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Low Back Pain: A Study on Which Demographic Characteristics Contribute

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24 November 2014

Submitted in partial fulfillment of the requirements for
graduation with Distinction

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Abstract

This statistical study examined low back pain and possible contributing socioeconomic factors using the National Health And Nutrition Examination Survey. The Center for Disease Control and Prevention funds this biannual survey which documents everything from nutrition, physical activity, and overall health status of Americans. The survey uses a nationally representative sample of approximately 10,000 individuals from all races and ethnicities. Across the United States, it is well-known that minorities suffer from a higher burden of illness and disease compared to Caucasians. The goal of this study was to identify if low back pain is also experienced more by minority populations. Using the data analysis software, R Studio, a logistic regression was performed and one variable was identified as significant. Subjects who reported they were not in school were more likely to experience back pain compared to those who reported they were currently in school. The literature review revealed that minorities do experience low back pain more frequently than Caucasians. The results were not supported by the literature review and this is most likely due to the fact that the survey question used was not specifically tailored to low back pain.

Acknowledgements

This paper would not have been possible without the help and direction from Dr. Robert Braun. He has done more than simply give advice and feedback, but encouraged my interest in public health from the beginning. He has continued to educate me and accept my questions with enthusiasm.

Thank you Dr. Joan Rocks, for your instruction and sizable knowledge on research. Your class will prove to be important in all future works and opportunities.

Also, I owe tremendous thanks to Dr. Daryl Baird for his statistical skills and willingness to share them with me by taking extra time after class to explain not only coding, but the concept behind the formula.

Lastly, a huge thank you to Dr. Shelley Payne. I am glad she accepted me as an advisee when I made the switch from another major to Allied Health. Her classes have always been fun, thought provoking, and challenging which pushed me to settle for nothing less than the best. I have enjoyed having her as an advisor and want to thank her for the 100% effort she puts into every student.

Introduction

Low back pain is described as any pain relating to above the buttocks and between the ribs., It is one of the most common health problems across the United States and expands across the borders as well. In 2013, The National Institute of Health reported that 8 out of 10 people at some point in their lives will suffer from back pain. Even further, a survey was conducted in 2011 by the National Center for Health Statistics (NCHS), which stated approximately 28.4% of the United States' population, claimed they had back pain within the past three months from when the survey was given (NCHS, 2012). In addition, as the age of the population is narrowed to 55-64, the prevalence of low back pain increases to 33.3%. The same data collected in 2011 was previously collected in 1997 and 2010. It shows a slight increase from 1997 to 2011 in each age group, except the 18-44 which decreased, but these numbers are only going to continue to rise unless contributing factors for low back pain are identified and addressed properly (see Table 1).

The same report published by NCHS described the population by race, poverty level, and educational attainment. Figure one (refer to appendix) breaks down the sample with low back pain by race from the year 1997 to 2005. Asians reported the least percentage of low back pain each year with an average of 19.3%. African Americans reported an average of 25.4% then whites were next to report the least amount of pain with an average of 28.4%. American Indians/ Alaskan Natives reported an average of 33.2% from 1997 to 2005. In 1999, the survey began to allow the option of identifying as two or more races. Those who chose two or more races reported the most pain compared to the other races in 2000 and 2001. The average across the seven years was 36.4% for biracial/multiracial minorities. Figure two breaks down the survey

sample by percent of poverty level from 1997 to 2005. Assessing this data reveals a noticeable trend. Persons who were greater than 400% of the poverty level reported the least amount of low back pain at an average of 25.1%. Each group after that, 200-399%, 100-199%, and below 100% of the poverty level had increasingly higher percentages of low back pain at averages of 27.9%, 30.9%, and 33.2% respectively. Lastly, Figure 3 reflects the percent of low back pain by level of education achieved from 1997 to 2005. Again, there is a noticeable trend reflected in this figure where persons with no high school diploma or GED reported the highest percentages of pain with an average of 32.8% from the years 1997 to 2005. As the amount of education attained increased, the percentage of persons reporting low back pain decreased. Persons with a high school diploma reported an average of 30.0% of low back pain from 1997 to 2005 while those with some college or more reported an average of 27.1%.

Table 1: Data Collected From National Center for Health Statistics (May 2013)

	1997	2010	2011
18 years and over	28.1	28.8	28.9
18-44 years	26.1	25.2	24.4
45-64 years	31.3	32.4	33.3
65 years and over	29.5	31.8	32.7

It is important to discuss the factors contributing to low back pain because of the number of people affected by it, which consequently costs Americans about $50 billion each year (Harvard Men's Health, 2006). For example, as a result of low back pain, money is spent on

surgery, office visits, and physical therapy. Causes of low back pain related to anatomy include disk injury such as a herniated disk, degenerative changes with age, and abnormal curvatures of the spine (American Academy of Orthopedic Surgeons, 2013). These causes may not be controllable, except by learning how to lift properly to decrease the possibility of a herniated disk.

The National Institute of Health (NIH) lists several "risk factors" that are associated with low back pain. These risk factors include over-activity/lack of activity, diet, cigarette smoking, race, heredity, presence of other diseases, and occupational risk factors (NIH, 2013). The former three are all controllable and can be altered if the public is properly education. Race, heredity, and presence of other diseases, however, are not controllable risk factors. In a study completed in Canada, the researchers proposed several explanations as to why cigarette smoking and low back pain are associated, "Smoking reduces bone mineral content, which increases the risk of osteoporosis and micro-fractures of the trabeculae of the of the vertebral bodies, cause an increase in degenerative changes in the spine" (Alkherayf, 2009, p.365).

Additionally, physical activity or a lack of physical activity which leads to weight gain will cause extensive strain on the spine and causes degenerative changes as well leading to pain. The American Academy of Orthopedic Surgeons (2013) explains that the pain could be caused by muscle soreness, which could have been over stretched or injured during physical activity. Alternatively, a lack of physical activity will cause weak muscles and a weak core in general leading to pain of the lower back.

There is one risk factor though, that the NIH does not mention. In an article written by Isaacs and Shroeder, "Differences in rates of premature death, illness, and disability are closely

tied to socioeconomic status" (2004, p. 1137). Socioeconomic status, as defined by the American Psychological Association (2014), is "commonly conceptualized as the social standing or class of an individual or group. It is often measured as a combination of education, income and occupation."

Class/Socioeconomic Status (SES) is important to consider when discussing health. A study written by Jennifer DeVoe said that, "Barriers to health care can be insurmountable for low-income families, even those with insurance coverage" (DeVoe, 2007, p. 511). People of lower socioeconomic status not only lack access to health care, but are also more likely to lack health insurance coverage and receive poor treatment. The consequence of no health coverage or access to health care is simple to see. For example, a single mother strains her back when she goes to pick up her three year old, but because she has to pay for her children's education, she took her chances and does not have insurance. Therefore, she does not go to the doctor and the pain becomes worse and persistent.

Similarly, there is a great deal of research on health inequalities related to minorities not having the same level of health care as everyone else and "are disproportionately more likely than the general population to be uninsured" (Institute of Medicine, 2002, p.1). In the 2011 statement from the Center for Disease Control, they reported that health inequalities in the United States of America is the highest among all the advanced industrialized nations. If people with lower SES are not getting the same level of health care, prevention care, or education as high SES individuals then those who may experience more back pain would have less access to treatment and receive less quality treatment than those who are of higher SES.

A study completed at the University of Hull in the United Kingdom investigated SES being a predictor of low back pain by completing a randomized controlled trial. Researchers did a "secondary analysis of data from a national primary care trial of physical treatments for back pain using a multilevel modeling" (Moffett, 2009, p. 783). Townsend scores were used to measure deprivation of a subject. Educational levels and work status were also indicators of socioeconomic status in the procedure and the Roland Disability Questionnaire (RDQ) was used to assess back pain. Moffett and colleagues concluded that as the deprivation of the subjects increased, as measured by the Townsend score, there also was a significant increase in the RDQ score. Moreover, subjects with lower education levels also tested higher on the RDQ, reporting more functional disability compared to subjects with high education levels. Interestingly, subjects who stated to not be working, also reported increased disability. The reason for unemployment is not mentioned. If unemployment is caused by the disability then this correlation is logical, but if the subjects' complaints of pain began after unemployment then the disability is probably not caused by occupational risk hazards. They concluded that the patients with the lowest socioeconomic status also had the worst prognosis for their back pain (Moffett, 2009, p.789).

With low back pain being one of the top causes of disability in the workforce, the relationship between socioeconomic status and prevalence of low back pain should be addressed so actions can be made in order to educate the population that is affected most. The purpose of this paper is to identify if low back pain is an extension of the health disparities prevalent within the United States.

Methods

Participants

A total of 10,149 individuals were surveyed through the National Health and Nutrition Examination Survey (NHANES) in 2007. There were a total of 5,096 male and 5,053 females. The average age of participants was 33 years old. The mode for annual household income was $25,000 - $34,999 which was 18% of our population. This value excludes 377 people who refused to respond or were unsure. The average ratio of income to poverty level is 2.09. Of the 10,149 subjects, 4,115 or 40% identified as Non-Hispanic White, 2,211 or 22% identified as Non-Hispanic Black, 2,157 or 21% identified as Mexican American, 1,201 or 12% identified as Other Hispanic and the remaining 465 or 5% identified as another race which included multi-racial.

Procedure

Data used was originally collected by Center for Disease Control and Prevention and National Center for Health Statistics through the National Health and Nutrition Examination Survey (NHANES). The data are based on household interviews of a sample of the civilian population. The sampling is non-random and they purposefully oversampled all races to create a nationally representative sample. Data collection is biannually and includes in home health interviews, physical examinations, as well as laboratory tests.

Instrument

This study used the dataset from 2007-2008. The variable of interest, or dependent variable within the dataset, was PFD069B. The question in the survey related to this variable was, “How long have you had back or neck pain problems (# of days)?” The independent

variables included demographic questions such as gender (male/female), age (in years), ethnicity, education level achieved, currently in school or not, household income, family income, and poverty level. Since the 2007-2008 assessment, the CDC did not include this question in more recent surveys.

Data Analysis

R Studio is a statistical coding program found online for free. This software was used because of its ease of access and the researcher's familiarity with the program. First, descriptive statistics were first calculated using excel. The mean was used to describe age and ratio of income to poverty and level while the mode was used to describe the most frequent annual household income selected on the survey. Inferential statistics were then calculated with a logistic regression using low back pain or neck pain as the outcome variable and age, race/ ethnicity, education level achieved, current school status, household income, family income, and ratio of income to poverty level as the predictor variables. . After completion of the logistic regression, a "drop1" function was used within R Studio in an attempt to isolate more significant variables. The Z-Value and p score were used to assess for statistical significance of each variable with a value of <-2 or >2 and $p<.05$ considered statistical significance.

Results

After using descriptive statistics to understand the sample based on our independent variables, logistic regression was performed including those ten variables. gender, age, race/ ethnicity, education level, current school status, number of people living in household, annual household income, annual family income, and ratio of income to poverty level. Table 2 displays the statistical results generated by R Studio. One variable was identified as statistically significant and thus potentially contributing to low back pain. Those who reported they were not in school were more likely to experience back pain compared to those who were in school. The z-value was -2.434.

Next, the drop1 function was used to drop the most insignificant variable and the logistic regression was performed again without that particular variable for a total of four analyses. The first variable dropped was annual family income. The next variable was ethnicity, followed by annual household income and age. No other statistical significance occurred with each dropped variable.. The only variable that remained to be significant and a potential contributing factor to low back pain was current school status.

Table 2: Logistic Regression Results

	Estimate	**Std. Error**	**Z Value**	**Pr(>|z|)**
(Intercept)	-2.487117	0.223585	-11/124	$< 2 \times 10^{-16}$
Gender	-0.044692	0.076227	-0.586	0.558
Age	0.001766	0.002125	0.831	0.406
Race/Ethnicity	0.016679	0.034034	0.490	0.624

	Estimate	Std. Error	Z Value	Pr(>|z|)
(Intercept)	-2.487117	0.223585	-11/124	$< 2 \times 10^{-16}$
Education Level (Children 6-19)	0.014962	0.010986	1.362	0.173
Education Level (Adults 20+)	-0.028278	0.030541	-0.926	0.354
Current School Status	-0.236193	0.097077	-2.434	0.015
Total Number of People Living in Household	0.022735	0.026225	0.867	0.386
Annual Household Income	0.003018	0.008356	0.361	0.718
Annual Family Income	0.000880	0.008065	0.109	0.913
Ratio of Income to Poverty Level	-0.015151	0.024854	-0.610	0.542

Discussion/Conclusions

Previous research conducted in the United Kingdom comparing SES and low back pain revealed a positive relationship between the two (Moffett, 2009). However, this study showed no relationship between the level of income or level of education. Health disparities are real within the United States and affect certain minority groups more so than others. Based on the logistic regression in this study, however, low back pain may not be an illness that extends to American minorities more than the majority. The logistic regression found no evidence to support that people who are low income have a higher burden of low back pain. This was true with the race/ethnicity variable as well as the education level, age, gender, and ratio of income to poverty level.

An interesting outcome of this study was finding that people whom are currently in school are less likely to have low back pain (or neck problems). This was the only significant finding from the logistic regression. Possible explanations for this outcome include age and occupation. Essentially, those who are in school are typically young and in their 20s. In addition, for many who are in school they have no job requiring physical labor, which could cause the back pain.

This study's outcome is different than the data posted by the NCHS. The NCHS data revealed a clear trend that people of lower socioeconomic status and racial/ethnic minorities experience low back pain. The difference in results could be due to the faulty question within this study. Furthermore, this project focused on only one period of time, where as the NCHS was completed from 1997 to 2005.

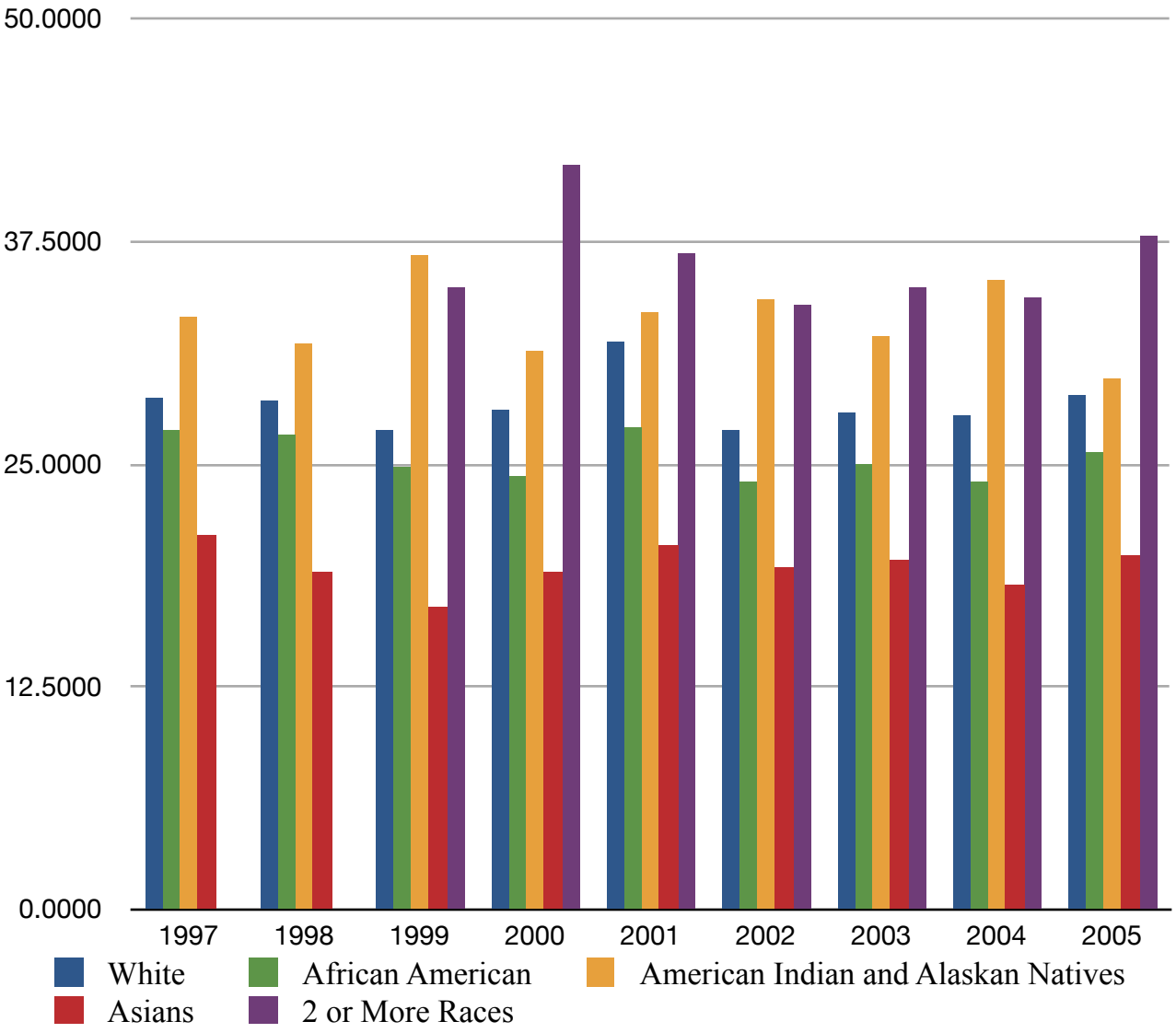
Future studies to be considered include conducting a linear regression over an extended period of time (five years or more) to identify not only which variables could potentially influence low back pain, but also how each variable has changed over time and its relationship. To complete this project, this particular survey question would need to be included and unchanged for multiple years, and only inquire about low back pain. NHANES is constantly changing in an effort to create better statistics of the health of the United States population. As a result, questions are added and deleted from year to year when the survey is under revision. This makes longitudinal studies difficult. Also, the most recent data concerning low back pain was the 2007-2008 survey because the question, "How long have you had low back pain or neck pain?" was removed on the preceding survey. The data is approximately six years old and a similar study using more recent responses would reveal more accurate results of the current United States population.

In addition, the data analysis program used, R Studio, was a difficult program to operate because it was not user friendly. R Studio made it laborious to condense the data into the only variables needed for the analysis and all researchers were not skilled enough with the program to complete wanted analyses. Moreover, the variable used from NHANES was not specific for low back pain, but also included neck pain responses. Therefore, even for our statistically significant result, we cannot solely assume that they have low back pain; people who responded to this survey could have experienced more neck pain instead. Future studies should narrow the responses to exclusively low back pain to create more accurate results.

Appendix

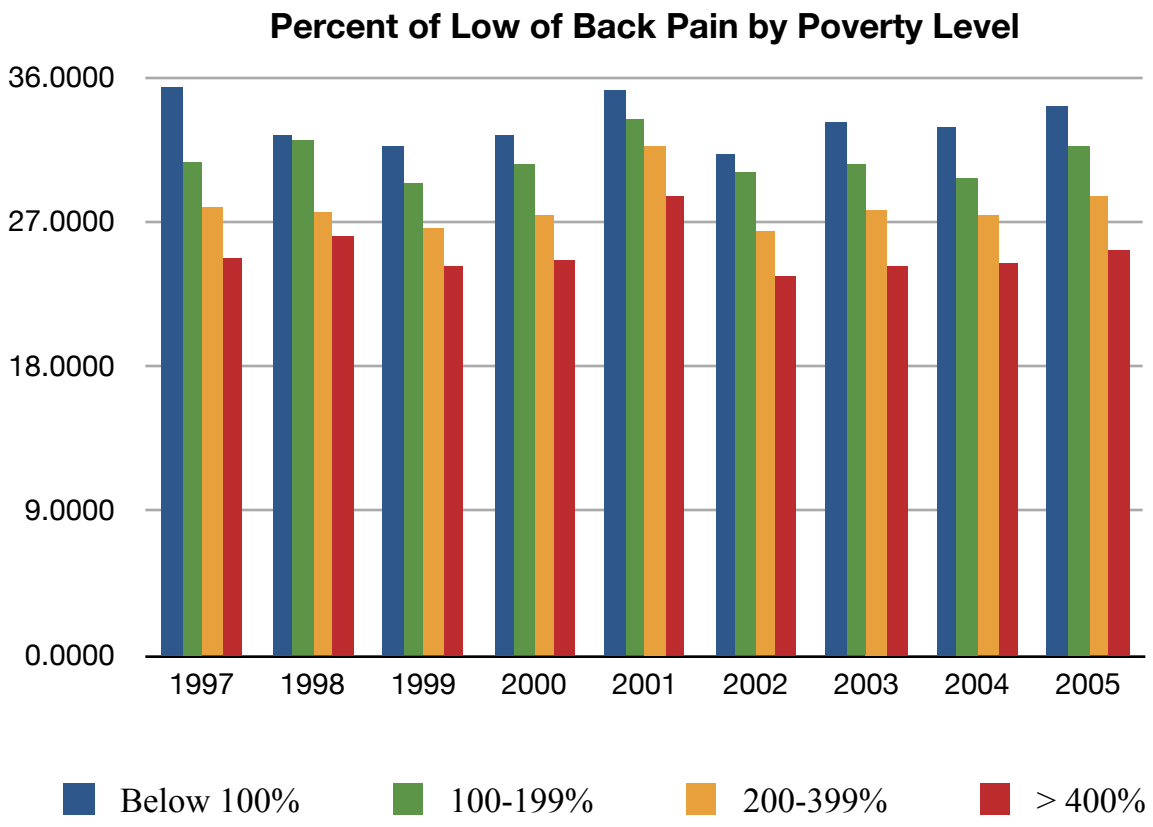
Figure 1

Percent of Low Back Pain by Race/Ethnicity



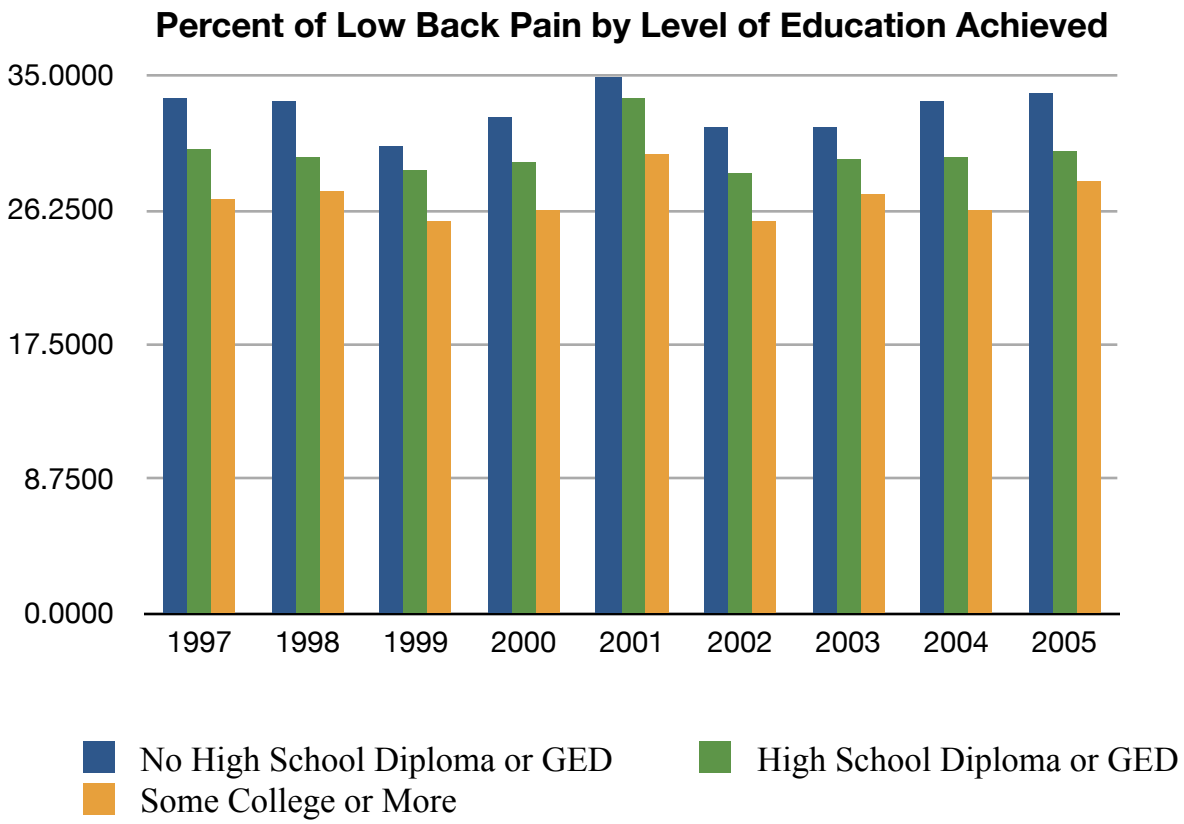
Data collected from National Center for Health Statistics.
SOURCE: CDC/NCHS, National Health Interview Survey, sample adult questionnaire.

Figure 2



Data collected from National Center for Health Statistics.
SOURCE: CDC/NCHS, National Health Interview Survey, sample adult questionnaire.

Figure 3



Data collected from National Center for Health Statistics.
SOURCE: CDC/NCHS, National Health Interview Survey, sample adult questionnaire.

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