

LUMBAR DISC DISORDERS AND LOW-BACK PAIN: SOCIOECONOMIC FACTORS AND CONSEQUENCES

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Socioeconomic factors are important risk factors for lumbar pain and disability. The total costs of low-back pain in the United States exceed \$100 billion per year. Two-thirds of these costs are indirect, due to lost wages and reduced productivity. Each year, the fewer than 5% of the patients who have an episode of low-back pain account for 75% of the total costs. Because indirect costs rely heavily on changes in work status, total costs are difficult to calculate for many women and students as well as elderly and disabled patients. These methodologic challenges notwithstanding, the toll of lumbar disc disorders is enormous, underscoring the critical importance of identifying strategies to prevent these disorders and their consequences.

Socioeconomic factors and health are inextricably linked. The definitions of two related socioeconomic concepts—*socioeconomic status* and the *socioeconomic consequences of health*—are required for an understanding of this article. Socioeconomic status refers to the resources possessed by an individual to obtain what he or she wants and needs, and the perception of those resources by society. Socioeconomic status may be an important risk factor for the development of specific disorders and for the occurrence of disability among patients with the disorder. Socioeconomic consequences of health refers to the effects of a disorder both on the resources of the individual and on the resources of society. This article discusses the measurement of socioeconomic status and socioeconomic disorders and how these concepts relate to lumbar disc disease.

Current concepts of socioeconomic status are rooted in nineteenth-century England. In that historical and cultural setting, social class included upper, middle, working, and underclasses. The upper class consisted of the landed gentry, who inherited land and wealth and did not work (e.g., Mr. Darcy in Jane Austen's *Pride and Prejudice*). The middle class worked with their minds. Members of this class were businessmen, barristers, and the like. Members of the working class worked with their hands and were subdivided into skilled and unskilled workers. The underclass comprised very poor individuals who worked inconsistently, if at all, in the most menial jobs. Because women generally did not work, a woman's social status was defined by her father's when she was growing up and then by her husband's if she married.

Measurement of Socioeconomic Status and Consequences

An individual's socioeconomic status is a latent concept, not easily measured with a single parameter. Researchers gen-

erally use one of three indicators, alone or in combination, to measure socioeconomic status—the individual's income, occupation, and educational attainment. More recently, investigators have also assessed neighborhood-level indicators of socioeconomic status¹. Easily measured with data from the United States Census, these indicators include the proportion of persons in the individual's neighborhood (e.g., census tract) who have an income that is below poverty level, who have had less than a high-school education, who are employed, or who have any of several dozen other indicators from census data.

Socioeconomic consequences of health disorders include direct and indirect costs². Direct costs are the resources expended on the management of the disorder. These include costs of hospitalization, outpatient visits, medications, assistive devices, diagnostic tests, alternative therapies, and other comparable expenses. Indirect costs are the resources expended to address the disability attendant to the disorder. These include the costs of lost wages due to work missed, reduced productivity among persons who are working with the disability, and costs of additional caregiving, transportation, and other expenditures necessitated by the disability.

These definitions of socioeconomic status and consequences raise methodologic challenges. We can call upon fundamental psychometric criteria of reliability and validity to assess these definitions. Reliability refers to reproducibility. Income and occupation are unreliable proxies for socioeconomic status, because they change frequently over the course of a lifetime³, while education is more stable. (Individuals may increase their level of education over time, but they cannot decrease it.) Validity refers to the extent that a measure captures what it is purported to measure. Among women, students, and elderly or disabled individuals, occupation is a particularly poor proxy for an individual's resources. The gender and age biases encoded in the class definitions of Jane Austen's

TABLE I Estimates of Direct Costs of Low-Back Pain in the United States*

Expense Category	Number Per Year	Median Unit Cost (US Dollars)	Total Cost (US Dollars)
Office visits for low-back pain	19 Million	\$150	\$3 Billion
Medical admissions for low-back pain	224,000	\$9000	\$2 Billion
Laminectomy and discectomy	286,000	\$14,000	\$4 Billion
Lumbar spinal fusion procedures	298,000	\$37,000	\$11 Billion

*Data obtained from reports of the 1989 National Ambulatory Medical Survey (as reported in the 2001 Institute of Medicine report²² and from the Healthcare Cost and Utilization Project database²⁷).

nineteenth-century England persist. Income is not an accurate proxy for elderly persons or for children or students, who may have marginal incomes but substantial resources from other sources such as inheritances.

Socioeconomic consequences are similarly vulnerable to measurement problems. For example, lost wages are often captured with Workers' Compensation data. However, many workers are not covered by Workers' Compensation insurance. In principle, it would be useful to assess productivity losses among workers who are indeed at work and earning their wages yet are less productive because of their health disorder. However, the field of health-related productivity measures is in its infancy, with measures first appearing only in the last decade^{4,5}.

Socioeconomic Factors and Disc Disorders

Socioeconomic Risk Factors for Disc Disorders and Disability

Risk factors for radiographically apparent lumbar disc disorders⁶⁻¹⁰ include age, gender, genetic factors (both heredity and specific genes), and smoking. In addition, occupational exposure is a risk factor for the development of radiographically apparent disc disorders, although the proportion of variance in disc degeneration explained by occupational exposure is quite modest^{7,11}. Thus, socioeconomic factors are not major risk factors for the development of radiographically apparent disc degeneration.

In contrast, socioeconomic factors are important risk factors for the onset of back pain and disability in general¹²⁻¹⁵. (It is not possible to limit these observations to degenerative disc disease.) Job dissatisfaction, physically strenuous work,

psychologically stressful work, low educational attainment, and Workers' Compensation insurance are all associated with low-back pain and/or disability. These largely socioeconomic factors are joined by smoking, obesity, older age, and psychological parameters such as measures of hypochondriasis, anxiety, depression, and Waddell signs.

Socioeconomic Consequences of Low-Back Pain and Disability

Direct Costs

Back pain is highly prevalent, affecting most individuals at some point in their lives. Only the common cold exceeds back pain in terms of the frequency of complaints that are heard by primary care physicians. Not surprisingly, direct costs are high. Estimates of various categories of direct costs of low-back pain are provided in Table I. The data in the table are far from complete, excluding, for example, medications and diagnostic tests. Even this incomplete and conservative listing, however, totals \$20 billion in direct costs for low-back pain.

Several aspects of the direct costs of low-back pain merit further discussion. Not only are costs high, but they vary considerably by provider specialty, patient race, and nation. For example, Carey et al.¹⁶ showed that outcomes were similar while costs varied widely among patients with low-back pain who were seen by primary care physicians, chiropractors, and orthopaedic surgeons. Carey and Garrett¹⁷ later reported that, after adjusting for provider type and other patient characteristics, the use of radiographs and other tests was lower among black patients with low-back pain than among white patients. Cherkin et al.¹⁸ demonstrated that there was up to a fivefold difference in

TABLE II Cost-Effectiveness of Interventions in Surgeries Pertaining to Disc Disease

Investigators	Intervention	Marginal Cost-Effectiveness*
Malter et al. ¹⁹ , 1996	Discectomy for herniated nucleus pulposus	\$34,000/QALY
Kuntz et al. ²⁰ , 2000	Noninstrumented fusion for degenerative spondylolisthesis with stenosis	\$85,000/QALY
Kuntz et al. ²⁰ , 2000	Instrumentation in fusion for degenerative spondylolisthesis with stenosis	\$3,000,000/QALY
Angevine et al. ²¹ , 2005	Instrumentation in anterior cervical decompression and fusion	\$33,000/QALY

*QALY = quality-adjusted life year.

the rate of performance of lumbar spine surgery among developed countries, with the highest rate in the United States.

Another important dimension of direct costs is cost-effectiveness—the amount that we spend, as a society, per year of life gained for various medical interventions². Cost-effectiveness ratios are expressed as marginal dollars per quality-adjusted life year (QALY). (Because disc disease is not fatal, dollars spent per life saved cannot be calculated.) Patients with chronic pain and functional limitation experience tangible decrements in quality of life. The QALY in disc disease quantifies the extent to which patients place less value on a year lived in chronic pain than a year lived in normal health. A person who indicates that every year with symptomatic disc disease is worth 0.9 QALYs actually values life with disc disease less than he or she values a year of healthy life. The methods for calculating QALYs are well established, but beyond the scope of this brief paper.

As a society, we spend \$33,000 to \$85,000 per QALY on such interventions as discectomy (as compared with conservative therapy)¹⁹, noninstrumented fusion for degenerative spondylolisthesis with stenosis (versus fusion without instrumentation)²⁰, and instrumentation in patients undergoing anterior cervical disc fusion (versus fusion without instrumentation)²¹ (Table II). This amount is well within the range of dollars per QALY that we spend as a society on other treatments, such as medications for hypertension, dialysis for end-stage renal disease, and coronary artery bypass grafting. However, the \$3 million per QALY investment in instrumented fusion for degenerative lumbar spondylolisthesis with stenosis is extremely high and should prompt thoughtful consideration of the value of instrumentation in this setting (as well as critical review of the assumptions of the analysis).

Indirect Costs

The major indirect cost components include lost wages due to absence from work, reduced productivity due to limitations at work, and costs of providing assistance with caregiving, transportation, and the like. Data on several of these components are available²². Five percent of American workers miss at least one day of work annually due to low-back pain. Further, the annual Workers' Compensation expenditure for musculoskeletal disorders exceeds \$20 billion. The major category of these disorders is low-back pain. In analyses that attempt to account for wage losses outside of the Workers' Compensation system, it is estimated that musculoskeletal disorders account for \$50 billion in productivity losses. Again, most of these costs are attributable to low-back pain.

Indirect costs can be attributed to a small number of workers who have chronic low-back pain symptoms. Data from many sources indicate that more than 80% of workers who report an episode of low-back pain return to work within one month^{23,24}; more than 90% return by three months. Yet a small number, fewer than 5%, never return. By the time a worker has been out of work for six months, the likelihood of return to work is just 50%. And by the time the worker has been out of work for one year, the likelihood of ever returning to work drops to 25%. These data indicate that there is little rationale for

aggressively treating injured workers in the first week or two of the episode²⁵. However, there is a compelling rationale for intervening in the subacute period—between two to four weeks and six months—because of the increasing likelihood that those who remain out of work have a diminishing probability of ever returning. These trends have predictable consequences for cost; fewer than 5% of workers account for 75% of the costs of work-associated low-back pain.

Total Costs

The total costs of disc disease are difficult to determine because the large databases that provide cost information do not distinguish disc disorders from other low-back pain syndromes. Still, the total costs of low-back pain have been estimated by several investigators. In 1991, Frymoyer and Cats-Baril²⁶ proposed that the total cost of low-back pain in the United States was \$50 to \$100 billion per year. Two-thirds of these costs were indirect costs, principally due to lost wages. Updated to 2005 dollars, these estimates suggest that the total cost of low-back pain ranges from \$100 to \$200 billion per year. This is a staggering economic toll and is paralleled by a huge patient burden of pain, disability, and psychological and social consequences.

Conclusions

Socioeconomic status is associated with important health consequences; conversely, health has important socioeconomic consequences. These complex relationships are particularly pronounced for lumbar disc disorders. Although genetic and demographic characteristics are the principal risk factors for radiographically apparent lumbar disc degeneration, socioeconomic factors are important risk factors for lumbar pain and disability. Back pain has enormous economic consequences, with total costs exceeding \$100 billion per year. Two-thirds of these costs are indirect, due to lost wages and reduced productivity. Fewer than 5% of patients who sustain a low-back pain episode each year account for 75% of the total costs.

Several methodologic challenges complicate this field of research. Socioeconomic status is difficult to measure (and is of questionable validity) in some key groups such as women, children, and the disabled because occupation and income in these groups tend to be variable. Because indirect costs rely heavily on changes in work status, these costs are difficult to calculate for many women, students, and elderly or disabled persons. These methodologic challenges notwithstanding, the toll of lumbar disc disorders is enormous, emphasizing the critical importance of identifying strategies for preventing these disorders and their consequences. ■

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