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# A New Look at the Incidence of Slipped Capital Femoral Epiphysis in New Mexico

Eric C. Benson, MD, Miryam Miller, BA, Patrick Bosch, MD, and Elizabeth A. Szalay, MD

**Purpose:** Past epidemiological studies demonstrated a nearly fivefold lower incidence of slipped capital femoral epiphysis (SCFE) in New Mexico compared with Connecticut. A recent study demonstrated some regional variability but did not address this earlier finding. We sought to reexamine the incidence of SCFE in New Mexico to improve the understanding of the epidemiology and ultimately the disorder itself.

**Methods:** The discharge databases for the 11 major medical centers in the state were reviewed for the ICD-9 code for SCFE (732.2) for 1995 to 2006. The data were analyzed by comparison with the 2000 New Mexico census data. The incidence data are reported as cases per 100,000 boys aged 10 to 17 years and girls aged 8 to 15 years, as per Kelsey's original article.

**Results:** The incidence of SCFE in New Mexico for the study period was 5.99. This is a doubling of the reported incidence in the 1960s (2.13) and represents a statistically significant change ( $P < 0.001$ ). More detailed analysis of our data demonstrated a statistically significant increase during 3-year intervals: 1995–1997, 2.27; 1998–2000, 2.75; 2001–2003, 4.73; and 2004–2006, 7.38.

The mean age of onset was 12.2 years. There was a male to female ratio of incidence of 1.94:1. Relative frequencies by race were as follows: 4.63x for African Americans, 2.20x for Hispanics, and 2.20x for Native Americans. A preponderance of cases was treated at the state's only tertiary pediatric orthopaedic center: 168 to 15 in the remaining 10 centers.

**Conclusions:** The incidence of SCFE has increased dramatically in New Mexico since Kelsey's epidemiological study in 1970.

Obesity is a patient factor that has changed over this same period. According to the National Health and Nutrition Examination Survey Data for 2003/2004, the rates of obesity have tripled since 1971. In New Mexico, 25% of high-school children are estimated to be overweight. However, according to a recent study examining a national database (compiled from 27 states), the national incidence of SCFE remained fairly constant at 10.8 per 100,000.

Interestingly, as more patients are seen at a tertiary center for children's orthopaedics, the rate of diagnosis in New Mexico has risen to resemble national trends. In the 1960, that center was located in a remote site and did not provide acute care for children's musculoskeletal issues.

Increased obesity in children and improved access to pediatric orthopaedic evaluation may have contributed to a significant increase in reported incidence of SCFE in New Mexico.

Level IV Evidence.

**Key Words:** slipped capital femoral epiphysis, epidemiology

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Slipped capital femoral epiphysis (SCFE) is a major cause of disability in young people. A recent epidemiological review described it as the most common hip disorder of adolescent children in the United States.<sup>1</sup> It is defined as displacement between the proximal femoral epiphysis and metaphysis. Slipped capital femoral epiphysis is associated with many complications including loss of motion and pain and may be a common cause of early arthrosis. Increased incidence of SCFE has been associated with male gender, African American and Hispanic race, climate in the Northeastern and Western United States, and seasonal variation in northern regions.<sup>1–5</sup> It is strongly correlated with obesity.<sup>6–9</sup>

Early epidemiological studies of SCFE in the 1970s found New Mexico to have a nearly fivefold lower incidence compared with the rest of the nation.<sup>10</sup> The incidence of SCFE in New Mexico has not been reexamined until now. Reviewing the trends of SCFE incidence within a specific region may have implications beyond local concerns by improving general understanding of the disorder. In the past 35 years, medical access, diagnostic accuracy, and obesity rates have all changed dramatically in the New Mexico.<sup>11</sup>

This study seeks to determine the current incidence of SCFE in New Mexico and compare it both to the incidence noted in 1970 and the current national incidence.

## METHODS

We searched the discharge databases of 11 major hospitals in New Mexico from 1995 to 2006 for the ICD-9 code corresponding to SCFE (732.2). For each case, we attempted to obtain the age, race, gender, and date of discharge. Compiling this with the 2000 census data for the New Mexico population, incidence rates were calculated.

Using the  $\chi^2$  goodness-of-fit test, statistical analyses were compiled to compare the incidence rates during four 3-year intervals spanning our collection period, as well as rates by age, gender, race, and season. We also compare our current data to that of Kelsey's reported rates.

## RESULTS

The overall incidence in New Mexico for children (aged 7–18 years) was 4.33/100,000. This accounts for 183 cases identified in the 12-year period from 1995 to 2006. Figure 1 shows the number of cases by year.

To directly compare incidence rates with Kelsey's data, we adopted his parameters and calculated incidence rates for

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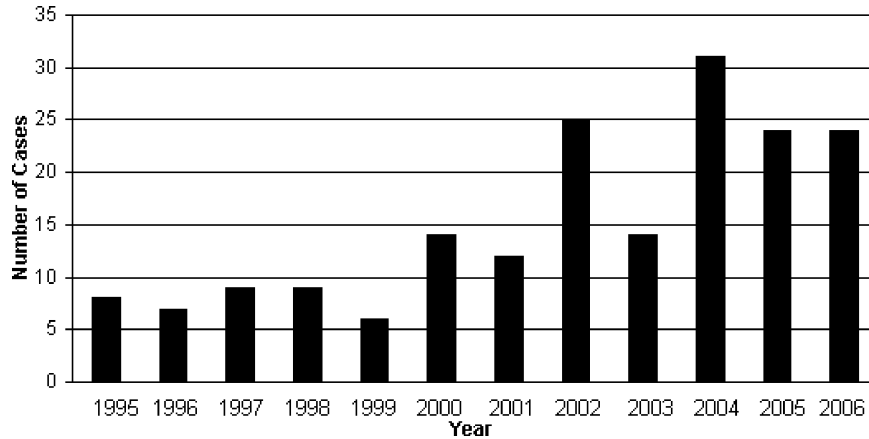


FIGURE 1. Number of SCFE cases by year.

boys aged 10 to 17 years and girls aged 8 to 15. With these criteria, 172 cases were identified in our data. Within this age group, the estimated population according to the 2000 New Mexico Census drops from 352,133 to 236,681. The newly calculated incidence of SCFE in New Mexico has more than doubled from 2.13/100,000 in 1970 to 6.05/100,000. This difference is statistically significant ( $P < 0.001$ ).

To account for the possible confounding factor of increased access to care between our study and Kelsey's, we analyzed our data across 4 separate 3-year time intervals (Fig. 2). The incidence has risen in statistically significant increments across each period ( $P < 0.001$ ). The rates for all children aged 7 to 18 years were as follows: 1995–1997 (2.27/100,000), 1998–2000 (2.75/100,000), 2001–2003 (4.83/100,000), and 2004–2006 (7.48/100,000).

The mean age of onset was 12.2 years. Age of onset for boys was 12.5 years and for girls 11.5 years ( $P < 0.001$ ). The incidence according to gender in New Mexico also showed a significant difference. The rates were 5.65/100,000 for boys and 2.86/100,000 for girls ( $P < 0.001$ ; Fig. 3). The male to female ratio is 1.98:1.

Racial variation was also confirmed in our data. The incidence among the African American population was

11.57/100,000; Hispanic, 5.49/100,000; Native American, 5.49/100,000; and whites, 2.59/100,000 (Fig. 4). These differences are significantly different ( $P < 0.001$ ). Normalized frequencies by race are often cited in the literature. Our data yield the following: African Americans, 4.47x; Hispanics, 2.12x; and American Indians, 2.12x.

Evaluating the seasonal variation, 51.4% of SCFEs in New Mexico occurred during the winter months. This did not demonstrate statistically significant seasonal variability.

**DISCUSSION**

Epidemiological studies of SCFE in the United States were conducted by Kelsey in the 1960s.<sup>4,10</sup> He reviewed diagnostic indices from all the general hospitals and operating rooms as well as the primary long-term care facility for children in Connecticut from 1960 to 1966. Cases were also located by reviewing operating room log books. This same investigation was conducted in New Mexico in 10 hospitals, including Carrie Tingley Hospital. Examiners found that the incidence of SCFE was significantly lower in New Mexico when compared with Connecticut. Estimated yearly incidence in Connecticut was 10.08 per 100,000. In New Mexico, the

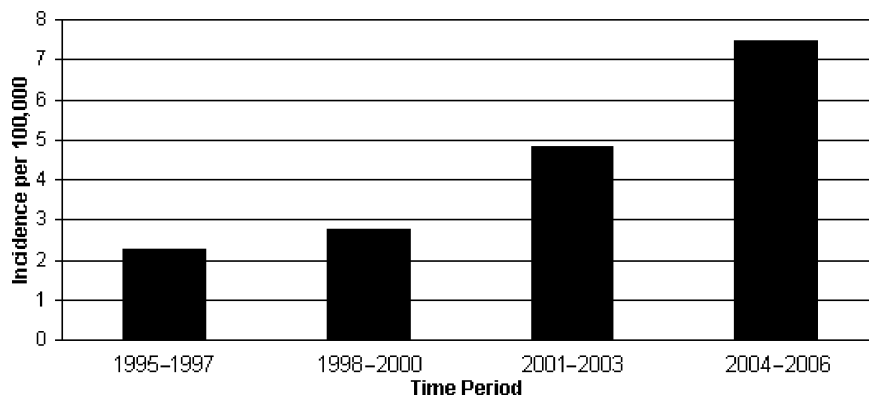


FIGURE 2. SCFE incidence by time period.

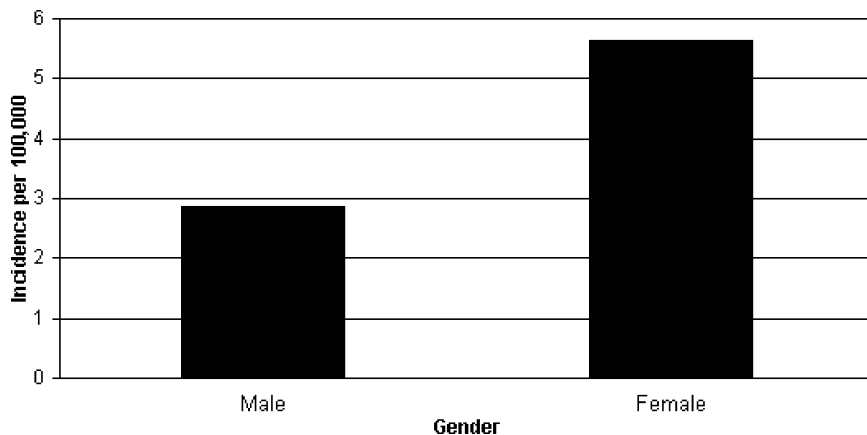


FIGURE 3. Incidence by gender.

incidence was 2.13 per 100,000.<sup>10</sup> The Connecticut results reflected the same incidence described in studies conducted via postal surveys conducted in the 1930s. The incidence in Connecticut was felt to reflect the general trend in the United States, whereas the New Mexico incidence was felt to be much lower than the US average. Although many assumptions rest at the foundation of that study, it stood as the source for reported incidence rates for SCFE for many years.

Lehmann et al<sup>1</sup> used a national database to examine the epidemiology of SCFE in 1997 and 2000. They examined data collected from 2784 nonrehabilitation community hospitals in 27 of the 50 states. They searched discharge records and used a complex algorithm to analyze the results to represent total pediatric discharges. Their results confirmed those of Kelsey in 1970. They found an overall incidence rate of 10.8 per 100,000. Rates were highest in the North (17.15) and the West (12.7) and lower in the South (8.12) and Midwest (7.69).

The current study found the incidence of SCFE to be lower than any national or regional level reported, but it is rising rapidly. The overall incidence in New Mexico for children (aged 7–18 years) from 1995 to 2006 was 4.33/100,000. Although an increase from Kelsey’s original New Mexico data, it remains well below Lehman’s national incidence of 10.8/100,000.

Examining 3-year interval trends, however, the incidence has been steadily increasing to 7.48 per 100,000 children in the years 2004 to 2006.

The study of Lehmann et al did not attempt to identify incidence by state. There are reasons to question the incidence of SCFE specific to New Mexico. First, accurate incidence aids in the diagnosis of the disorder. Early diagnosis and treatment is critical for obtaining the best outcomes and avoiding significant morbidity from this condition.<sup>12–14</sup> Slipped capital femoral epiphysis has been called an enigmatic disorder that easily mimics other conditions. It is not uncommon for the diagnosis of SCFE to be delayed.<sup>13,14</sup> These delays are less common when suspicion is high.<sup>14</sup> Therefore, knowledge of accurate incidence in New Mexico is valuable for increased awareness and timely diagnosis of the disorder. Although our incidence rate is lower than that of Lehmann et al, the increasing trend from our 3-year interval data suggests that increased awareness of the disorder by healthcare providers in New Mexico is appropriate.

Moreover, a focused examination of the New Mexico data also allows more direct comparison with Kelsey’s early work, providing the opportunity to consider a 40-year trend within a specific geographic region. The incidence of SCFE has

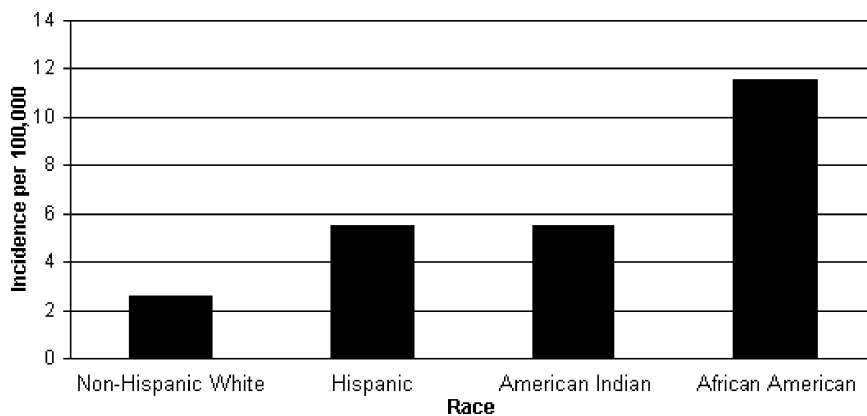


FIGURE 4. Incidence by race.

more than doubled in New Mexico since 1970 and seems to be steadily rising during the last 12 years. One potential explanation for the rising incidence of SCFE in New Mexico may be improved access to pediatric orthopaedic care, rather than any patient factor or true change in incidence. In their report, Kelsey et al<sup>10</sup> discussed the lower per capita income and less adequate diagnostic and treatment facilities as a likely factor in the low number of “diagnosed cases” in New Mexico compared with Connecticut. At the time of Kelsey’s earlier study, Carrie Tingley Hospital for Children (CTH), the state’s only pediatric orthopaedic specialty hospital was remotely located (Truth or Consequences, formerly Hot Springs, NM) and intended as a chronic care facility for children with polio, spina bifida, and cerebral palsy. Since then, CTH has relocated to the state’s population center, Albuquerque, and provides access to pediatric orthopaedic evaluation for most children in the state (approximately 1500 outpatient visits per month). The preponderance of cases in the current study was treated at CTH: 168 to 15 in the remaining 10 centers. In Kelsey’s data, only 5 cases were reported at CTH. Electronic hospital records may also contribute to improved ability to capture diagnosed cases in our search. As a result, we believe our data to be a more accurate representation of SCFE presentation in New Mexico. This may indicate that the increased rates we report result, in part, from improved access to care and improved hospital record keeping. However, the rapid rise in incidence during the 12-year span of our study indicates that the incidence seems to be rising quickly in New Mexico.

It is possible that increased obesity rates may also contribute to an increased incidence of SCFE. Obesity is commonly defined as a body mass index  $\geq$  95th percentile. More than half of children with SCFE have a body mass index above the 95th percentile. Incidence rates of SCFE and prevalence rates of obesity reflect each other for each ethnic group. These facts support, though do not prove, the theory that obesity is one of the primary factors in the etiology of SCFE. According to the National Health and Nutrition Examination Survey Data for 2003–2004, the prevalence of obesity among children tripled from 1971 to 2002. In 2002, 16% of children aged 9 to 16 years were obese. The data by race show that 20.5% of African Americans, 22.2% of Hispanics, and 13.6% of white children were obese in 2002.<sup>15</sup> Other authors report a significant increase in prevalence of obesity for boys and girls in the 5-year interval from 1999 to 2004. Prevalence for girls increased from 13.8% to 16.0%; boys increased from 14.0% to 18.2%. In New Mexico, the proportion of adults who were obese doubled from 1990 to 2002, whereas 25% of high-school children and 20% of children aged 2 to 5 years were either overweight or at risk for being overweight.<sup>11</sup>

These data may give some insight into the dramatic rise in the incidence of SCFE in New Mexico during the last 3 decades. However, the incidence of SCFE seems to be relatively constant nationally according to the data of Lehmann et al, perhaps discounting this hypothesis. Nevertheless, increasing rates of childhood obesity across the country raise significant concerns, given the correlation shown between the 2 diseases.<sup>6–9</sup>

This information has general as well as regional importance. Decreasing numbers of pediatric orthopaedic

surgeons is creating shortages in many regions of the country. At present, New Mexico has only 2 full-time fellowship-trained pediatric orthopaedic surgeons for a state of 2 million people. As physician shortages limit access, recognition of disorders such as SCFE may decrease, reversing improvements made in rural, geographically expansive areas such as New Mexico. Regional SCFE incidence may provide a useful surrogate for measuring access to pediatric musculoskeletal care.

Moreover, the New Mexico data reported in this study expand our knowledge of racial variability of SCFE. The work of Lehman was the first to describe an increased incidence among Hispanic children. They reported a normalized frequency of 2.53x (x = white incidence rates) for Hispanics. In New Mexico, the normalized frequency for Hispanics was 2.12x. Furthermore, we demonstrate a statistically significant higher rate among Native Americans also 2.12x.

Unlike many previous studies, we were not able to demonstrate any seasonal variability of SCFE diagnosis in New Mexico. There were 52.6% of cases of SCFE reported in the winter months,  $P > 0.05$ . New Mexico is south of 40 degrees latitude, but due to altitude in most of the major population centers (Albuquerque and Santa Fe), seasonal weather variability is seen.

## CONCLUSIONS

Our reported incidence of SCFE is more than double that of the original SCFE epidemiological study of Kelsey et al<sup>10</sup> from the 1960s. The incidence of SCFE from 1995 to 2006 among children at risk is 6.05/100,000. That incidence increased to 7.48/100,000 when only the last 3-year interval was considered (2004–2006). These numbers are trending toward recently reported national levels.<sup>1</sup> Reasons for the rising rates in New Mexico are unclear. They may represent more accurate data, given improved access to pediatric orthopaedic care since the 1960s. However, statistically significant increases during the 12-year study period indicate a true rise in incidence. Racial variability was also detected, with increased rates among African Americans, Hispanics, and Native Americans.

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