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REVIEW

# The Global Spine Care Initiative: a summary of the global burden of low back and neck pain studies

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## Abstract

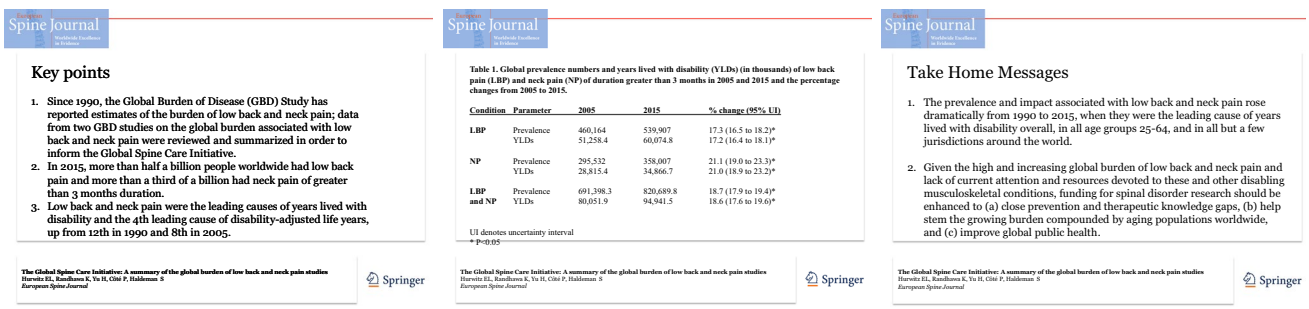
**Purpose** This article summarizes relevant findings related to low back and neck pain from the Global Burden of Disease (GBD) reports for the purpose of informing the Global Spine Care Initiative.

**Methods** We reviewed and summarized back and neck pain burden data from two studies that were published in Lancet in 2016, namely: "Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015" and "Global, regional, and national disability-adjusted life years (DALYs) for 315 diseases and injuries and healthy life expectancy (HALE), 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015."

**Results** In 2015, low back and neck pain were ranked the fourth leading cause of disability-adjusted life years (DALYs) globally just after ischemic heart disease, cerebrovascular disease, and lower respiratory infection {low back and neck pain DALYs [thousands]: 94 941.5 [95% uncertainty interval (UI) 67 745.5–128 118.6]}. In 2015, over half a billion people worldwide had low back pain and more than a third of a billion had neck pain of more than 3 months duration. Low back and neck pain are the leading causes of years lived with disability in most countries and age groups.

**Conclusion** Low back and neck pain prevalence and disability have increased markedly over the past 25 years and will likely increase further with population aging. Spinal disorders should be prioritized for research funding given the huge and growing global burden.

**Graphical abstract** These slides can be retrieved under Electronic Supplementary Material.




**Keywords** Spine · Neck pain · Back pain · Global burden of disease

## Introduction

People are living longer, on average, but the health-related quality of life has not kept pace with enhanced longevity, resulting in an expansion of morbidity [1]. Low back and neck pain are conditions affecting an increasing number of

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individuals in terms of prevalence and disability [2, 3]. The 2015 Global Burden of Disease Study of injuries and risk factors brought together over 1800 independent experts in more than 120 countries and territories [4]. This study highlighted areas where improvements can be made in healthcare delivery. The 2015 Global Burden of Disease Study analyzed 249 causes of death, 315 diseases and injuries, and 79 risk factors for 195 countries and territories between 1990 and 2015. Incidence and prevalence were estimated for 2619 sequelae of 310 causes for 591 geographical regions using 60,900 data sources for the years 1990, 1995, 2000, 2005, 2010, and 2015. Four main papers were published for the Global Burden of Disease Study [3, 5–7]. Our objective is to summarize the methods and findings of two of the four capstone papers that include outcomes relevant to neck and back pain [3, 7]. These papers reported global data from 1990 to 2015 on the prevalence, years lived with disability (YLD), and disability-adjusted life years (DALYs), the sum of years of potential life lost due to premature mortality and the years of productive life lost due to disability [8].

The World Spine Care (WSC) vision is "a world in which everyone has access to the highest quality spine care possible." (www.worldspinecare.org) The WSC created the Global Spine Care Initiative (GSCI) to develop an evidence-based, practical, sustainable, and scalable spine health-care pathway and model of care that can be implemented to underserved communities. A better understanding of the global burden of spine pain is needed. Therefore, the objective of this paper is to summarize relevant findings and trends related to back and neck pain from the most up-to-date 2015 GBD reports for the purpose of informing the GSCI, identifying critical global spine care and research gaps and needs, and offering potential explanations for differences between estimates of community and global burden.

## Methods

We summarized the methods and findings of two of the four capstone papers that include outcomes relevant to neck and back pain [3, 7]. From these papers, we summarized data on the prevalence, years lived with disability (YLD), and disability-adjusted life years (DALYs) [8].

### Global burden of disease survey

The global burden estimates for low back pain and neck pain were established through eight steps: (1) establishing a case definition; (2) establishing health states; (3) systematic reviews; (4) establishing disability weights; (5) adding national health surveys; (6) performing Bayesian meta-regression; (7) performing severity distribution; and (8) finalizing YLD estimates [2, 9]. The GBD Neck Pain Expert Group and GBD Low Back Pain Expert Group performed steps 1–3, and the GBD Core Team performed the remaining steps [2, 9]. We have provided summaries of the case definitions, establishing health states, measures of burden, and establishing disability weights used in the GBD reports below.

### Measures of burden

Disability-adjusted life years (DALYs) is an overall summary measure of population health that the GBD uses, which combines years of life lost due to premature mortality (YLLs) and years lived with disability (YLDs) [10].

### Established disability weights

For GBD 2010, a comprehensive re-estimation of disability weights was carried out through a large-scale empirical study. Household surveys were conducted in five countries that were diverse in languages, cultures, and socioeconomic status. The surveys used paired comparison questions, where respondents considered two hypothetical individuals with different, randomly selected health states and indicated which person they believed was healthier. An open access web survey was also used that asked additional questions about population health equivalence, which compared the overall health benefits of various life-saving or disease prevention programs [11]. An analysis of the paired comparison data was performed using probit regression analysis. Results from the population health equivalence responses were used to anchor results from the paired comparisons on the disability weight units between 0 (no loss of health) and 1 (loss equivalence to death) [11]. In 2013, additional Web-based surveys were completed in four European countries and combined with data previously completed in the GBD 2010 disability weights measurement study [12].

### Socio-demographic index

The GBD investigators computed a summary measure for each geographic location in 2015 called the Socio-Demographic Index (SDI) that takes into account per capita income, years of education, and fertility rate [6, 7]. Expected disease-specific YLDs and DALYs based on the SDI for each location were computed and compared to observed YLDs and DALYs, yielding observed to expected ratio measures of disease burden that exceed, are consistent with, or lag behind expectation based on the SDI components [6, 7].

### Taking uncertainty into account

To account for uncertainty in estimation due to sampling, model estimation, and model specification (e.g., variable

study sample sizes, adjustments from non-reference definitions, parameter and disability weight uncertainty), 95% uncertainty intervals (UIs) were derived from 1000 draws from the posterior distribution of each step in the estimation process (the UIs reflect the ordinal 25th and 975th draw) [7].

### Definitions of low back pain and neck pain

The case definition for low back pain (LBP) was LBP (± pain referred into one or both lower limbs) that lasts for at least 1 day [13]. The 'low back' was defined as the area on the posterior aspect of the body from the lower margin of the 12th ribs to the lower gluteal fold [2]. The case definition for neck pain was: neck pain [± pain referred into the upper limb(s)] that lasts for at least 1 day [2]. The anatomical region of the neck was defined according to the recommendation by The Bone and Joint Decade 2000–2010 Task Force on Neck Pain and its Associated Disorders [14]. 'Neck or shoulder' pain was assumed to be a proxy for 'neck' pain.

### Health states

The GBD low back and neck pain expert groups developed a series of sequelae to characterize the different levels of severity considering the variation in functional loss associated with acute and chronic neck pain with or without arm pain, and acute and chronic LBP with or without leg pain.

## Results

### Burden

Table 1 reports the global prevalence numbers of low back and neck pain and YLDs caused by these conditions. The global point prevalence of low back pain and neck pain of greater than 3 months increased by 18.7% from 2005 to 2015 [3]. Specifically, the global prevalence of low back pain of more than 3 months duration has increased by 17.3% [539,907,000 (95% UI 521,449,000–559,556,000)] and neck pain of more than 3 months duration has increased by 21.1% [358,007,000 (95% UI 313,408,000–409,411,000)] over the last 10 years [3]. Low back and neck pain YLD remain the top cause of global YLD since 1990 [3].

**Table 1** Global prevalence numbers and years lived with disability (YLDs) (in thousands) of low back pain (LBP) and neck pain (NP) of duration greater than 3 months in 2005 and 2015 and the percentage changes from 2005 to 2015 [3]

| Condition | Parameter | 2005 | 2015 | % Change (95% UI) |
|---|---|---|---|---|
| LBP | Prevalence | 460,164 | 539,907 | 17.3 (16.5–18.2)* |
| | YLDs | 51,258.4 | 60,074.8 | 17.2 (16.4–18.1)* |
| NP | Prevalence | 295,532 | 358,007 | 21.1 (19.0–23.3)* |
| | YLDs | 28,815.4 | 34,866.7 | 21.0 (18.9–23.2)* |
| LBP and NP | Prevalence | 691,398.3 | 820,689.8 | 18.7 (17.9–19.4)* |
| | YLDs | 80,051.9 | 94,941.5 | 18.6 (17.6–19.6)* |

*UI* uncertainty interval

*$P < 0.05$

Age-specific global rankings of low back and neck pain YLDs and DALYs are reported in Online Resource Table 1. Globally, in 2015, low back and neck pain were the leading causes of YLD in persons 25–64 years old, second leading cause of YLD in those 20–24 or 65–79 year olds, third leading cause of YLD in those aged 80 +, and fourth leading cause of YLD in 15–19 year olds [3]. Furthermore, the global YLD caused by low back and neck pain has increased 18.6% (95% UI 17.6% to 19.6%) from 2005 to 2015 [3]. Similarly, YLD caused by low back pain alone increased by 17.2% (95% UI 16.4–18.1%) and YLD caused by neck pain increased by 21.0% (95% UI 18.9–23.2%) over the last 10 years [3].

The rankings of low back and neck pain YLDs and DALYs by geographic area are reported in Online Resource Table 2. Low back and neck pain were the leading cause of disability in all high-income countries, the leading cause of YLD for all but two countries in Latin America and the Caribbean (Haiti and Venezuela were the exceptions), and the leading cause of YLD for three out of five countries in South Asia (second leading cause of YLD in India and Pakistan) [3]. Low back and neck pain were the leading cause of disability in every geographical region within central Europe, eastern Europe, and central Asia and the leading cause of YLD in 9/46 Sub-Saharan African countries [3]. Low back and neck pain YLDs and DALYs were greater than expected in North America and Europe, and generally consistent with or less than expectation based on the SDI in most other locations (see Online Resource Table 2).

### Determinants

Occupational ergonomic factors (e.g., heavy manual lifting, excessive bending and twisting, whole body vibration) and high body mass index (BMI) are estimated to be responsible for 30.9% [95% confidence interval (CI) 29.2, 32.5] and 5.5% (95% CI 3.4–7.6) of YLD due to low back pain [7]. The GBD investigators estimate that the highest occupational risks of LBP are in service industries and manual work such as agriculture, and although the proportion of the workforce engaged in agriculture may decline in the coming years, they estimate that almost 65% of the burden would remain [7].

### Trends

In 1990, low back and neck pain were ranked as the 12th leading cause of DALYs globally; in 2005, the 8th leading cause, moving up to 4th in 2015, after ischemic heart disease, cerebrovascular disease, and lower respiratory infection [7]. From 1990 to 2005, DALYs from low back and neck pain increased by 34.5%, and from 2005 to 2015 by 18.6% (from 1990 to 2015 low back and neck pain DALYs increased by 59.5%). In 2015, low back and neck pain was the leading cause of disability in most countries (second leading cause of DALYs in high-income countries after ischemic heart disease) [7]. A reason for this increase may be aging populations around the world. Both low back and neck pain have a higher prevalence in older age groups; therefore, as life expectancy increases and the number of older individuals increases compared to the number of younger individuals, we may see an increase in conditions prevalent in older age groups (i.e., expansion of morbidity) [3]. Other risk factors that may influence an increase in spinal pain include overweight and obesity [7]. As the GBD report shows, painful musculoskeletal disorders are the leading cause of disability globally and great threats to health in general; because of their effects on mobility, the threats will likely only worsen as the population ages. Although disability estimates and rankings have increased over time, the true magnitude of increased burden of disease attributable to low back and neck pain is unknown due to uncaptured sources of uncertainty and to differences in case definitions over time [10].

## Discussion

### Gaps in the GBD reports informing future research

Although there is a large body of research in the area of spinal disorders, including neck and back pain, notable gaps remain in our understanding of the epidemiology of these conditions in both developed and emerging countries. The global burden of disease reports give us a standardized, comprehensive indication of the burden, yet the data are based on estimates with many underlying disability weighting, modeling, and other assumptions. GBD investigators acknowledge the challenge of quantifying the burden of disease accurately given the variety of data sources, variable data quality, the range of biases, and data gaps in many jurisdictions. With respect to spinal disorders, definitions of neck and back pain vary among studies, which affects who is included and excluded in the study populations. This may result in high variability in prevalence between studies and thus affect the GBD prevalence estimates.

In addition, as noted in the GBD reports, the largest data gaps regarding spinal disorders and other non-communicable diseases exist because data on these conditions and their sequelae are not routinely collected and reported in systematic fashion in many jurisdictions (e.g., low back and neck pain, as well as other high ranking YLD disorders had data representativeness indices under 50%). GBD investigators recommend that countries centralize and invest in population-level epidemiological data systems for conditions responsible for high YLD (such as low back and neck pain). They also recommend that journal editors require authors of epidemiological studies to include data on functional health status as well as severity, distribution, and duration of symptoms. These research gaps are well within our abilities to address. Greater efforts should be applied to gather data on spine disorders in communities that are most in need. World Spine Care and the Global Spine Care Initiative are helping to address these data gaps using participatory action research methods, collecting and analyzing qualitative, epidemiologic and outcomes data from low- and middle-income communities and designing and testing models of care and data collection systems with the goal of reducing disability due to spinal disorders worldwide [15, 16].

### Differences between global and community estimates

There are large variances between estimates of global versus community prevalence of spinal disorders. As we have reported elsewhere [17], methodological variability across studies may be due to differences in case definitions, recall periods, modes of data collection, and validation of the instruments used or the representativeness of the samples. These issues affect the estimates and our ability to make valid comparisons between communities and populations. In general, studies that specify a minimum episode duration (e.g., 1 day, 3 months) have lower prevalence estimates than ones with non-specified episode duration [18], but even so the range of estimates is variable. Heterogeneity in case definitions (e.g., “back pain”, “low back pain”, “dorsolumbar”) result in different prevalence estimates. Prevalence estimates are higher in surveys of self-reported pain than in health-care utilization surveys. Large variation within and between studies of different modes of data collection precludes accurate estimates and meaningful inferences regarding the true frequency and impact of spinal pain within and between communities at single points and over time [19–21]. For example, when using a checklist to indicate musculoskeletal symptoms, there is an expectation that prevalence will be higher than when using more open ended or generally worded descriptions of the musculoskeletal disease and symptoms [20].

## Conclusion

The 2015 Global Burden of Disease Study has highlighted the enormous global burden of spinal disorders. Lower back and neck pain was the leading cause of disability in 2015 [7]. Globally, the prevalence of low back and neck pain has increased by 18.7% over the last 10 years and YLD caused by low back and neck pain has increased by 18.6% over the last 10 years [7]. Given the growing global burden of spinal disorders and the adverse personal and societal effects on quality of life and work ability, we agree with the GBD authors that low back and neck pain should be a priority for future research on prevention and therapy, especially critical as the worldwide population increases in size and average age. Large heterogeneity in observed to expected burden associated with back and neck pain indicates differences in how health systems are meeting population health needs. As noted by GBD, research funders are increasingly using DALYs for prioritizing decisions. Therefore, conditions highly prevalent and disabling, but historically underfunded (such as low back and neck pain and other musculoskeletal conditions) in populations with relatively low health-care market power (e.g., low- and middle-income communities) should receive more attention, research, and resources. This is a position fully endorsed and being put into place in several low- and middle-income communities by the World Spine Care and the Global Spine Care Initiative. With increasing disability from back and neck pain, these research and health-care efforts on prevention and therapy must be implemented more widely if we hope to compress morbidity in both absolute (fewer years lost due to functional health loss) and relative (lower ratio of years of functional health lost to life expectancy) terms.

## Compliance with ethical standards

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