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Clinical Study

Low back pain in the United States: incidence and risk factors for presentation in the emergency setting

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Abstract

BACKGROUND CONTEXT: Low back pain is prevalent in the United States. At the present time, no large longitudinal study is available characterizing the incidence of this condition in the US population or identifying potential risk factors for its development.

PURPOSE: To characterize the incidence of acute low back pain requiring medical evaluation in the emergency department and establish risk factors for its development.

STUDY DESIGN: Cross-sectional study.

PATIENT SAMPLE: United States population estimates.

OUTCOME MEASURES: Incidence rate ratios were calculated to determine the influence of age, sex, and race on the development of low back pain requiring emergent medical evaluation.

METHODS: The National Electronic Injury Surveillance System was queried for all cases of low back pain presenting to emergency departments between 2004 and 2008. Incidence rate ratios were then calculated with respect to age, sex, and race. The chi-square statistic was used to identify statistically significant differences in the incidence of low back pain requiring emergent medical evaluation between subgroups.

RESULTS: An estimated 2.06 million episodes of low back pain occurred among a population at risk of over 1.48 billion person-years for an incidence rate of 1.39 per 1,000 person-years in the United States. Low back pain accounted for 3.15% of all emergency visits. Injuries sustained at home (65%) accounted for most patients presenting with low back pain. Low back pain demonstrates a bimodal distribution with peaks between 25 and 29 years of age (2.58/1,000 person-years) and 95 to 99 years of age (1.47/1,000) without differentiation by underlying etiology. When compared with females, males showed no significant differences in the rates of low back pain. However, when analyzed by 5-year age group, males aged 10 to 49 years and females aged 65 to 94 years had increased risk of low back pain than their opposite sex counterparts. When compared with Asian race, patients of black and white race were found to have significantly higher rates of low back pain. Older patients were found to be at a greater risk of hospital admission for low back pain.

CONCLUSION: Age, sex, and race are significant risk factors for the development of low back pain necessitating treatment in an emergency department. Published by Elsevier Inc.

Keywords: Low back pain; Lumbago; Epidemiology; National Electronic Injury Surveillance System

Introduction

Low back pain is one of the most common conditions prompting individuals to seek medical care [1–4]. Because of its wide prevalence, especially among working age individuals, low back pain as a whole has a substantial impact on economic productivity and health care resource utilization. The point prevalence of low back pain is estimated to be in the range of 20% to 30% for the general population [1] with individuals aged 45 to 65 years thought to be at greatest risk [3]. Among the American population, low

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EVIDENCE & METHODS

Context

Knowledge of the incidence of low back pain within a society may be useful at the policy level, specifically by establishing priorities for care and providing insight for estimates into potential societal costs.

Contribution

In this study using information obtained from NEISS, the authors found that about 2 million people in the United States went to emergency rooms for low back pain between 2004 and 2008, accounting for about 3% of all ER visits.

Implication

This information is valuable as a snapshot of back pain at the societal level. It can serve as an impetus for further investigation. As with most database analyses, the information is insufficiently specific to be used to guide care of individual patients, as the authors have acknowledged in their discussion of the weaknesses inherent in such studies.

—*The Editors*

back pain is the fifth most common reason individuals seek medical care [2,3], and 30–50 billion health care dollars are spent on the treatment of this condition annually [2–4].

There are numerous factors that can result in symptoms of low back pain. Specific etiologies, such as tumors, spinal instability, and infections, may be immediately treatable. There are other conditions such as degenerative disc disease and spondylotic processes whose contribution to back pain is incompletely understood. Still, in some patients, nonspecific factors are felt to contribute to the origin of back pain, and these individuals may be especially difficult to effectively treat [4]. Some authors have maintained that close to 85% of patients with acute back pain have nonspecific etiologies for their condition [2–5]. Such individuals may be at greater risk for developing chronic back pain, and it is these cases that bear a disproportionate share of the burden of health care costs related to back pain [2,4]. In fact, less than 5% of patients with low back pain consume up to 75% of attributable health care costs [6].

Obstacles to the effective study of this condition include its near ubiquity among the population in terms of lifetime risk, as well as the disparate number of conditions that can manifest with symptoms of low back pain. In terms of nonspecific back pain, a number of factors have been postulated to play a role in its development, including age [7–10], sex [8,10,11], genetic predisposition [12–15], occupation [7,8,16,17], smoking [6,9,13,14,18], race [10], job satisfaction [16,19], psychological issues [2,19], anthropometry, and posture [10]. Limitations within prior investigations, such as sample size and a reliance on select populations of unique occupation or ethnic group, have limited the applicability of findings to the population at large. At present, no large study has been able to identify the incidence of low back pain necessitating emergency medical evaluation, or risk factors for its development, among the general American population.

This investigation sought to determine the incidence and epidemiology of low back pain necessitating emergency medical evaluation in the United States from 2004 to 2008. In addition, this research also endeavored to describe the effect of age, sex, and race on the development of low back pain. To the best of our knowledge, this report is the first of its kind, documenting findings that may be representative of the general American population as a whole.

Methods

This cross-sectional descriptive epidemiological study was approved by our institutional review board and used cases of low back pain identified in the Consumer Product Safety Commission's (CPSC) National Electronic Injury Surveillance System (NEISS) database. A full description of the design and utilization of this system has been published on the CPSC electronic web page [20–22]. Furthermore, the NEISS has served as a reliable and reproducible source for a wide range of prior epidemiological investigations [23–30], and our methods have been described in prior publications [23,24].

The NEISS database was originally created by stratifying all hospitals in the United States based on three baseline variables (geographic location, hospital size, and emergency room volume). From this pool, 100 sample hospitals were designated through a process of randomized selection, and data from each hospital were assigned statistical sample weights to create a national probability sample of hospitals in the United States and its territories. Patient information and injury characteristics are collected from each hospital for every emergency visit related to injury. Encounters pertaining to the following are not reported in the NEISS database: traffic or transportation accidents (eg, automobiles, motorcycles, planes, and trains), intentional, nonaccidental injuries (eg, assault), occupational injuries (ie, injuries that occur during work eligible for compensation), or other injuries previously treated at a given hospital.

In the present study, the NEISS database was queried in 1-year intervals for all injuries between January 1, 2004 and December 31, 2008 classified in the NEISS database as "strain- or sprain-" type injuries in the "lower trunk" region. The diagnosis of "strain or sprain" in the NEISS database represents a catch-all category not just for true lumbosacral sprains or strain (846.0–848.9), but a variety of conditions with specific (degenerative disc disease [722.52], spinal stenosis [724.0], spondylosis [721.3]) and nonspecific etiologies (eg, lumbago [724.2], backache [724.5], trunk injury [959.1], myalgia, or myositis [729.1]) not otherwise covered in the database. Conditions with evident spinal fractures, radicular features, or soft-tissue contusions are recorded in other diagnostic categories (‘‘fracture,’’ ‘‘nerve damage,’’ and ‘‘contusion or abrasion,’’ respectively) and were not considered in this study. Subsequent narrative fields including ‘‘hip,’’ ‘‘groin,’’ or ‘‘abdomen’’ were excluded, yielding 52,465 patient encounters. Query results were pooled and analyzed for any redundancy by use of the unique case identifier (CPSC case number). Initial analysis focused on overall demographics of this cohort with nonoccupational, mechanical low back pain in the estimated mean annual population at risk in the United States (297,048,260 persons) during the study period. Because of the nature of the NEISS probability sample design, all proportions are calculated based on weighted estimates. Using SAS statistical software (SAS Institute Inc., Cary, NC, USA) and SAS programming codes provided by the CPSC for the NEISS model, the gross sample population (denoted n) with low back pain was converted to the US population estimates (N) with 95% confidence intervals (CIs).

Statistical analysis

Weighted totals for the incidence of low back pain were used to analyze the proportional demographic data of the NEISS sample population as well as that of specific subgroups (eg, age, sex, and race) with respect to location of injury event, patient disposition, and activity at time of injury. Additional statistical analyses including the chi-square and Wald's chi-square were performed to identify statistically significant differences between subgroups. United States Census Bureau population estimates were used to calculate at-risk person-years for the both the US population and specific subgroups throughout the defined time period, allowing the calculation of incidence rate (IR) with 95% CIs. Because of the off-cycle nature of US population estimates (index date July 1) relative to the NEISS sample (data range, January 1–December 31 of given year), at-risk person-years were calculated by including the full population estimates for each year from 2004 to 2007 and half the population estimate for 2003 and 2008. Incidence rates are expressed as the number of cases of low back pain per 1,000 at-risk person-years and are calculated as the number of estimated cases of low back pain divided by at-risk person-years in the United States during the study period. When necessary, subgroups were combined to facilitate statistical analysis. Incidence rate ratio (IRR) is a unit-less expression of risk in the comparison of IRs between two separate subgroups, with the incidence rate of an identified referent subgroup serving as the denominator in all calculations. In all statistical analyses, p value less than .05 was considered significant.

Results

A total of 1.82 million emergency room visits were recorded in the sample network over the 5-year study period (N=65.63 million). Of these, a total of 52,465 actual low back pain–related encounters were identified in the NEISS database, resulting in an estimated 2.07 million cases of low back pain (413,416/year) among an at-risk population of over 1.48 billion person-years. This patient cohort comprised approximately 3.15% of all estimated emergency room visits. The estimated IR of low back pain presenting to emergency departments in the general US population is 1.39 per 1,000 person-years. Over the study period, no statistically significant differences were noted in the overall and sex-specific IR of low back pain presenting to US emergency departments.

Age

Low back pain demonstrated a bimodal distribution, with peaks during 25 to 29 years of age (2.58/1,000 person-years) and 95 to 99 years of age (1.47/1,000) (Fig. 1). However, when analyzed by 5-year age group, males aged 10 to 49 years and females aged 65 to 94 years had increased risk of low back pain than their opposite sex counterparts. Mean patient age was 38.8 years (95% CI, 38.6–38.9). Patients aged 20 to 39 years had the highest incidence of low back pain, with an IRR of 5.19 (95% CI, 4.65–5.72; $p<.0001$) when compared with individuals younger than 20 years. Incidence rates by 20-year age group are listed in Table 1.

Sex

When analyzed by sex, males accounted for an estimated 51.5% episodes of low back pain, whereas females accounted for 48.5%. Males and females had overall IRs of 1.46 and 1.33 per 1,000 person-years, respectively, for an IRR of 1.09 (95% CI, 0.94–1.25; $p=.23$).

The peak male and female incidence occurred between 25 and 29 years of age, with an IR of 1.39 and 1.19 per 1,000 person-years, respectively (Fig. 2). Males aged 10 to 49 years and females aged 65 to 94 years had significantly higher risk for developing low back pain than their opposite sex counterparts ($p=.045$).

Race

Racial category demographic data were available for an estimated 77.0% of individuals. Low back pain IRs were 2.10 among Native Americans, 1.38 among blacks, 1.23 among whites, 0.40 among Hispanics, and 0.20 among Asians per 1,000 person-years. When compared with Asian race, white race 6.04 (95% CI, 1.03–11.05; $p=.049$) and black race 6.78 (95% CI, 1.05–12.51; $p=.028$) had statistically significantly increased risk for developing low back pain requiring treatment, whereas Hispanic and Native American race demonstrated no statistically significant differences (Table 2). Furthermore, comparisons between black, white, and Native American race demonstrated no statistically significant differences. When analyzing by race and sex, males and females of white and black race also had significantly higher rates of low back pain than the Asian cohorts (Table 2).

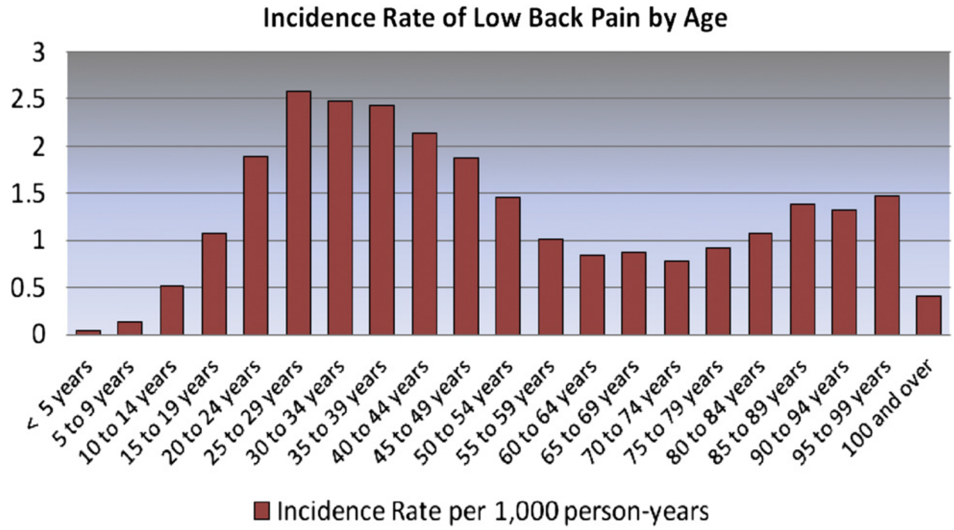

Fig. 1. Incidence rate of low back pain by 5-year age group, 2004–2008.

Location

Location of injury was available in 79.7% of patient encounters. Most injuries occurred in or around the home (81.0%), followed by place of recreation or sport (8.1%), other public property (5.7%), school (1.7%), and street or highway (1.5%). Males were more likely to sustain low back pain in a recreational/athletic setting than females (IRR, 2.45; 95% CI, 2.20–2.69; $p<.0001$). No other significant differences were detected when stratified by sex and location of injury. When evaluating by age, individuals aged 20 to 40 years were more likely to be injured at home or in a recreational/athletic setting than those individuals younger than 20 years ($p<.0001$) and older than 60 years ($p<.05$).

Activity/mechanism of injury

Activities of daily living accounted for the majority of all episodes of low back pain. Lifting was the most commonly reported mechanism, accounting for nearly one-third (32.70%) of all visits, followed by slip or fall (27.07%) and twisting movement (3.74%). Sports or recreational activity were associated with 23.97% of all injuries, with aerobic exercise (2.77%), weightlifting (2.58%), baseball (2.53%), and bicycling (2.02%) being the most commonly reported.

Disposition

Of all patients, only 1.22% of patients required hospital admission or temporary observation, whereas the majority were treated on an outpatient basis and discharged from the emergency department (98.42%). Of those patients admitted, 61.1% (95% CI, 56.1–66.1) were female and 38.9% (95% CI, 33.9–43.9) were male. Males (51.6%; 95% CI, 50.6–52.7) were more frequently treated and released than their female counterparts (48.4%; 95% CI, 47.3–49.4). Average age of admitted patients was 61.8 (95% CI, 59.0–64.5) compared with 39.1 (95% CI, 38.2–40.0) in patients discharged from emergency department. When analyzed by 20-year age group, patients older than 80 years were at a 175-fold increased risk of hospital admission for low back pain than their younger counterparts (Table 3). Among those patients admitted, no statistically significant differences were detected by race.

Discussion

Low back pain is a widespread condition among the American population and one that exerts a significant toll on the workforce and health care system [1–5,10]. Despite

Table 1
Incidence rates of low back pain by 20-year age group, 2004–2008

Age (y)	Estimated low back pain	IR (per 1,000 person-years)	95% Confidence interval	Risk ratio (95% CI)	p Value
Under 20	184,822	0.45	0.39–0.52	N/A	
20–39	960,361	2.34	1.91–2.77	5.19 (4.65–5.72)	<.0001
40–59	687,096	1.66	1.35–1.97	3.68 (3.24–4.12)	<.0001
60–79	169,260	0.85	0.64–1.07	1.89 (1.51–2.26)	<.0001
Over 80	65,453	1.21	0.89–1.53	2.68 (2.10–3.26)	<.0001

IR, incidence rate; 95% CI, 95% confidence interval.
N/A=not applicable because this category was used as the referent.
Incidence rate is expressed as per 1,000 person-years.

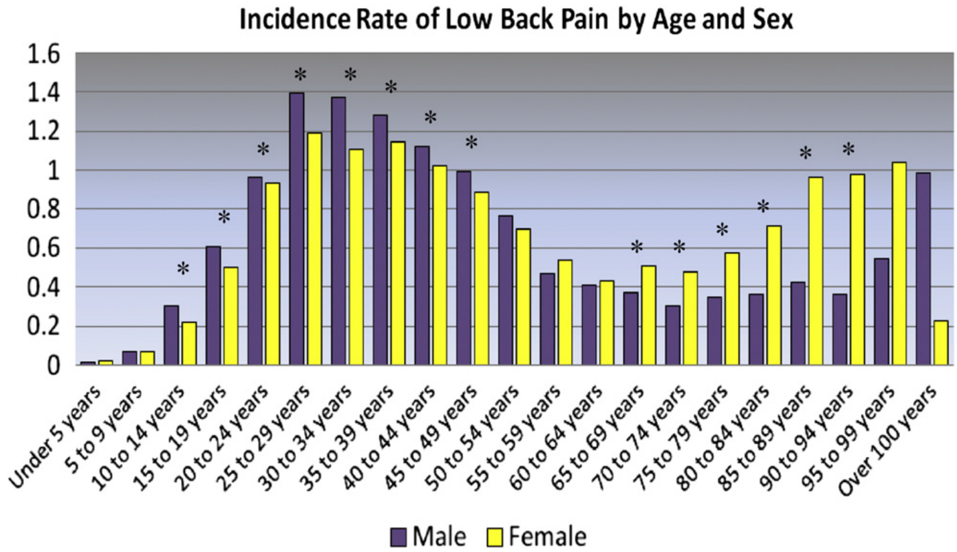

Fig. 2. Incidence rates and incidence rate ratios of low back pain among males and females by 5-year age group, 2004–2008.

its prevalence [1–5,10,17,31], remarkably little is known regarding the incidence of this condition or its risk factors for development. Obstacles to such determinations in the past have included the inability to identify a population at risk, as well as studies conducted among small cohorts of specific background and ethnicity that precluded broader applicability to the general population. Relying on data obtained from the NEISS database, this investigation sought to determine the incidence of low back pain necessitating emergency medical evaluation for the general US population along with risk factors contributing to its etiology. Advantages of using data gathered from the NEISS system include the fact that a population at risk can be determined and that estimates can be extrapolated to the general population of the United States. Prior studies have established the use of the NEISS database to make estimates for the incidence and epidemiology of orthopedic conditions [22,23]. This study is the first of its kind, however, to attempt to characterize the incidence and epidemiology of clinically significant low back pain in the United States.

The present study indicates that age, sex, and race all play a role in the incidence and ultimate disposition of low back pain. This investigation found that back pain presents in a bimodal distribution among age groups, with the preponderance of cases occurring in young- to middle-aged adults and, to a lesser extent, the elderly (Fig. 1). When sex is considered, younger males appear to account for most individuals in the earlier age-related peak, whereas women

Table 2
Incidence rates and incidence rate ratio of low back pain by race, 2004–2008

Race	IR*	95% CI	IRR†	95% CI	p Value
White					
All	1.23	0.90–1.56	6.04	1.03–11.05	.049
Male	1.28	0.94–1.62	6.04	1.01–12.12	.042
Female	1.18	0.85–1.51	6.04	1.39–10.68	.033
Black					
All	1.38	0.88–1.88	6.78	1.05–12.51	.028
Male	1.40	0.91–1.89	6.59	1.03–12.19	.048
Female	1.36	0.85–1.88	6.98	1.34–12.61	.038
Native American					
All	2.10	0.0–4.99	10.34	0–26.64	.258
Male	1.93	0–4.67	9.08	0–24.44	.299
Female	2.28	0–5.35	11.65	0–29.39	.236
Hispanic					
All	0.40	0.16–0.63	1.95	<0.01–3.89	.335
Male	0.42	0.20–0.64	1.97	0–4.09	.369
Female	0.36	0.11–0.62	1.85	0–3.70	.363
Asian					
All	0.20	0.03–0.37	N/A		
Male	0.21	0.01–0.41	N/A		
Female	0.20	0.06–0.35	N/A		

IR, incidence rate; IRR, incidence rate ratio.
N/A = not applicable because this category was used as referent.
* Denotes IR by race per 1,000 person-years.
† Denotes an IRR of total, male, and female populations by race with Asian race as the referent.

Table 3
Hospital admission rates for low back pain by 20-year age group, 2004–2008

Age (y)	IR*	95% CI	IRR†	95% CI	p Value
Under 20	0.0007	0.0002–0.0013	N/A		
20–39	0.011	0.007–0.014	15.01	4.21–25.80	.012
40–59	0.015	0.011–0.020	21.07	4.66–37.48	.017
60–79	0.037	0.027–0.047	51.46	13.12–89.80	.011
Over 80	0.13	0.087–0.17	175.00	36.94–313.05	.014

IR, incidence rate; IRR, incidence rate ratio.
N/A = not applicable because this category was used as referent.
* Incidence rate denotes hospital admission rate by 20-year age group per 1,000 person-years.
† Incidence rate ratio denotes an incidence rate ratio of the total populations by 20-year age group with the under 20 years old group as the referent.

appear to be at greater risk beyond the age of 65 (Fig. 2). These factors may reflect a disproportionate exposure to at-risk activity among young males [7,8,17] and the increased rate of occult compression fractures, other osteoporotic or age-related conditions, and secondary low back pain described in elderly women [32,33]. Additionally, women and the elderly were found to be at greater risk for hospital admission for their back pain. Those reported as Asian were found to be at the lowest risk for clinically significant back pain, whereas whites and blacks demonstrated a significantly increased risk.

In most respects, our findings are consistent with earlier reports on the epidemiology of low back pain [1–3,7,8,11,17]. For example, many investigations have documented an increased incidence of clinical low back pain in middle-aged patients [3,8,34]. Knox et al. [8] encountered an increased risk among patients older than 35 years, whereas Lebouef-Yde et al. [34] cited greatest risk in individuals aged 20 to 41 years. However, there is limited documentation of the epidemiology of low back pain in the elderly. In fact, the prevalence and burden of low back pain in the elderly has been historically underrepresented, with reported prevalence rates between 6% and 47% [33]. Such a finding was not possible in the works of Knox et al. and Lebouef-Yde et al. because of demographic limitations of their respective cohorts. Our description of greater hospital admission among female patients echoes the finding of Chenot et al. [11] that women are more severely affected by low back pain and more frequently use health care resources. Contrary to prior investigations [8,10,11], this study did not substantiate the fact that, overall, females are at a greater risk of developing clinically significant low back pain than male counterparts.

Conclusions presented here regarding the impact of race on the incidence of low back pain are relatively novel, in that no substantial research among a large series of patients has previously been performed. One study has suggested that black when compared with white adolescents may be at greater risk of low back pain [10]. In their study on the prevalence of low back pain within the population of North Carolina, Carey et al. [35] reported that 72% of patients seeking care for chronic low back pain were white, whereas only 5% were Hispanic. Such findings may be borne out in the results presented here, although the outcomes published by Carey et al. can also be viewed as a reflection of the racial demographic peculiar to the region where their study was conducted. Although Native Americans had the highest incidence of low back pain and previous works have substantiated an increased predisposition toward its development [1], the small sample population has precluded meaningful statistical comparisons in the present study. To date, no other studies have rigorously evaluated the comparative IRs of low back pain in multiple racial categories in the broader US population, and further research is required to determine whether these differences are the byproduct of socioeconomic status, differential health care utilization, or underlying anthropomorphic differences.

Few studies have been able to calculate an incidence for clinically significant low back pain, mainly because of the fact that most prior works were unable to determine a population at risk. Two prior investigations have characterized the incidence of low back pain amidst fixed populations [8,17], although both were conducted in a military setting, thereby limiting their applicability to the general population. This is evidenced in the fact that in both these military studies, the estimated incidence of low back pain far exceeds that documented in the present investigation (Table 4). It is possible, however, that the findings presented by Knox et al. [8] and Mattila et al. [17] are merely reporting on the initial age- and sex-related peak encountered in this study without the additional details afforded by access to a data set that includes younger individuals and the elderly. Moreover, environmental determinants such as the rigorous physical demands and heavy lifting requirements of military personnel may place individuals at even greater risk of low back pain than their nonuniformed counterparts. In the present study, the estimated population at risk encompasses the entire average population of the United States, a wider demographic than previous investigations.

In comparison with other studies on musculoskeletal conditions performed using the NEISS database, low back pain figures among one of the more common conditions requiring treatment in an emergency room [22,23]. In previous investigations, ankle sprain was found to have an incidence slightly higher than low back pain (2.15/1,000 person-years) [23], whereas distal radius fractures and shoulder dislocations were exceedingly lower at 0.62 and 0.24 per 1,000 person-years, respectively [22]. The NEISS data set has been accepted as a tool for calculating injury IRs for the American population [22–30], although it has not been widely used in the area of musculoskeletal medicine. Nonetheless, when compared with other reports on musculoskeletal conditions evaluated using this same system, our findings regarding the incidence of low back pain appear to coincide with what is known about this condition and its prevalence relative to other orthopedic issues.

Table 4
Previous studies calculating incidence of low back pain

Study	Population	Injuries	Population at risk (person-years)	Incidence rate (per 1,000 person-years)
Knox et al. (2010) [8]	Military, United States	557,059	13,754,261	40.5
Mattila et al. (2009) [17]	Military, European	7,240	267,700	19.1
Present study	General, United States	2,067,081	1,485,241,300	1.39

There are several limitations to the present investigation that must be taken into account when reviewing the results. Chief among these is the fact that this is a database study and subject to the limitations inherent to such research design. For example, patient-specific information regarding each individual case of low back pain was not recorded in the system, and mitigating factors, such as medical comorbidities, family history, spinal surgeries or prior fractures, smoking history, and drug use, are not available for consideration. Additionally, the data set is limited by the fact that there is no means in the system to isolate and control for visits related to acute-on-chronic low back pain or clinical errors in misdiagnosis, as the medical record and adjunctive radiographic workups were unavailable. Also, the specific etiologies for mechanical low back pain are well elucidated and would warrant more advanced radiographic imaging not typically obtained or recommended in the emergency setting [36,37].

Another limitation is the fact that, by design, our sample only captures those patients who present to an emergency room seeking treatment. Our definition of ‘‘clinically significant back pain,’’ meaning that which necessitates medical evaluation takes this into account, although admittedly those patients who present to a primary care practitioner or other specialist for treatment for their back pain would also have a clinically significant condition that is not captured in this data set. Similarly, patients with true occupational low back injuries or those inappropriately identified as ‘‘work related’’ were not included in this analysis. Therefore, our calculated incidence of low back pain is likely an underestimation and suffers from sampling bias.

While accepting the potential drawbacks of the NEISS data set, one must also recognize that the system's protocols have been accepted as accurate determinations for the incidence and epidemiology of other injuries within the American population [22–30]. The NEISS cohort used in this study was obtained in the modern period and represents the general population of the United States to the fullest extent possible. At the present time, our estimations regarding the incidence of, as well as risk factors for, clinically significant low back pain can be accepted as representing the best available evidence for this condition.

In conclusion, our study documented an incidence of clinically significant low back pain of 1.39 per 1,000 person-years. To varying degrees, age, sex, and race were all found to play a role in influencing the development of the condition, as well as final disposition and health care resource utilization. Our findings identify at-risk groups that can be targeted in future prospective investigations to better isolate any underlying pathology contributing to the development of low back symptoms. With further directed research, directed interventions among potential populations at risk may help to mollify the development of clinically significant low back pain.

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