Discordant minority	0.218	1.24	(0.69 - 2.25)
Male (referent)			
Female	0.135	1.15	(0.99 - 1.33)
Other	0.504	1.66	(0.65 - 4.21)
Private (referent)			
Medicaid	-0.649	0.52***	(0.40 - 0.68)
Medicare	-0.178	0.84	(0.69 - 1.02)
Other Government	-0.205	0.82	(0.52 - 1.28)
No Insurance	-0.354	0.70**	(0.57 - 0.87)
Other	-0.315	0.73*	(0.57 - 0.93)
Not Severely Obese (referent)			
Severely Obese	-0.358	0.70***	(0.57 - 0.85)
Constant		0.547	
Number of Cases		3,244	
-2 log likelihood		4,203	
Pseudo R2 (Nagelkerke)		0.025	

Note: B = logistic regression coefficient and OR=odds ratio
* p< .05, ** p< .01, *** p< .001

Summary

Significant differences by a patient's societally relevant ("social") characteristics were found in both process measures (EMS treatments) as well as outcome measures (pain reduction) in the PCR sample when investigating the EMS management of patients with cardiac chest pain. Many racial minority patients were more likely to receive less than the treatment indicated by treatment protocols. Further, female patients were less likely to receive a 12-lead in a timely manner as well as less likely to receive NTG when presenting with cardiac chest pain. Poor patients were less likely to receive a timely 12-lead or pain medications when in pain. And finally, poor patients and severely obese patients were both less likely to have their pain reduced as a result of the EMS treatments received.

Limitations

There are several limitations to this analysis. First, this analysis is based on the EMS provider's medical chart and may not accurately reflect the treatments provided on scene. Next, the electronic medical chart does not provide a consistent mechanism to capture treatments offered and refused, and some EMS medical providers may not consistently chart refused treatments comprehensively. In addition, a patient's socio-economic status is a complex characteristic that health insurance status is unlikely to comprehensively capture. Further, using an average height for men and women to determine obesity status based on CDC guidelines is a crude proxy meant only to provide an indication of possible treatment differences.

Appendix

Abbreviations

AED	Automated External Defibrillator
AMR	American Medical Response
AMS	Altered Mental Status
ASA	Aspirin
BMI	Body Mass Index
CDC	Centers for Disease Control
CE	Continuing Education
CoV	City of Vancouver
CPAP	Continuous Positive Airway Pressure
CQI	Continuous Quality Improvement
EMS	Emergency Medical Services
ESO	Software company providing VFD with EMS medical charting software and service
ETT	Endotracheal Tube
GCS	Glasgow Coma Scale
IO	Intraosseous
IV	Intravenous
KPI	Key Performance Indicator
LEP	Limited English Proficiency
LL	Less Likely
MEDS	EMS charting software used by AMR
MI	Myocardial Infarction
ML	More Likely
MPD	Medical Program Director
NTG	Nitroglycerin
PCEP	Paramedic Continual Education Program
PCR	Patient Care Record
ROSC	Return of Spontaneous Circulation
RSI	Rapid Sequence Intubation
SES	Socio-Economic Status
STEMI	A type of myocardial infarction characterized as having an elevated EKG tracing between S point and the beginning of the T wave, aka an ST elevation myocardial infarction.
TLC	Time Life Critical
VFD	Vancouver Fire Department
WEMSIS	Washington Emergency Medical System Information System

Table 8: Adjusted Multivariable Logistic Regressions on Pain Management EMS Treatments on Primary Impressions of Atraumatic Pain or Traumatic injuries (2015-2019)

	Pain Assessment			*IV or IO*			*Pain Medication*			*Pain Reduction*		
Regressor	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*
White (referent)												
Black	-0.158	0.85	(0.7 - 1.04)	-0.194	0.82	(0.68 - 1)	-0.168	0.85	(0.67 - 1.07)	0.118	1.13	(0.9 - 1.41)
Asian	-0.337	0.71*	(0.54 - 0.95)	0.194	1.21	(0.91 - 1.61)	-0.227	0.80	(0.56 - 1.14)	-0.103	0.9	(0.62 - 1.31)
Hispanic	-0.260	0.77**	(0.64 - 0.93)	-0.024	0.98	(0.82 - 1.17)	-0.424	0.65***	(0.52 - 0.83)	-0.170	0.84	(0.67 - 1.06)
Other	-0.472	0.62***	(0.56 - 0.69)	0.056	1.06	(0.95 - 1.18)	-0.112	0.89	(0.79 - 1.02)	-0.035	0.97	(0.85 - 1.1)
Unknown	-0.221	0.80	(0.51 - 1.26)	-0.587	0.56*	(0.35 - 0.89)	-1.103	0.33**	(0.15 - 0.72)	-0.665	0.51*	(0.27 - 0.97)
Discordant minority	0.924	2.52	(0.73 - 8.67)	0.509	1.66	(0.67 - 4.14)	1.408	4.09**	(1.71 - 9.8)	0.672	1.96	(0.77 - 5)
Male (referent)												
Female	0.182	1.2***	(1.12 - 1.28)	-0.006	0.99	(0.93 - 1.06)	0.202	1.22***	(1.13 - 1.32)	0.132	1.14**	(1.05 - 1.24)
Private (referent)												
Medicare	-0.157	0.86**	(0.77 - 0.95)	-0.199	0.82***	(0.74 - 0.91)	-0.295	0.75***	(0.67 - 0.83)	-0.167	0.85**	(0.75 - 0.95)
Medicaid	-0.431	0.65***	(0.57 - 0.74)	-0.434	0.65***	(0.58 - 0.73)	-0.651	0.52***	(0.45 - 0.6)	-0.509	0.6***	(0.52 - 0.69)
Other Government	0.183	1.20	(0.91 - 1.59)	-0.214	0.81	(0.63 - 1.03)	-0.071	0.93	(0.7 - 1.23)	-0.146	0.87	(0.65 - 1.14)
No Insurance	-0.172	0.84**	(0.75 - 0.94)	0.201	1.22***	(1.1 - 1.35)	-0.169	0.84**	(0.75 - 0.95)	-0.244	0.78***	(0.7 - 0.88)
Unknown	-0.752	0.47***	(0.42 - 0.53)	-1.008	0.37***	(0.33 - 0.41)	-0.849	0.43***	(0.38 - 0.49)	-0.567	0.57***	(0.5 - 0.65)
Severely Obese	0.205	1.23**	(1.09 - 1.38)	0.029	1.03	(0.92 - 1.15)	0.078	1.08	(0.95 - 1.22)	0.044	1.05	(0.92 - 1.18)
Patient Age	-0.009	0.99***	(0.99 - 0.99)	-0.002	1.00**	(1.00 - 1.00)	-0.005	1.00***	(0.99 - 1)	-0.001	1.00	(1.00 - 1.00)
Traumatic Injury (referent)												
Abdominal Pain	0.827	2.29***	(2.08 - 2.52)	1.081	2.95***	(2.71 - 3.21)	0.349	1.42***	(1.29 - 1.56)	0.388	1.47***	(1.34 - 1.63)
Back or Body Pain	0.884	2.42***	(2.2 - 2.66)	-0.725	0.49***	(0.44 - 0.53)	-0.310	0.73***	(0.66 - 0.82)	-0.132	0.88*	(0.79 - 0.97)
Pain Management	1.609	5.00***	(3.87 - 6.45)	-3.260	0.04***	(0.03 - 0.06)	0.464	1.59***	(1.34 - 1.89)	0.125	1.13	(0.95 - 1.35)
First Pain Score		na		0.192	1.21***	(1.20 - 1.23)	0.511	1.67***	(1.63 - 1.71)	0.352	1.42***	(1.40 - 1.45)
Constant		0.815			-0.291			-1.101			-0.788	
Number of Cases		17,917			12,511			12,511			12,421	
-2 log likelihood		20,833			14,536			10,858			13,181	
Pseudo R2 (Nagelkerke)		0.096			0.247			0.335			0.233	

Note: B = logistic regression coefficient and OR=odds ratio
* p< .05, ** p< .01, *** p< .001

Table 9: Adjusted Multivariable Logistic Regressions on Pain Management EMS Treatments on Primary Impressions of Atraumatic Pain or Traumatic injuries in Moderate or Severe Pain (2015-2019)

	IV or IO			*Pain Medication*			*Pain Reduction*		
Regressor	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*
White (referent)									
Black	-0.144	0.87	(0.67 - 1.12)	-0.243	0.78	(0.59 - 1.04)	0.064	1.07	(0.83 - 1.37)
Asian	0.296	1.34	(0.86 - 2.1)	0.109	1.12	(0.7 - 1.78)	0.067	1.07	(0.7 - 1.64)
Hispanic	-0.004	1.00	(0.78 - 1.27)	-0.426	0.65**	(0.49 - 0.87)	-0.146	0.86	(0.67 - 1.11)
Other	-0.090	0.91	(0.79 - 1.06)	-0.093	0.91	(0.78 - 1.07)	-0.072	0.93	(0.8 - 1.08)
Unknown	-1.077	0.34**	(0.18 - 0.65)	-1.326	0.27**	(0.11 - 0.65)	-0.817	0.44*	(0.22 - 0.88)
Discordant minority	-0.040	0.96	(0.35 - 2.63)	0.371	1.45	(0.52 - 4.05)	0.080	1.08	(0.41 - 2.86)
Male (referent)									
Female	-0.124	0.88**	(0.81 - 0.97)	-0.041	0.96	(0.87 - 1.06)	-0.010	0.99	(0.91 - 1.08)
Private (referent)									
Medicare	-0.154	0.86*	(0.75 - 0.98)	-0.331	0.72***	(0.62 - 0.83)	-0.167	0.85*	(0.74 - 0.97)
Medicaid	-0.472	0.62***	(0.54 - 0.73)	-0.813	0.44***	(0.38 - 0.53)	-0.678	0.51***	(0.44 - 0.59)
Other Government	-0.298	0.74	(0.54 - 1.02)	-0.151	0.86	(0.61 - 1.21)	-0.179	0.84	(0.61 - 1.14)
No Insurance	0.059	1.06	(0.92 - 1.22)	-0.257	0.77**	(0.67 - 0.9)	-0.308	0.74***	(0.64 - 0.84)
Unknown	-0.467	0.63***	(0.54 - 0.73)	-0.495	0.61***	(0.52 - 0.72)	-0.456	0.63***	(0.55 - 0.74)
Severely Obese	-0.070	0.93	(0.81 - 1.07)	-0.081	0.92	(0.8 - 1.07)	-0.055	0.95	(0.83 - 1.08)
Patient Age	0.003	1.00*	(1.00 - 1.01)	0.004	1.00**	(1.00 - 1.01)	0.007	1.01***	(1.00 - 1.01)
Traumatic Injury (referent)									
Abdominal Pain	0.633	1.88***	(1.69 - 2.1)	-0.557	0.57***	(0.51 - 0.65)	-0.157	0.86**	(0.77 - 0.95)
Back or Body Pain	-1.271	0.28***	(0.25 - 0.31)	-1.369	0.25***	(0.22 - 0.29)	-0.748	0.47***	(0.42 - 0.53)
Pain Management	-3.449	0.03***	(0.02 - 0.06)	0.673	1.96***	(1.56 - 2.46)	0.542	1.72***	(1.39 - 2.13)
Pain Score	0.247	1.28***	(1.25 - 1.31)	0.505	1.66***	(1.61 - 1.71)	0.297	1.35***	(1.31 - 1.38)
Constant		-0.092			-0.779			-0.471	
Number of Cases		9,651			9,651			9,651	
-2 log likelihood		11,453			10,144			11,916	
Pseudo R2 (Nagelkerke)		0.239			0.248			0.126	

Note: B = logistic regression coefficient and OR=odds ratio
* p< .05, ** p< .01, *** p< .001

Table 10: Adjusted Multivariable Logistic Regressions on Pain Management EMS Treatments on Primary Impressions of Traumatic injuries (2015-2019)

	Pain Assessment			*IV or IO*			*Pain Medication*			*Pain Reduction*		
Regressor	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*
White (referent)												
Black	0.135	1.15	(0.15 - 8.51)	-0.273	0.76	(0.54 - 1.08)	-0.459	0.63*	(0.41 - 0.98)	-0.058	0.94	(0.64 - 1.39)
Asian	-1.335	0.26	(0.06 - 1.13)	0.227	1.26	(0.76 - 2.06)	-0.032	0.97	(0.48 - 1.96)	0.144	1.16	(0.63 - 2.13)
Hispanic	0.497	1.64	(0.22 - 12.36)	-0.016	0.98	(0.74 - 1.31)	-0.558	0.57**	(0.39 - 0.85)	-0.212	0.81	(0.57 - 1.15)
Other	-0.469	0.63	(0.28 - 1.41)	-0.052	0.95	(0.79 - 1.15)	0.173	1.19	(0.94 - 1.51)	0.129	1.14	(0.91 - 1.42)
Unknown	insufficient sample size			-1.139	0.32*	(0.13 - 0.82)	-0.511	0.6	(0.2 - 1.79)	-0.468	0.63	(0.23 - 1.67)
Discordant minority	insufficient sample size			-0.020	0.98	(0.26 - 3.75)	-0.021	0.98	(0.24 - 4.06)	0.094	1.10	(0.29 - 4.24)
Male (referent)												
Female	0.796	2.22**	(1.27 - 3.86)	-0.267	0.77***	(0.69 - 0.86)	-0.003	1.00	(0.86 - 1.15)	0.033	1.03	(0.91 - 1.18)
Private (referent)												
Medicare	0.254	1.29	(0.63 - 2.66)	-0.163	0.85*	(0.73 - 1)	-0.322	0.73**	(0.59 - 0.89)	-0.169	0.84	(0.7 - 1.01)
Medicaid	1.234	3.43	(0.77 - 15.27)	-0.451	0.64***	(0.52 - 0.78)	-0.902	0.41***	(0.31 - 0.53)	-0.667	0.51***	(0.41 - 0.65)
Other Government	insufficient sample size			-0.220	0.80	(0.53 - 1.21)	-0.097	0.91	(0.54 - 1.54)	-0.312	0.73	(0.45 - 1.19)
No Insurance	0.240	1.27	(0.59 - 2.75)	0.207	1.23*	(1.05 - 1.45)	-0.218	0.8*	(0.66 - 0.99)	-0.352	0.7***	(0.58 - 0.85)
Unknown	0.495	1.64	(0.67 - 4)	-0.648	0.52***	(0.44 - 0.63)	-0.490	0.61***	(0.48 - 0.78)	-0.424	0.65***	(0.53 - 0.81)
Severely Obese	-0.154	0.86	(0.34 - 2.18)	-0.227	0.80*	(0.67 - 0.96)	-0.178	0.84	(0.67 - 1.05)	-0.053	0.95	(0.77 - 1.16)
Patient Age	-0.009	0.99	(0.98 - 1.01)	0.006	1.01***	(1 - 1.01)	0.013	1.01***	(1.01 - 1.02)	0.010	1.01***	(1.01 - 1.01)
Pain Score	0.014	1.01	(0.94 - 1.1)	0.220	1.25***	(1.23 - 1.27)	0.578	1.78***	(1.73 - 1.84)	0.411	1.51***	(1.47 - 1.54)
Constant		4.759			-0.252			-1.057			-0.86	
Number of Cases		6,585			6,585			6,585			6,529	
-2 log likelihood		625			8,107			5,116			6,199	
Pseudo R2 (Nagelkerke)		0.033			0.174			0.449			0.334	

Note: B = logistic regression coefficient and OR=odds ratio
* p< .05, ** p< .01, *** p< .001

Table 11: Adjusted Multivariable Logistic Regressions on Pain Management EMS Treatments on Primary Impressions of Traumatic injuries in Moderate or Severe Pain (2015-2019)

	IV or IO			*Pain Medication*			*Pain Reduction*		
Regressor	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*
White (referent)									
Black	-0.271	0.76	(0.52 - 1.12)	-0.459	0.63*	(0.41 - 0.98)	-0.081	0.92	(0.62 - 1.38)
Asian	0.142	1.15	(0.61 - 2.18)	-0.076	0.93	(0.44 - 1.94)	0.170	1.19	(0.62 - 2.27)
Hispanic	-0.039	0.96	(0.69 - 1.34)	-0.541	0.58**	(0.39 - 0.87)	-0.229	0.80	(0.56 - 1.14)
Other	-0.105	0.90	(0.72 - 1.12)	0.143	1.15	(0.9 - 1.48)	0.120	1.13	(0.9 - 1.42)
Unknown	-1.195	0.30*	(0.11 - 0.86)	-0.817	0.44	(0.14 - 1.44)	-0.655	0.52	(0.18 - 1.49)
Discordant minority	-0.106	0.90	(0.23 - 3.52)	-0.051	0.95	(0.23 - 3.94)	0.134	1.14	(0.3 - 4.35)
Male (referent)									
Female	-0.282	0.75***	(0.66 - 0.86)	-0.047	0.95	(0.82 - 1.11)	0.040	1.04	(0.91 - 1.2)
Private (referent)									
Medicare	-0.248	0.78*	(0.64 - 0.95)	-0.331	0.72**	(0.58 - 0.89)	-0.187	0.83	(0.68 - 1.01)
Medicaid	-0.511	0.60***	(0.48 - 0.75)	-0.906	0.40***	(0.31 - 0.53)	-0.732	0.48***	(0.38 - 0.61)
Other Government	-0.331	0.72	(0.44 - 1.18)	-0.058	0.94	(0.55 - 1.62)	-0.281	0.76	(0.46 - 1.25)
No Insurance	0.123	1.13	(0.93 - 1.37)	-0.205	0.81	(0.66 - 1.01)	-0.358	0.70***	(0.58 - 0.85)
Unknown	-0.568	0.57***	(0.45 - 0.71)	-0.471	0.62***	(0.49 - 0.8)	-0.433	0.65***	(0.52 - 0.82)
Severely Obese	-0.244	0.78*	(0.64 - 0.96)	-0.184	0.83	(0.66 - 1.05)	-0.040	0.96	(0.78 - 1.18)
Patient Age	0.007	1.01***	(1 - 1.01)	0.013	1.01***	(1.01 - 1.02)	0.011	1.01***	(1.01 - 1.01)
Pain Score	0.316	1.37***	(1.33 - 1.42)	0.583	1.79***	(1.72 - 1.87)	0.366	1.44***	(1.39 - 1.49)
Constant		0.077			-0.531			-0.358	
Number of Cases		4,445			4,445			4,445	
-2 log likelihood		5,638			4,674			5,387	
Pseudo R2 (Nagelkerke)		0.146			0.320			0.179	

Note: B = logistic regression coefficient and OR=odds ratio
* p< .05, ** p< .01, *** p< .001

Table 12: Adjusted Multivariable Logistic Regressions on Pain Management EMS Treatments on Primary Impressions of Abdominal Pain (2015-2019)

	Pain Assessment			*IV or IO*			*Pain Medication*			*Pain Reduction*		
Regressor	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*
White (referent)												
Black	-1.320	0.27	(0.06 - 1.25)	-0.121	0.89	(0.59 - 1.33)	-0.143	0.87	(0.55 - 1.36)	0.198	1.22	(0.81 - 1.83)
Asian	insufficient sample size			0.748	2.11	(0.92 - 4.87)	0.398	1.49	(0.72 - 3.09)	-0.061	0.94	(0.47 - 1.88)
Hispanic	-0.930	0.39	(0.05 - 3.24)	-0.071	0.93	(0.57 - 1.51)	-0.649	0.52*	(0.29 - 0.95)	-0.509	0.6	(0.36 - 1.01)
Other	0.509	1.66	(0.22 - 12.79)	-0.075	0.93	(0.72 - 1.2)	-0.419	0.66**	(0.49 - 0.89)	-0.091	0.91	(0.7 - 1.18)
Unknown	insufficient sample size			-1.042	0.35*	(0.14 - 0.91)	-2.338	0.1*	(0.01 - 0.74)	-1.318	0.27*	(0.08 - 0.94)
Discordant minority	insufficient sample size			-0.822	0.44	(0.06 - 3.18)	0.238	1.27	(0.17 - 9.43)	-0.953	0.39	(0.04 - 3.76)
Male (referent)												
Female	0.142	1.15	(0.46 - 2.91)	0.138	1.15	(0.97 - 1.36)	0.006	1.01	(0.83 - 1.22)	0.074	1.08	(0.91 - 1.28)
Private (referent)												
Medicare	0.677	1.97	(0.52 - 7.45)	0.025	1.03	(0.78 - 1.36)	-0.324	0.72*	(0.54 - 0.97)	-0.071	0.93	(0.71 - 1.22)
Medicaid	0.459	1.58	(0.43 - 5.78)	-0.365	0.69**	(0.53 - 0.91)	-0.698	0.5***	(0.37 - 0.66)	-0.541	0.58***	(0.45 - 0.76)
Other Government	insufficient sample size			-0.243	0.79	(0.44 - 1.39)	-0.154	0.86	(0.45 - 1.62)	0.132	1.14	(0.65 - 2.01)
No Insurance	1.997	7.37	(0.86 - 63.15)	-0.119	0.89	(0.68 - 1.17)	-0.363	0.7*	(0.52 - 0.92)	-0.318	0.73*	(0.56 - 0.95)
Unknown	0.361	1.44	(0.4 - 5.21)	-0.395	0.67**	(0.51 - 0.89)	-0.471	0.62**	(0.46 - 0.84)	-0.374	0.69**	(0.52 - 0.91)
Severely Obese	insufficient sample size			0.038	1.04	(0.81 - 1.33)	-0.089	0.92	(0.7 - 1.2)	0.043	1.04	(0.82 - 1.33)
Patient Age	-0.006	0.99	(0.97 - 1.02)	0.001	1.00	(1.00 - 1.01)	-0.002	1.00	(0.99 - 1.00)	-0.002	1.00	(0.99 - 1.00)
Pain Score	0.145	1.16	(0.99 - 1.35)	0.124	1.13***	(1.1 - 1.17)	0.443	1.56***	(1.47 - 1.65)	0.229	1.26***	(1.21 - 1.31)
Constant	4.925			0.714			-0.89			-0.488		
Number of Cases	2,635			2,635			2,635			2,616		
-2 log likelihood	206			3,256			2,778			3,290		
Pseudo R2 (Nagelkerke)	0.088			0.042			0.201			0.093		

Note: B = logistic regression coefficient and OR=odds ratio
* p< .05, ** p< .01, *** p< .001

Table 13: Adjusted Multivariable Logistic Regressions on Pain Management EMS Treatments on Primary Impressions of Abdominal Pain in Moderate or Severe Pain (2015-2019)

	IV or IO			*Pain Medication*			*Pain Reduction*		
Regressor	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*
White (referent)									
Black	-0.065	0.94	(0.61 - 1.45)	-0.144	0.87	(0.55 - 1.37)	0.275	1.32	(0.87 - 2)
Asian	0.822	2.27	(0.93 - 5.55)	0.411	1.51	(0.72 - 3.15)	-0.033	0.97	(0.48 - 1.94)
Hispanic	-0.099	0.91	(0.55 - 1.49)	-0.637	0.53*	(0.29 - 0.96)	-0.489	0.61	(0.37 - 1.03)
Other	-0.053	0.95	(0.72 - 1.25)	-0.405	0.67**	(0.49 - 0.9)	-0.068	0.93	(0.72 - 1.21)
Unknown	-1.048	0.35*	(0.14 - 0.9)	-2.339	0.10*	(0.01 - 0.74)	-1.309	0.27*	(0.08 - 0.95)
Discordant minority	-0.848	0.43	(0.06 - 3.09)	0.248	1.28	(0.17 - 9.54)	-0.919	0.40	(0.04 - 3.88)
Male (referent)									
Female	0.154	1.17	(0.97 - 1.4)	0.003	1.00	(0.83 - 1.22)	0.108	1.11	(0.94 - 1.33)
Private (referent)									
Medicare	0.017	1.02	(0.76 - 1.37)	-0.337	0.71*	(0.53 - 0.96)	-0.101	0.90	(0.69 - 1.19)
Medicaid	-0.326	0.72*	(0.55 - 0.96)	-0.731	0.48***	(0.36 - 0.64)	-0.554	0.58***	(0.44 - 0.75)
Other Government	-0.273	0.76	(0.42 - 1.39)	-0.149	0.86	(0.45 - 1.64)	0.122	1.13	(0.63 - 2.02)
No Insurance	-0.099	0.91	(0.68 - 1.2)	-0.371	0.69*	(0.52 - 0.92)	-0.326	0.72*	(0.55 - 0.94)
Unknown	-0.313	0.73*	(0.55 - 0.98)	-0.494	0.61**	(0.45 - 0.83)	-0.364	0.70*	(0.53 - 0.92)
Severely Obese	0.021	1.02	(0.79 - 1.33)	-0.075	0.93	(0.71 - 1.22)	0.023	1.02	(0.8 - 1.31)
Patient Age	0.002	1.00	(1.00 - 1.01)	-0.002	1.00	(0.99 - 1.00)	-0.001	1.00	(0.99 - 1.00)
Pain Score	0.119	1.13***	(1.07 - 1.18)	0.446	1.56***	(1.47 - 1.66)	0.186	1.2***	(1.15 - 1.26)
Constant		0.782			-0.776			-0.383	
Number of Cases		2,405			2,405			2,405	
-2 log likelihood		2,945			2,708			3,155	
Pseudo R2 (Nagelkerke)		0.028			0.159			0.050	

Note: B = logistic regression coefficient and OR=odds ratio
* p< .05, ** p< .01, *** p< .001

Table 14: Adjusted Multivariable Logistic Regressions on Pain Management EMS Treatments on Primary Impressions of Back or Body Pain (2015-2019)

	Pain Assessment			*IV or IO*			*Pain Medication*			*Pain Reduction*		
Regressor	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*
White (referent)												
Black	Insufficient sample size			-0.146	0.86	(0.51 - 1.46)	-0.053	0.95	(0.52 - 1.73)	-0.002	1.10	(0.6 - 1.67)
Asian	-2.675	0.07*	(0.01 - 0.65)	-0.272	0.76	(0.25 - 2.33)	0.115	1.12	(0.3 - 4.17)	0.124	1.13	(0.39 - 3.27)
Hispanic	Insufficient sample size			0.192	1.21	(0.72 - 2.05)	0.140	1.15	(0.61 - 2.15)	0.293	1.34	(0.78 - 2.29)
Other	-1.990	0.14***	(0.05 - 0.41)	-0.107	0.90	(0.67 - 1.21)	-0.185	0.83	(0.58 - 1.2)	-0.495	0.61**	(0.44 - 0.85)
Unknown	Insufficient sample size			-0.761	0.47	(0.1 - 2.15)	-0.943	0.39	(0.05 - 3.14)	-0.198	0.82	(0.22 - 3.07)
Discordant minority	Insufficient sample size			0.849	2.34	(0.32 - 17.37)	1.291	3.64	(0.46 - 28.89)	0.833	2.30	(0.31 - 17.04)
Male (referent)												
Female	0.372	1.45	(0.51 - 4.15)	-0.142	0.87	(0.72 - 1.04)	-0.294	0.75**	(0.6 - 0.93)	-0.251	0.78**	(0.65 - 0.94)
Private (referent)												
Medicare	1.576	4.84	(0.95 - 24.73)	-0.204	0.82	(0.63 - 1.06)	-0.423	0.66**	(0.48 - 0.9)	-0.266	0.77*	(0.59 - 1.00)
Medicaid	0.459	1.58	(0.38 - 6.64)	-0.555	0.57***	(0.42 - 0.78)	-0.876	0.42***	(0.29 - 0.6)	-0.663	0.52***	(0.38 - 0.7)
Other Government	Insufficient sample size			-0.386	0.68	(0.38 - 1.22)	-0.353	0.70	(0.36 - 1.37)	-0.330	0.72	(0.41 - 1.27)
No Insurance	1.477	4.38	(0.84 - 22.84)	0.027	1.03	(0.78 - 1.36)	-0.137	0.87	(0.63 - 1.21)	-0.097	0.91	(0.68 - 1.2)
Unknown	0.757	2.13	(0.4 - 11.26)	-0.392	0.68*	(0.49 - 0.93)	-0.508	0.6**	(0.42 - 0.87)	-0.433	0.65**	(0.47 - 0.89)
Severely Obese	-0.618	0.54	(0.14 - 2.06)	0.018	1.02	(0.78 - 1.32)	0.052	1.05	(0.77 - 1.43)	-0.192	0.83	(0.63 - 1.09)
Patient Age	-0.019	0.98	(0.95 - 1.01)	-0.002	1.00	(0.99 - 1.00)	-0.005	1.00	(0.99 - 1.00)	0.007	1.01*	(1.00 - 1.01)
Pain Score	0.091	1.10	(0.92 - 1.31)	0.150	1.16***	(1.12 - 1.21)	0.394	1.48***	(1.39 - 1.58)	0.236	1.27***	(1.22 - 1.32)
Constant	5.16			-1.043			-1.582			-0.988		
Number of Cases	2,628			2,628			2,628			2,613		
-2 log likelihood	160			2,924			2,142			2,872		
Pseudo R2 (Nagelkerke)	0.135			0.050			0.156			0.098		

Note: B = logistic regression coefficient and OR=odds ratio
* p< .05, ** p< .01, *** p< .001

Table 15: Adjusted Multivariable Logistic Regressions on Pain Management EMS Treatments on Primary Impressions of Back or Body Pain in Moderate or Severe Pain (2015-2019)

	IV or IO			*Pain Medication*			*Pain Reduction*		
Regressor	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*
White (referent)									
Black	-0.061	0.94	(0.55 - 1.60)	-0.032	0.97	(0.53 - 1.77)	-0.035	0.97	(0.57 - 1.64)
Asian	-0.391	0.68	(0.19 - 2.44)	0.188	1.21	(0.32 - 4.56)	0.250	1.28	(0.43 - 3.83)
Hispanic	0.183	1.20	(0.69 - 2.09)	0.160	1.17	(0.63 - 2.20)	0.264	1.30	(0.75 - 2.26)
Other	-0.109	0.90	(0.66 - 1.23)	-0.185	0.83	(0.58 - 1.20)	-0.529	0.59**	(0.42 - 0.82)
Unknown	-0.680	0.51	(0.11 - 2.36)	-0.935	0.39	(0.05 - 3.17)	-0.192	0.83	(0.22 - 3.12)
Discordant minority	0.846	2.33	(0.31 - 17.51)	1.298	3.66	(0.46 - 29.17)	0.850	2.34	(0.31 - 17.46)
Male (referent)									
Female	-0.089	0.92	(0.76 - 1.11)	-0.288	0.75*	(0.6 - 0.94)	-0.267	0.77**	(0.63 - 0.92)
Private (referent)									
Medicare	-0.139	0.87	(0.66 - 1.15)	-0.425	0.65*	(0.47 - 0.90)	-0.237	0.79	(0.6 - 1.04)
Medicaid	-0.533	0.59**	(0.43 - 0.81)	-0.857	0.43***	(0.29 - 0.62)	-0.694	0.5***	(0.36 - 0.69)
Other Government	-0.234	0.79	(0.44 - 1.44)	-0.331	0.72	(0.37 - 1.40)	-0.293	0.75	(0.42 - 1.33)
No Insurance	0.074	1.08	(0.81 - 1.44)	-0.125	0.88	(0.64 - 1.22)	-0.092	0.91	(0.68 - 1.22)
Unknown	-0.435	0.65*	(0.46 - 0.91)	-0.558	0.57**	(0.39 - 0.83)	-0.535	0.59**	(0.42 - 0.81)
Severely Obese	0.068	1.07	(0.82 - 1.4)	0.052	1.05	(0.77 - 1.44)	-0.188	0.83	(0.63 - 1.09)
Patient Age	-0.002	1.00	(0.99 - 1.00)	-0.004	1.00	(0.99 - 1.00)	0.006	1.01*	(1.00 - 1.01)
Pain Score	0.210	1.23***	(1.17 - 1.3)	0.396	1.49***	(1.39 - 1.59)	0.227	1.26***	(1.19 - 1.32)
Constant		-1.01			-1.477			-0.894	
Number of Cases		2,367			2,367			2,367	
-2 log likelihood		2,655			2,083			2,722	
Pseudo R2 (Nagelkerke)		0.055			0.125			0.076	

Note: B = logistic regression coefficient and OR=odds ratio
* p< .05, ** p< .01, *** p< .001

Table 16: Adjusted Multivariable Logistic Regressions on Pain Management EMS Treatments on Primary Impressions of Pain Management (2015-2019)

	Pain Assessment			*IV or IO*			*Pain Medication*			*Pain Reduction*		
Regressor	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*
White (referent)												
Black	Insufficient sample size			1.286	3.62	(0.37 - 35.27)	-0.415	0.66	(0.14 - 3.12)	0.052	1.05	(0.24 - 4.69)
Asian	-0.550	0.58	(0.07 - 4.87)	1.694	5.44	(0.54 - 55.1)	-1.177	0.31	(0.03 - 2.76)	0.564	1.76	(0.36 - 8.57)
Hispanic	Insufficient sample size			Insufficient sample size			-0.309	0.73	(0.27 - 2)	0.412	1.51	(0.52 - 4.35)
Other	-1.286	0.28***	(0.14 - 0.55)	-0.032	0.97	(0.12 - 7.91)	0.521	1.68	(0.81 - 3.52)	0.468	1.6	(0.75 - 3.42)
Unknown	Insufficient sample size			Insufficient sample size			Insufficient sample size			Insufficient sample size		
Male (referent)												
Female	0.005	1.01	(0.6 - 1.7)	-0.461	0.63	(0.23 - 1.73)	0.202	1.22	(0.84 - 1.78)	-0.060	0.94	(0.64 - 1.38)
Private (referent)												
Medicare	-0.850	0.43*	(0.22 - 0.83)	0.721	2.06	(0.41 - 10.36)	-0.135	0.87	(0.47 - 1.62)	0.246	1.28	(0.7 - 2.34)
Medicaid	-1.140	0.32*	(0.11 - 0.93)	-0.229	0.8	(0.08 - 7.73)	-0.458	0.63	(0.27 - 1.46)	-1.119	0.33*	(0.13 - 0.8)
Other Government	-0.684	0.51	(0.06 - 4.37)	Insufficient sample size			0.216	1.24	(0.2 - 7.81)	-0.253	0.78	(0.12 - 5.24)
No Insurance	-0.328	0.72	(0.23 - 2.27)	0.175	1.19	(0.14 - 10.26)	-0.233	0.79	(0.35 - 1.79)	-0.399	0.67	(0.29 - 1.58)
Unknown	-0.814	0.44	(0.18 - 1.08)	1.664	5.28**	(1.64 - 17.01)	-0.053	0.95	(0.47 - 1.9)	-0.578	0.56	(0.27 - 1.18)
Severely Obese	-0.329	0.72	(0.28 - 1.84)	0.351	1.42	(0.30 - 6.85)	-0.050	0.95	(0.49 - 1.86)	-0.050	0.95	(0.48 - 1.88)
Patient Age	-0.022	0.98**	(0.96 - 0.99)	-0.027	0.97	(0.95 - 1.00)	-0.014	0.99*	(0.98 - 1.00)	-0.004	1.00	(0.99 - 1.01)
Pain Score	Insufficient sample size			0.174	1.19	(0.98 - 1.45)	0.409	1.51***	(1.39 - 1.63)	0.524	1.69***	(1.55 - 1.84)
Constant	2.263			-3.579			-0.769			-0.586		
Number of Cases	732			663			663			663		
-2 log likelihood	416			145			678			650		
Pseudo R2 (Nagelkerke)	0.117			0.135			0.283			0.378		

Note: B = logistic regression coefficient and OR=odds ratio
* p< .05, ** p< .01, *** p< .001

Table 17: Adjusted Multivariable Logistic Regressions on Pain Management EMS Treatments on Primary Impressions of Pain Management in Moderate or Severe Pain (2015-2019)

	IV or IO			*Pain Medication*			*Pain Reduction*		
Regressor	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*	*B*	*OR*	*CI 95%*
White (referent)									
Black	1.412	4.11	(0.37 - 45.88)	-0.350	0.70	(0.14 - 3.52)	-0.460	0.63	(0.13 - 3.06)
Asian	2.324	10.22	(0.81 - 129.37)	-1.045	0.35	(0.04 - 3.45)	0.099	1.10	(0.17 - 7.2)
Hispanic	Insufficient sample size			-0.166	0.85	(0.30 - 2.42)	0.688	1.99	(0.63 - 6.29)
Other	0.426	1.53	(0.18 - 13.41)	0.260	1.30	(0.55 - 3.07)	0.348	1.42	(0.59 - 3.40)
Unknown	Insufficient sample size			Insufficient sample size			Insufficient sample size		
Male (referent)									
Female	-0.370	0.69	(0.22 - 2.22)	0.208	1.23	(0.82 - 1.85)	-0.212	0.81	(0.53 - 1.23)
Private (referent)									
Medicare	0.311	1.37	(0.15 - 12.17)	-0.071	0.93	(0.48 - 1.82)	0.124	1.13	(0.58 - 2.20)
Medicaid	-0.569	0.57	(0.05 - 6.48)	-0.419	0.66	(0.28 - 1.55)	-0.981	0.38*	(0.15 - 0.91)
Other Government	Insufficient sample size			0.430	1.54	(0.2 - 11.69)	-0.238	0.79	(0.10 - 6.00)
No Insurance	0.112	1.12	(0.12 - 10.64)	-0.353	0.7	(0.29 - 1.73)	-0.584	0.56	(0.22 - 1.42)
Unknown	1.199	3.32	(0.79 - 13.99)	-0.349	0.71	(0.33 - 1.49)	-0.521	0.59	(0.28 - 1.27)
Severely Obese	0.569	1.77	(0.35 - 9.01)	-0.066	0.94	(0.46 - 1.92)	-0.017	0.98	(0.48 - 2.03)
Patient Age	-0.040	0.96*	(0.93 - 1.00)	-0.015	0.99**	(0.97 - 1.00)	-0.001	1.00	(0.99 - 1.01)
Pain Score	0.276	1.32	(0.93 - 1.86)	0.342	1.41***	(1.25 - 1.59)	0.456	1.58***	(1.39 - 1.8)
Constant	-3.401			-0.241			0.018		
Number of Cases	434			434			434		
-2 log likelihood	107			551			536		
Pseudo R2 (Nagelkerke)	0.149			0.128			0.184		

Note: B = logistic regression coefficient and OR=odds ratio
* p< .05, ** p< .01, *** p< .001