

# Demographic Factors Influencing Injection Therapy for Radiculopathy Pain Management

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Radiculopathy significantly impacts the prevalence of back pain, one of the most common issues leading to primary care visits in developed countries. Therefore, it is crucial to study the etiology and epidemiology of this disease to optimize treatments. One of the major treatments is epidural steroid injections (ESI), which is an injection of anti-inflammatory medicine (steroid) into the epidural space around the spinal nerves in the back. This study examines how age, gender, race, and cause of pain in patients with moderate to severe spinal nerve pain caused by radiculopathy are associated with ESI treatments using data from the Atlantic Spine Center in five years from January 1, 2019 to December 31, 2023. Our findings reveal no significant difference in the mean age between genders, but a higher proportion of females received injections compared to males, indicating possible gender-related disparities in chronic pain conditions or treatment-seeking behaviors. Racial analysis showed an overrepresentation of African Americans and other races among patients. Additionally, patients with traumatic injuries are generally younger than those with degenerative conditions, revealing age-related impacts on radiculopathy. These results unveil hidden associations between factors that could lead to further research in the need for targeted interventions and disparities in pain management for radiculopathy treatment and improvement in treatment outcomes.

**Keywords:** radiculopathy, statistics, injections, spine, pain management, back pain

## Introduction

Radiculopathy is among one of the biggest concerns in the pain market, contributing significantly to the prevalence of back pain, which is one of the top five most common issues prompting visits to primary care physicians in developed countries<sup>1,2</sup>.

A 2022 national survey of adults in the United States reported that 28% of the population suffers from chronic low back or sciatic pain. Globally, low back pain affected 619 million people in 2020, or about 8% of the population, with projections suggesting 843 million cases by 2050<sup>3</sup>. This only accounts for one type of back pain, while there are a number of back pain types that affect all areas of the spine.

Radiculopathy, a condition caused by compression or irritation of spinal nerves, can occur in different regions of the spine. The primary causes of radiculopathy pain include traumas (accidents like car accidents and falls), bone spurs growing on vertebrae, and herniated discs<sup>4</sup>. It is a leading contributor to back pain and often requires medical intervention.

The treatment for such pain is managed mainly by injections, most commonly epidural steroid injections (ESIs), which can relieve excruciating long-term neck and radiculopathy temporarily, and in some cases, indefinitely<sup>5</sup>. ESIs are performed by injecting an anti-inflammatory medication into the epidural space surrounding the spine and around the spinal nerves<sup>5</sup>. For exam-

ple, Lumbar ESI treats radiculopathy radiating down the legs<sup>6</sup>. If injections are not successful in managing the pain, patients are referred to surgery<sup>7</sup>.

Despite the growing burden of radiculopathy, research on its epidemiology remains limited. Previous studies have suggested disparities in pain perception, access to treatment, and clinical outcomes based on age, gender, and race, but research specifically linking these factors to radiculopathy and ESI treatment is scarce. Studies indicate that older patients may be more likely to receive ESIs due to increased severity of degenerative spinal conditions<sup>8</sup>, while gender differences have been observed in both pain reporting and treatment approaches, with women often receiving less aggressive pain management than men<sup>9</sup>. Racial disparities in pain treatment are also well-documented, with research suggesting that minority patients are less likely to receive adequate pain management interventions, including ESIs<sup>10</sup>. However, few studies have specifically analyzed how these demographic factors interact in radiculopathy cases requiring injection-based treatment.

This study aims to examine these demographic influences, hypothesizing that older patients are more likely to receive ESIs due to increased severity of radiculopathy, gender differences affect treatment outcomes and pain perception, and racial disparities exist in access to ESIs and reported pain levels. Understanding these patterns may enhance clinical decision-making

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and improve patient outcomes as back pain cases continue to rise globally.

## Results

### Age and Gender

We reviewed a total of 4020 patients in this study (1051 from 2019, 662 from 2020, 782 from 2021, 865 from 2022, and 844 from 2023); 2097 females and 1923 males. The sample size is large enough to draw statistical conclusions. The mean age in radiculopathy injections for females was approximately 49, and the mean age in radiculopathy for males was also about 49 (Figure 1). There was no statistical difference between mean age in females and males for patients who receive these injections ( $p\text{-value} = 8.040 \times 10^{-1}$ ).

We also compared the distribution of gender for radiculopathy patient injections with the gender ratio of NJ to see if one gender has more need for radiculopathy injections than the other. In 2022, the gender percentages of NJ were 50.74% female and 49.26% male<sup>11</sup>. There was a statistical difference between the proportion of female radiculopathy injection patients and proportion of females in NJ ( $p\text{-value} = 0.9056 \times 10^{-3}$ ). In addition, the most common age group for males and females is 45-54 years, with this age group being the most overrepresented among all age groups.

### Racial Distribution

We next compared the distribution of race for patients who received radiculopathy pain management injections with the racial distribution of NJ (Figure 2). 748 patients have reported the race information and are reviewed in this study. The races groups are White, African American, Hispanic, Asian, American Indian or Alaska Native, and Other Race.

The observed counts were 267 White patients, 262 African American patients, 141 Hispanic patients, 49 Asian patients, 1 American Indian or Alaska Native patient, and 28 patients of other races. The true distribution of race in NJ is 55% White, 13.1% Black, 21.6% Hispanic, 10% Asian, 0.6% American Indian and Alaska Native, and 21% other race<sup>12</sup>.

The racial distribution of radiculopathy injection patients is extremely statistically different from the racial distribution of NJ ( $p\text{-value} = 2.9 \times 10^{-94}$ ), with the African American group being the most overrepresented group who contribute most to the chi-square test statistic, contributing 274.4490 out of a chi-square value of 446.4097.

### Cause Of Pain

We also reviewed the data for age distribution for patients whose pain is caused by degenerative diseases, car accidents, and work-related injuries (Figure 3). The mean age of radiculopathy

injection patients whose pain was caused by degenerative diseases was 50.2 years, for car accidents was 47.0 years, and for work-related injuries was 49.3 years.

Although for car accident related injuries the age of patients was significantly younger than those of degenerative injuries ( $p\text{-value} = 2.5620 \times 10^{-11}$ ), there is no significance in the difference of age for patients with work-related injuries compared to those with degenerative injuries ( $p\text{-value} = 1.144 \times 10^{-1}$ ).

## Discussion

The results of this study provide insights into the demographics and characteristics of patients receiving injections for spinal nerve pain caused by radiculopathy, highlighting significant patterns related to age, gender, race, and causes of pain.

A limitation of this study is that the data lacked other important demographic data, such as smoking history, drinking history, and marital status, which has shown in research to be associated with spinal disorders<sup>13</sup>. The absence of these variables presents potential confounding factors that may influence the observed associations.

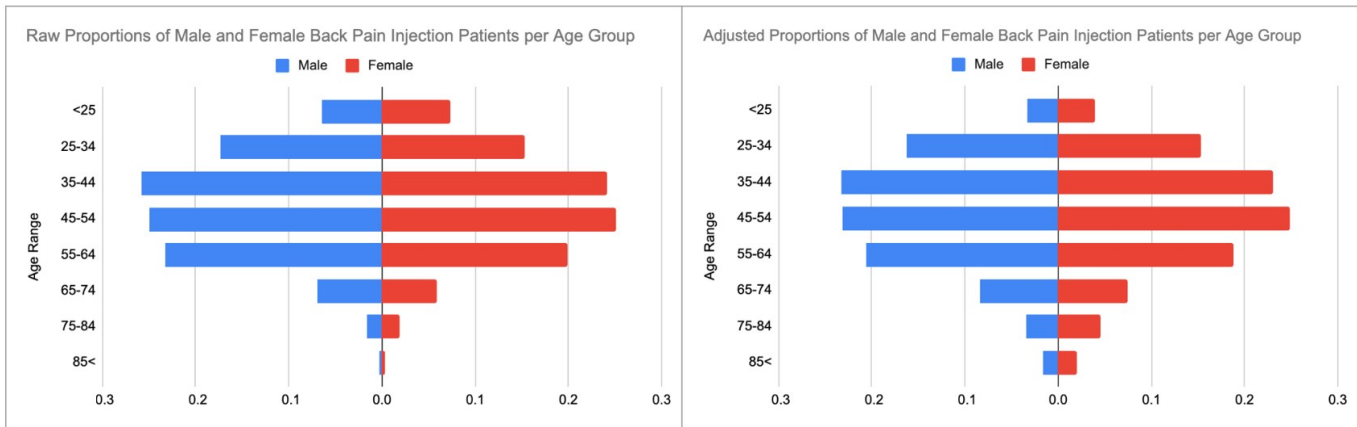
### Age And Gender

The analysis of age and gender distribution among patients receiving spinal pain injections revealed no significant difference in the mean age between males and females, with both groups averaging around 49 years. This peak may be when people are still working, making them have to exert physical effort (increasing radiculopathy prevalence), but not yet old enough to retire and rest (easing radiculopathy prevalence). Alternatively, the peak may be explained by the conditions of some elderly injection patients having progressed to a more severe stage and have to take the more advanced treatment of surgery.

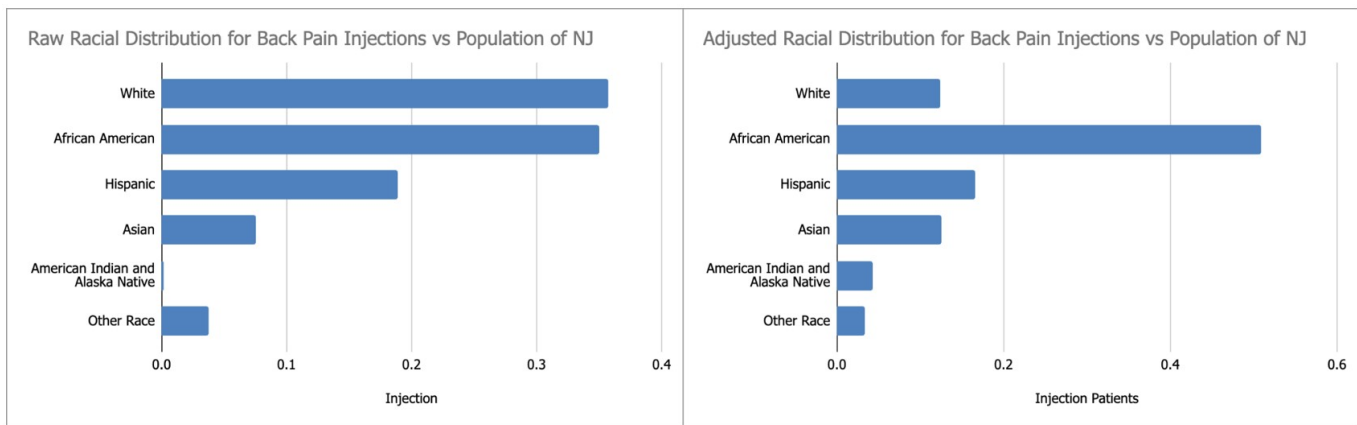
The findings suggest that radiculopathy requiring injection treatment affects both genders similarly in terms of age. However, the study found a significantly higher proportion of females receiving injections compared to the general population of NJ. This indicates that women are correlated more with seeking treatment for chronic pain conditions such as radiculopathy<sup>9</sup>.

One hypothesis we had was that there would be a peak in radiculopathy around menopause age (around age 50) for female patients<sup>14</sup>. According to the histogram there is a peak in that area. Thus, there is a possibility that menopause could affect the onset of radiculopathy. On the other hand, although there is still a high prevalence in male patients of the same age group, the same peak is not present. Additional research is necessary to further this hypothesis.

However, the lack of data on smoking and drinking history could confound these findings. Smoking has been linked to an increased risk of degenerative spinal conditions due to its effects on vascular health and tissue repair, while alcohol consumption



**Fig. 1** Different proportions of age groups for radiculopathy injection treatment for men and women. Bar graph showing proportions of Male and Female Radiculopathy Injection Patients per Age Group; raw (left) and adjusted for NJ population (right). Data was collected through eClinicalWorks database from Atlantic Spine Center.



**Fig. 2** Different proportions of race for radiculopathy injection treatment. Bar graphs showing racial distribution of patients who received radiculopathy injections vs distribution of NJ; raw (left) and adjusted for NJ population (right). Data was collected through eClinicalWorks database from Atlantic Spine Center

can contribute to inflammation and neuropathy<sup>13</sup>. If smoking and drinking behaviors differ between men and women in the study population, they may partly explain the gender disparity in radiculopathy prevalence and treatment-seeking behaviors.

Further research could explore underlying reasons for gender disparity for radiculopathy, considering factors such as hormonal differences, pain perception, and healthcare-seeking behaviors. Data constraints could have potentially biased this study.

### Racial Distribution

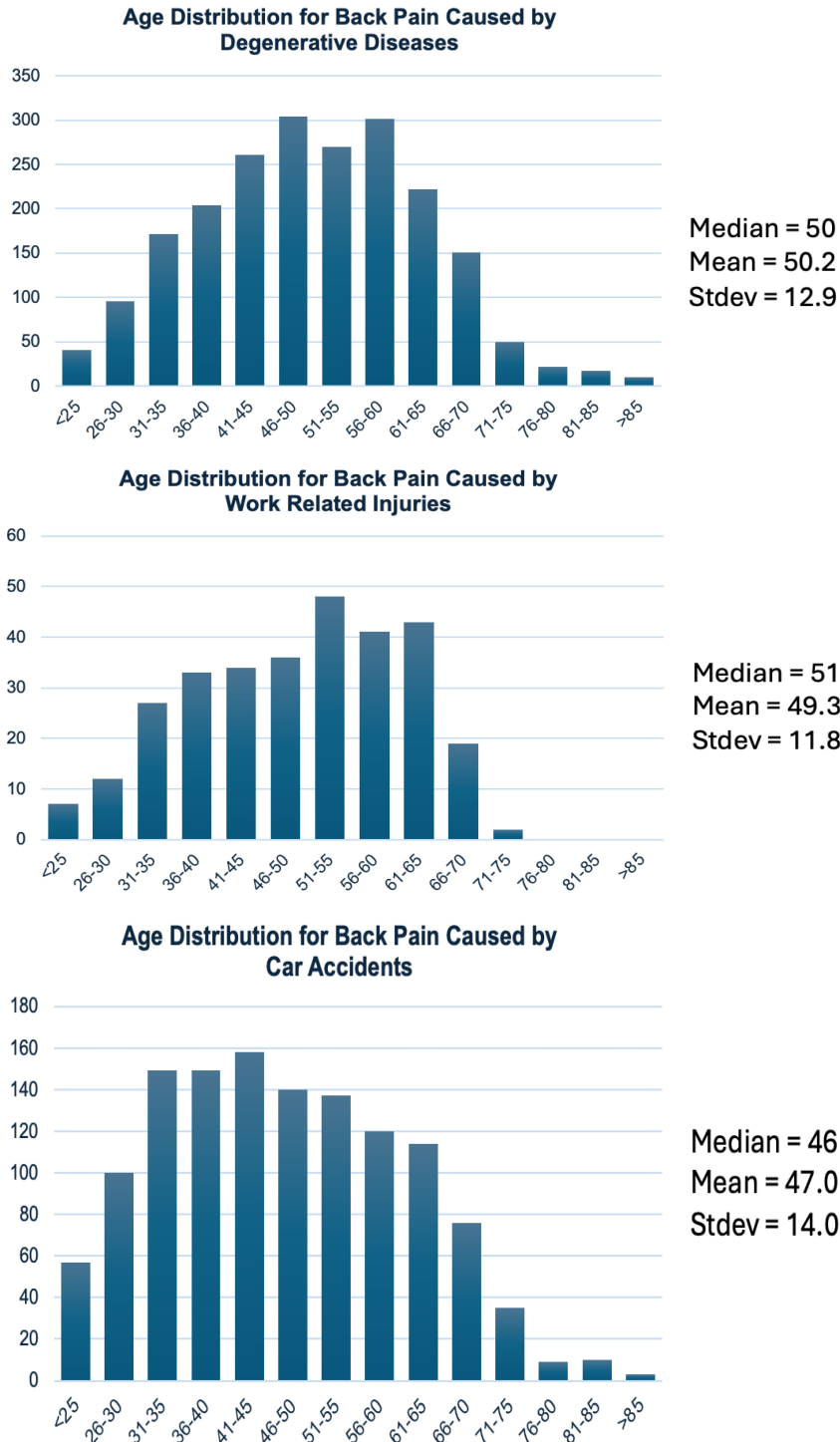
The racial distribution analysis showed a significant deviation between the racial composition of patients receiving spinal pain injections and the general population of New Jersey. African Americans were overrepresented among the injection patients

which could be related to genetic and biological factors. Further research could explore the connection between these factors to the treatment priorities and strategies.

One possible limitation regarding the results of the data is that socioeconomic factors play a part in injection therapy treatment. African Americans and Hispanic people in NJ are more correlated to being of lower socioeconomic statuses<sup>15</sup>, which could lead to race being a confounding factor in place of socioeconomic status.

### Causes Of Pain

Analyzing the causes of pain revealed that patients with traumatic injuries (e.g., car accidents and work-related accidents) were generally younger than those with degenerative conditions.



**Fig. 3** Distribution of age for various radiculopathy injuries who received injection treatments. Histogram showing age vs number of injections booked for radiculopathy caused by degenerative diseases, car accidents, and work injuries. Degenerative diseases: (mean = 50.2, medium = 50); car accidents (mean = 51, median = 49.3); work injury (mean = 47, median = 46). Data was collected through eClinicalWorks database from Atlantic Spine Center.

This is expected as traumatic injuries can occur at any age, whereas degenerative diseases are more likely to develop with aging. The study found no significant difference in the mean age between patients with work-related injuries and those with degenerative conditions.

### Implications For Treatment And Future Research

The findings from this study have several implications for the treatment and management of spinal nerve pain caused by radiculopathy. Healthcare providers should consider the demographic and occupational factors that may influence a patient's likelihood of developing radiculopathy and tailor their prevention and treatment strategies accordingly. For instance, targeted interventions for specific racial groups may help address the observed disparities in pain management.

Further research is needed to explore the long-term effectiveness of pain management injections and to identify alternative treatments that may be more effective for certain patient populations. Additionally, studies examining the psychosocial factors contributing to chronic pain and treatment-seeking behaviors could provide a more comprehensive understanding of the disparities observed in this study.

In conclusion, this study highlights significant patterns in the demographics and characteristics of patients receiving spinal pain injections in NJ, suggesting the need for targeted interventions and further research to address the observed disparities and improve pain management outcomes for all patients.

### Methods

This study utilized data from January 1, 2019 to December 31, 2023 through the eClinicalWorks Business Optimizer (eBO) database from Atlantic Spine Center (dataset titled: eCWEBO\_7.3.1). Atlantic Spine Center is a medical center specializing in pain management of spinal nerve injuries, based in New Jersey (NJ). The database consists of records of all patients who come to the office for treatment and have received injections for radiculopathy pain management. Patients who attended more than one appointment were consolidated, therefore, this statistical analysis is based on the number of patients. The population of patients was chosen because it can be generalized to the entire NJ population.

Demographics of patients include age and gender which are recorded from patients filling out New Patient Packets (NPPs). Patients also voluntarily self-report race. All patient data is de-identified.

For medical records, patients are grouped into 3 causes for their pain according to insurance: degenerative diseases, work-related accidents, or car accidents.

Statistical analyses are conducted on the aforementioned data. Statistical tests are conducted at the  $\alpha=0.05$  level. The tests

include: statistical difference in the mean age of female vs male injection patients, statistical difference in proportion of female vs male injection patients, chi square goodness of fit for distribution of patient race vs. that of NJ population, statistical difference in mean age of car accident vs degenerative injuries, and statistical difference in mean age for work-related vs degenerative injuries. These tests are conducted to suggest statistical significance for their respective data.

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