EXTENDED REPORT

The global burden of low back pain: estimates from the Global Burden of Disease 2010 study

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ABSTRACT

Objective To estimate the global burden of low back pain (LBP).

Methods LBP was defined as pain in the area on the posterior aspect of the body from the lower margin of the twelfth ribs to the lower glutaeal folds with or without pain referred into one or both lower limbs that lasts for at least one day. Systematic reviews were performed of the prevalence, incidence, remission, duration, and mortality risk of LBP. Four levels of severity were identified for LBP with and without leg pain, each with their own disability weights. The disability weights were applied to prevalence values to derive the overall disability of LBP expressed as years lived with disability (YLDs). As there is no mortality from LBP, YLDs are the same as disability-adjusted life years (DALYs).

Results Out of all 291 conditions studied in the Global Burden of Disease 2010 Study, LBP ranked highest in terms of disability (YLDs), and sixth in terms of overall burden (DALYs). The global point prevalence of LBP was 9.4% (95% CI 9.0 to 9.8). DALYs increased from 58.2 million (M) (95% CI 39.9M to 78.1M) in 1990 to 83.0M (95% CI 56.6M to 111.9M) in 2010. Prevalence and burden increased with age.

Conclusions LBP causes more global disability than any other condition. With the ageing population, there is an urgent need for further research to better understand LBP across different settings.

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INTRODUCTION

Low back pain (LBP) is well documented as an extremely common health problem[1–4]; it is the leading cause of activity limitation and work absence throughout much of the world,[5] and it causes an enormous economic burden on individuals, families, communities, industry and governments.[6–8] As part of the Global Burden of Disease 2010 Study (GBD 2010),[9] the global burden of musculoskeletal conditions was estimated using updated methods that address methodological limitations of previous GBD studies.[10–12] Burden was expressed in disability-adjusted life years (DALYs).

This paper details the methods and results for estimating the global burden of LBP for GBD 2010. It is one of a series of articles. The overall capstone GBD 2010 papers were published in the Lancet,[9 13–16] and the papers that report the methods and results for the MSK conditions are published in *Annals of Rheumatic Diseases*.[17–25] One of these papers describes in detail the methods used for estimating the global burden of the MSK conditions[22] and should be read in conjunction with the current paper.

METHODS

Figure 1 outlines the steps taken in estimating the burden of LBP. The GBD LBP expert group performed steps 1 to 3, and the GBD core team performed the remaining steps.

Established case definition

The initial case definition for LBP was 'activity-limiting LBP (± pain referred into one or both lower limbs) that lasts for at least one day'.[12] The 'low back' was defined as the area on the posterior aspect of the body from the lower margin of the twelfth ribs to the lower glutaeal folds. For the final analysis, 'activity-limiting' was removed from the case definition because: (1) this provided a more robust analytical model given that relatively few data points from the systematic review conformed to the case definition of LBP that was activity-limiting and (2) this definition aligned better with the LBP definition used in national health surveys that were included in the final analysis.

Established health states

A series of sequelae were developed to characterise the different levels of severity and take into account the variation in functional loss associated with acute and chronic LBP with or without leg pain (table 1).[12] Each sequela was defined in lay terms.

Performed systematic reviews

The systematic reviews have been described elsewhere[26–28]—see online supplementary file 1 for further details. For incidence, a small number of studies were found, but all counted the number of people as the numerator rather than the number of incident episodes. This number could not be converted to episode incidence as no data were found on the average number of episodes a person with LBP experiences over time. Thus, incidence could not be used as a parameter in the burden estimates.[26] For duration and remission, no population-based studies were found, and for mortality, there was no consistent and conclusive evidence that LBP is associated with an increased risk of mortality.[26]

For prevalence, 170 published studies were identified. These reported 1139 age and/or sex-specific

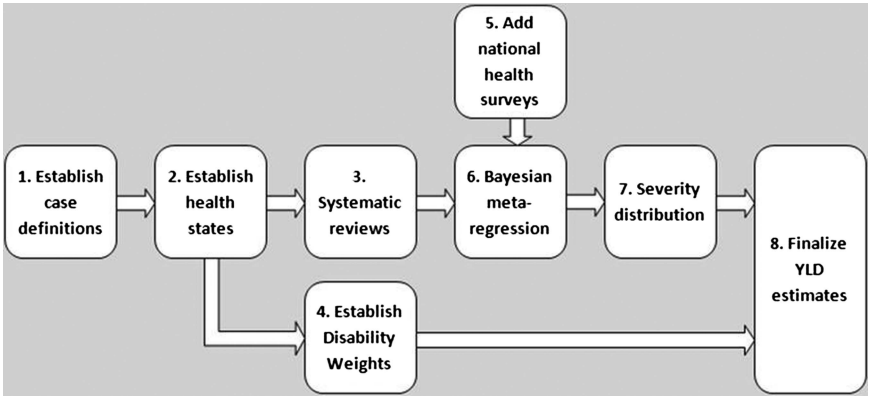

Figure 1 Steps taken in estimating the global burden of low back pain, GBD 2010.

estimates. All included studies were assessed for risk of bias using a tool specifically developed for GBD 2010.[28] High risk of bias estimates (n=242) and estimates with a prevalence recall period greater than 1 year (n=105) were excluded, leaving a total of 792 estimates from 118 studies (101 papers). One German study[29] was excluded, as it contained outlier data (point prevalence ranging from 77% to 92% in elderly Germans), and estimates more consistent with most other studies (point prevalence ranging from 20% to 50%) were available in two other German studies of equal or lower risk of bias.[30 31] This left a total of 117 studies and 780 estimates, with data available from 47 countries and 16 of the 21 GBD world regions.

There was substantial heterogeneity between studies with respect to prevalence period and case definition (ie, the minimum episode duration), anatomical location, and whether or not cases had to experience activity limitation. To make data points more comparable, adjustments were made in DisMod-MR, a Bayesian meta-regression tool developed for GBD 2010 by predicting the value of a data point as if the study had used the reference definition. To do so, DisMod-MR estimates coefficients for study-level covariates by comparing the values of prevalence measured by various methods in the global dataset. For the purpose of these analyses, it was necessary to reduce the number of categories of case definition and prevalence period. This was done by merging some of the categories on the basis of overlapping CIs or expert opinion (on the basis of proximity to overlapping CIs) for prevalence and/or regression coefficients. To determine how best to reduce the number of categories, a multivariate regression was done with prevalence (log transformed plus 0.2 to achieve normality) as the dependent variable and the following independent variables: age, sex, prevalence period, minimum episode duration, anatomical location, activity limitation, coverage, urbanicity and risk of bias (see online supplementary file 2).

Three groups were formed for prevalence recall period: (1) point (including one day); (2) short-term (one week to two months); and (3) longer-term (three months to one year). Three groups were formed for anatomical case definition: (1) back, low back, 'posterior aspect of the body from the lower margin of the twelfth ribs to the lower glutaeal folds', and 'thoraco-lumbo-sacral'; (2) lumbar, 'lumbar or sacro-iliac joint (s)', and 'neck or back'; and (3) 'posterior aspect of the body from the seventh cervical vertebra to the lower glutaeal folds', and 'thoracic or lumbar'. For the minimum episode duration definition variations, two groups were formed: (1) 'not specified', '>1 day', '>3 days', '>1 week', and '>7 weeks'; and (2) '>3 months', '>6 months', 'chronic', and 'frequent'. Note, the first category in each of the above groups is considered the reference category.

Table 1 Sequelae for low back pain in GBD 2010

Sequela	Lay description	Disability weight
Severe acute low back pain without leg pain	This person has severe low back pain, which causes difficulty dressing, sitting, standing, walking and lifting things. The person sleeps poorly and feels worried	0.269 (0.184–0.373)
Severe acute low back pain with leg pain	This person has severe low back and leg pain, which causes difficulty dressing, sitting, standing, walking and lifting things. The person sleeps poorly and feels worried	0.322 (0.219–0.447)
Severe chronic low back pain without leg pain	This person has constant low back pain, which causes difficulty dressing, sitting, standing, walking and lifting things. The person sleeps poorly, is worried and has lost some enjoyment in life	0.366 (0.248–0.499)
Severe chronic low back pain with leg pain	This person has constant low back and leg pain, which causes difficulty dressing, sitting, standing, walking and lifting things. The person sleeps poorly, is worried and has lost some enjoyment in life	0.374 (0.252–0.506)

Established disability weights

Surveys were conducted in five countries for GBD 2010 and complemented by an open access internet survey; pair-wise comparison questions were used, in which respondents were asked to indicate which of two health states presented as brief lay descriptions they considered 'the healthier'. Results were used to derive DWs.[15]

Added information from National Health Surveys

Additional information on prevalence of LBP was derived from the World Health Surveys (50 countries; 1495 data points)[32]; Australian National Health Surveys (1995, 2001, 2003/2004 and 2007/2008; 43 data points)[33]; Australian Surveys of Disability, Ageing and Carers (2003 and 2009; 41 data points)[34]; and the US National Health Information surveys (2001–2008; 168 data points)[35] and NHANES (2009; 20 data

points).[36] Data from these surveys were not included in the systematic review as they did not fulfil our inclusion criteria at that time.

Bayesian metaregression

DisMod-MR is a Bayesian metaregression tool that has a number of functions, including: (1) pooling heterogeneous data and adjusting data for methodological differences; (2) checking data on incidence, prevalence, duration, remission and mortality risk for internal consistency and (3) predicting values for countries and regions with little or no data using disease-relevant country characteristics and random effects for country, region and super-region. In the absence of usable incidence and remission data, a 'prevalence-only' model was run (see online supplementary file 3).

Severity distribution

To estimate the distribution of LBP cases across the GBD 2010 health states, the US Medical Expenditure Panel Survey (MEPS) from 2000 to 2009 was used. This had information on the prevalence of 156 disorders included in the GBD as well as health status information provided by all individuals using the Short Form-12 (SF-12) questionnaire.[37]

In order to provide a translation of SF-12 values into a scale comparable with that used by the GBD 2010 DWs, the GBD core team conducted a small study on a convenience sample of respondents who were asked to fill in SF-12 to reflect 62 lay descriptions covering a wide range of severity that were used in the GBD DW surveys. With regression methods, the proportion of an individual's SF-12 score, translated into a GBD DW, that could be attributed to LBP was calculated, while controlling for any comorbid other condition.

Cases were then grouped in categories of disability based on the midpoints between DWs reflecting successive levels of severity. It was assumed that those with no disability in MEPS were cases that had remitted since their diagnosis of LBP was reported. As the case definition was for 'point prevalence', this proportion of cases was excluded from the calculation of the average DW for all LBP and the remaining proportions were scaled to add up to 100%.

MEPS respondents with LBP were partitioned into levels of severity for LBP with leg and another four for LBP without leg pain. The mild acute and chronic neck pain DWs were used as proxy DWs for the lowest LBP disability classes given that no mild LBP health states were available from the household and on-line surveys used to derive DWs (tables 2 and 3). An age distribution of the proportions of LBP with and without leg pain was derived from the prevalence figures in MEPS. The proportions for males and females combined were calculated after finding little difference by sex. From these proportions, the average DWs were calculated by age.

Table 2 The eight sequela categories used for calculating the severity distribution of low back pain (with disability weights, and proportional distributions), GBD 2010

Category	DW	Proportion
Low back pain without leg pain		
Mild acute low back pain	0.040 (0.023–0.064)	49.8% (42.1–57.1)
Mild chronic low back pain	0.101 (0.067–0.149)	22.7% (16.9–28.8)
Severe acute low back pain	0.269 (0.184–0.373)	10.5% (8.1–13.4)
Severe chronic low back pain	0.366 (0.248–0.499)	17.0% (11.8–23.2)
Low back pain with leg pain		
Mild acute low back pain	0.040 (0.023–0.064)	36.1% (28.3–43.7)
Mild chronic low back pain	0.101 (0.067–0.149)	26.1% (20.4–33.0)
Severe acute low back pain	0.322 (0.219–0.447)	12.0% (9.3–15.3)
Severe chronic low back pain	0.374 (0.252–0.506)	25.8% (18.1–33.8)

The two milder classes of low back pain disability weights used the mild acute and chronic neck pain weights.

Final burden estimates

The Disability-Adjusted Life Year (DALY) is the standard metric used to quantify burden.[38] DALYs are calculated by combining years of life lost (YLL) due to premature mortality, and years lived with disability (YLD). As there is no mortality from LBP, YLDs and DALY estimates are the same. The average DW was multiplied by the age/sex/region-specific prevalence for the years 1990, 2005 and 2010 to derive YLDs. The uncertainty interval (UI) around each quantity of interest was calculated from SEs around all data inputs and the uncertainty from all steps of data manipulations, including the use of country and region fixed effects in DisMod-MR and the severity distributions. Uncertainty ranges are presented as the 2.5 and 97.5 centile values, which can be interpreted as a 95% UI. Further detail on how uncertainty was calculated can be found elsewhere.[9] Prevalence estimates were standardised using the 2001 WHO standard population.[39]

As disability weights were derived for single health states, simple addition of YLDs for all conditions would assume that disability is additive if a person has comorbid health states. Thus, a person with a number of more severe health states could be awarded a cumulative disability weight that exceeds 1, which equates to greater health loss than 'being dead'. Assuming a multiplicative function between DWs for comorbid health states assures that a combined DW can never be greater than 1. To make a correction for comorbidity, hypothetical populations were simulated for each age, sex, country and year. Individuals in these hypothetical populations were assigned to have no, one or more health states based on the prevalence figures for each health state. The multiplicative function was applied to any individual with comorbid health states and the DW for each component health state reduced proportionately. This allowed an estimate of the reduction in DW for any health state in an age and sex group by country and year: the comorbidity correction.

RESULTS

Description of included data

There were 2566 data points included in the final DisMod-MR models. These were from 85 countries, and 20 of the 21 GBD 2010 regions. The majority of studies used for these data included both sexes, a broad age range in the adult population, and urban and rural populations.

Prevalence

The global age-standardised point prevalence of LBP (from 0 to 100 years of age) in 2010 was estimated to be 9.4% (95% CI 9.0 to 9.8). It was higher in men (mean: 10.1%; 95% CI 9.4 to 10.7) compared with women (mean: 8.7%; 95% CI 8.2 to 9.3). The age and sex distribution across regions was similar. DisMod-MR assumes a similar age pattern for all regions unless there are sufficient data points in a region to indicate a variation from the global age pattern. The large heterogeneity in the LBP dataset meant that there was no departure from the default of a common age pattern (figure 2). Prevalence peaked at around 80 years of age.

Table 3 Age-standardised prevalence and DALYs (with 95% CIs) for low back pain in the age range 0–100 years, by region and sex, 2010, GBD 2010

					----------(in thousands)----------		
Country	**Sex**	**Prevalence**	**Prevalence LL**	**Prevalence UL**	**DALYs**	**DALY LL**	**DALY UL**
Asia-Pacific high income	Male	9.4	6.9	12.5	1388	859	2117
	Female	8.6	6.4	11.5	1385	885	2125
Australasia	Male	12.9	10.6	15.5	252	167	364
	Female	11.5	9.3	13.9	235	156	342
Caribbean	Male	7.0	5.8	8.3	183	119	260
	Female	6.0	4.9	7.2	165	111	229
Central Asia	Male	9.1	7.5	11.2	417	269	590
	Female	7.8	6.4	9.5	396	268	560
Central Europe	Male	12.6	10.5	15.1	1126	739	1582
	Female	10.3	8.6	12.5	1050	688	1490
East Asia	Male	7.1	5.3	9.3	7390	4710	11 018
	Female	6.2	4.7	8.2	6210	3766	9069
Eastern Europe	Male	12.2	10.2	14.6	1744	1179	2493
	Female	10.4	8.6	12.3	1942	1331	2701
Latin America Andean	Male	8.0	5.8	10.8	247	151	379
	Female	6.7	5.0	9.2	213	133	325
Latin America central	Male	7.0	5.8	8.3	942	613	1343
	Female	6.2	5.2	7.4	887	586	1265
Latin America southern	Male	8.8	6.0	12.2	347	207	538
	Female	7.2	5.0	10.0	316	190	484
Latin America tropical	Male	12.3	9.7	15.2	1542	1007	2288
	Female	10.1	7.9	12.6	1360	854	1973
North Africa/Middle East	Male	15.7	14.2	17.5	4179	2845	5773
	Female	13.9	12.6	15.3	3550	2446	4898
North America high income	Male	7.7	6.2	9.4	1914	1231	2743
	Female	7.7	6.1	9.5	2012	1304	2887
Oceania	Male	8.6	5.9	12.3	44	26	69
	Female	7.6	5.2	11.0	38	23	62
South Asia	Male	11.1	9.3	13.2	10 406	7014	14 704
	Female	9.2	7.8	10.9	8258	5585	11 631
Southeast Asia	Male	8.7	7.5	10.0	3165	2156	4376
	Female	7.1	6.2	8.2	2723	1839	3805
Sub-Saharan Africa central	Male	8.9	6.1	12.6	365	212	574
	Female	7.6	5.3	10.5	324	193	498
Sub-Saharan Africa east	Male	9.7	8.5	11.1	1514	1018	2107
	Female	7.6	6.6	8.7	1220	840	1677
Sub-Saharan Africa southern	Male	8.3	6.8	9.8	300	201	416
	Female	6.7	5.5	8.0	260	169	374
Sub-Saharan Africa west	Male	11.7	10.3	13.5	1759	1230	2416
	Female	9.5	8.2	10.9	1419	963	1977
Western Europe	Male	15.5	14.2	16.9	4964	3417	6806
	Female	14.5	13.3	15.8	4915	3361	6652

Age-standardised prevalence in 2010 was highest in western Europe (mean: 15.0%; 95% CI 14.1 to 16.0) followed by North Africa/Middle East (mean: 14.8%; 95% CI 13.8 to 15.9), and lowest in the Caribbean (mean: 6.5%; 95% CI 5.6 to 7.4) followed by central Latin America (mean: 6.6%; 95% CI 5.8 to 7.4). Prevalence did not change significantly from 1990 to 2010.

YLD and DALYs

Globally, and out of the 291 conditions studied, LBP was ranked as the greatest contributor to global disability (measured in YLDs), and the sixth in terms of overall burden (measured in DALYs)—table 4. It was ranked as the greatest contributor to disability in 12 of the 21 world regions and the greatest contributor to overall burden in two of the 21 world regions (western Europe and Australasia).

DALYs increased from 58.2 million (M) (95% CI 39.9M to 78.1M) in 1990 to 83.0M (95% CI 56.6M to 111.9M) in 2010. Population increase contributed 30% of the 43% increase in DALYs between 1990 and 2010 while ageing was responsible for the remaining 13%. DALYs were highest in mens (44.2M; 95% CI 30.3M to 60.1M) compared with women (38.9M; 95% CI 26.5M to 52.9M). DALYs were highest between ages 35 and 50 years.

DISCUSSION

New estimates of the global burden of low back pain

The process for estimating the global burden of LBP has been extensive, and has taken almost 6 years. The results show that

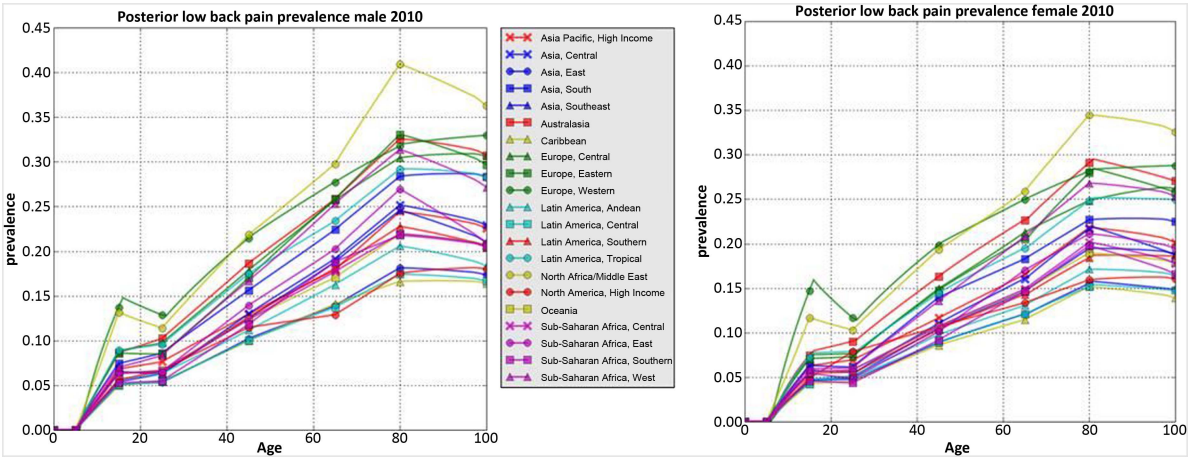

Figure 2 DisMod-MR-generated prevalence (per 1) of low back pain by age, sex, year and region, GBD 2010.

the prevalence and burden from LBP is very high throughout the world. Out of the 291 conditions studied in GBD 2010, LBP was found to have the sixth highest burden. LBP caused more disability globally than any other condition. The study has also enhanced our understanding of LBP. It suggests that prevalence peaks in older age groups. As a consequence, in regions with higher life expectancies, burden of LBP was ranked higher. With ageing populations throughout the world, but especially in low and middle-income countries, the number of people living with LBP will increase substantially over coming decades.

Previous estimates of the global burden of low back pain

For the original GBD study (GBD 1990), no estimates were made for LBP. For the GBD 2000–2004 updates, separate estimates were made for three LBP health states: (1) Acute episode of LBP resulting in moderate or greater limitations to mobility and usual activities; (2) Episode of intervertebral disc displacement or herniation; and (3) Chronic intervertebral disc disorder.[11] The global burden of LBP in 2004 was estimated to be 2.5 million DALYs, representing just 0.09% of the overall global disease burden. Overall, LBP ranked 105th out of 136 conditions studied.

The previous approach for estimating the burden of LBP had a number of limitations. First, the assumptions used to derive the incidence and duration of a LBP episode led to significant underestimation. Duration of acute LBP episodes was assumed to be four days, and incidence was derived from period prevalence figures ('in the last 2 weeks did you have back pain?'). Other factors explaining the low estimates for 2004 were lower DWs and the exclusion of mild non-specific LBP, which is common and has a substantial global impact.[40–43] There were also limitations due to methodological heterogeneity between LBP prevalence studies and a paucity of suitable data.

Intervertebral disc pathology was a defining factor for two of the health states in GBD 2004, yet the presence of intervertebral disc pathology requires imaging, and most population-based studies do not have the resources to perform these investigations. More importantly, the presence of intervertebral disc pathology correlates poorly with clinical symptoms, and is therefore unlikely to be a good indicator of functional disability.[44]

Table 4 Regional low back pain YLD and DALY rankings in 2010 (out of 291 conditions), GBD 2010

Region	YLD ranking	DALY ranking
Globally	1	6
Central Asia	2	7
East Asia	1	5
Asia-Pacific high income	1	2
South Asia	1	10
Southeast Asia	2	7
Australasia	1	1
Caribbean	4	13
Central Europe	1	3
Eastern Europe	1	3
Western Europe	1	1
Andean Latin America	2	5
Central Latin America	2	7
Southern Latin America	1	2
Tropical Latin America	1	3
North Africa/Middle East	1	2
North America high income	1	3
Oceania	2	14
Central sub-Saharan Africa	3	23
Eastern sub-Saharan Africa	3	17
Southern sub-Saharan Africa	4	15
Western sub-Saharan Africa	2	13

Strengths and limitations of the new estimates

GBD 2010 provided an opportunity to ensure that LBP is quantified more accurately. There were several improvements on previous methods, including: (1) the development of a new case definition and set of functional health states, which are more in line with the natural history of LBP, and include mild LBP; (2) the development of a new set of DWs for these health states, which were derived through community-based and health professional surveys in a number of countries; (3) more in-depth systematic review methods to capture country-specific information; (4) substantial attempts at dealing with risk of bias and the methodological heterogeneity between studies; and (5) use of a new, more advanced version of DisMod that can (a) pool all data rather than rely on a 'pick and choose' method, (b) perform meta-regression to make data points from different studies more comparable, (c) use data to fill in missing information and (d) carry forward uncertainty throughout the analysis.

Despite these strengths, there were limitations. The functional domains in GBD 2010 refer to body functions and structures (eg, vision) as well as more complex human operations (eg, mobility). They do not refer to broader aspects of life such as participation, well-being, carer burden and economic impact. It is important that burden of disease estimates are supplemented with this information to consider the full impact of a condition in a population.

There was considerable methodological variation between studies, especially relating to the prevalence period and case definition used. Researchers are encouraged to adopt recent recommendations on defining LBP in epidemiologic studies to assist future reviews, enable comparisons between countries, and improve our understanding of LBP.[12 45]

While using the MEPS study had the advantage of estimating the distribution of severity while taking comorbidity into account, it also had limitations. There is likely to have been some level of recall bias despite there being three follow-up points per year. Also, MEPS may not be representative of the health state experience for LBP across the globe. In low-income and middle-income countries, where services for the prevention and management of LBP are less extensive as in the USA, the health state experience could be different.

Suggested further research

There is a clear need for further research on the natural history of LBP. Long-term longitudinal studies that include people from the general population would provide important information on the average duration, and severity of disability over the course of an episode of LBP. Incorporating this research with pain diaries to track the daily patterns of pain and disability would add greater depth to this research. With expanding and ageing populations in many low-income and middle-income countries, the enormous burden from LBP in these areas will grow significantly over coming decades. There is an urgent need to increase our understanding, and attempt to mitigate the growing burden of LBP in these areas.

CONCLUSION

Globally, LBP causes more YLD than any other condition. Governments, health service and research providers and donors need to pay far greater attention to the burden that LBP causes than what they have done previously. Further research is urgently needed to better understand the predictors and clinical course of LBP across different settings, and the ways in which LBP can be prevented and better managed.

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Online supplementary file 1: Systematic review search strategies for low back pain, GBD 2010

Prevalence

We searched Ovid MEDLINE, EMBASE, CINAHL, CAB abstracts, WHOLIS, and SIGLE databases for previous systematic reviews on the prevalence of low back pain (LBP) throughout the world and found six reviews published between 1980 and 2007 (see Table S1.1). Only two were published since the Year 2000 and of these, one was limited to LBP in the elderly [1], and one limited to LBP among adolescents [2]. The most recent global review of LBP prevalence across a broader age range was conducted by Walker and published in the Year 2000 [3]. This was based on studies published up to and including 1998.

Table S1.1: Systematic reviews on the global prevalence of low back pain

Authors	Year	Years in search	Age group
Volinn	1997	1980-95	All
Loney et al	1999	1981-98	Adults
Bressler et al	1999	1966-98	Elderly
Walker	2000	1966-98	All
Dionne et al	2006	1966-2004	Elderly
Jeffries et al	2007	1984-2006	Adolescents

For this GBD review, Ovid MEDLINE, EMBASE, CINAHL, CAB abstracts, WHOLIS, and SIGLE databases were searched using the following terms: *back pain, lumbar pain, back ache, backache, and lumbago* individually and combined with each of the following terms: *prevalence, incidence, cross-sectional, and epidemiology*. Ovid MEDLINE and EMBASE were also searched using the following search string:

(back pain OR lumbar pain OR back ache OR backache OR lumbago) AND "[country name]". In addition, the reference lists of full papers from the original search were examined and any eligible titles were added to the search. Inclusion criteria were:

- Published or unpublished studies
- Population-based studies
- Studies on humans
- Studies from 1980-2009
- Studies of any region or country of the world
- Studies of urban and/or rural populations
- Studies of males and/or females
- Studies of any age group
- Studies published in any language.

Exclusion criteria were:

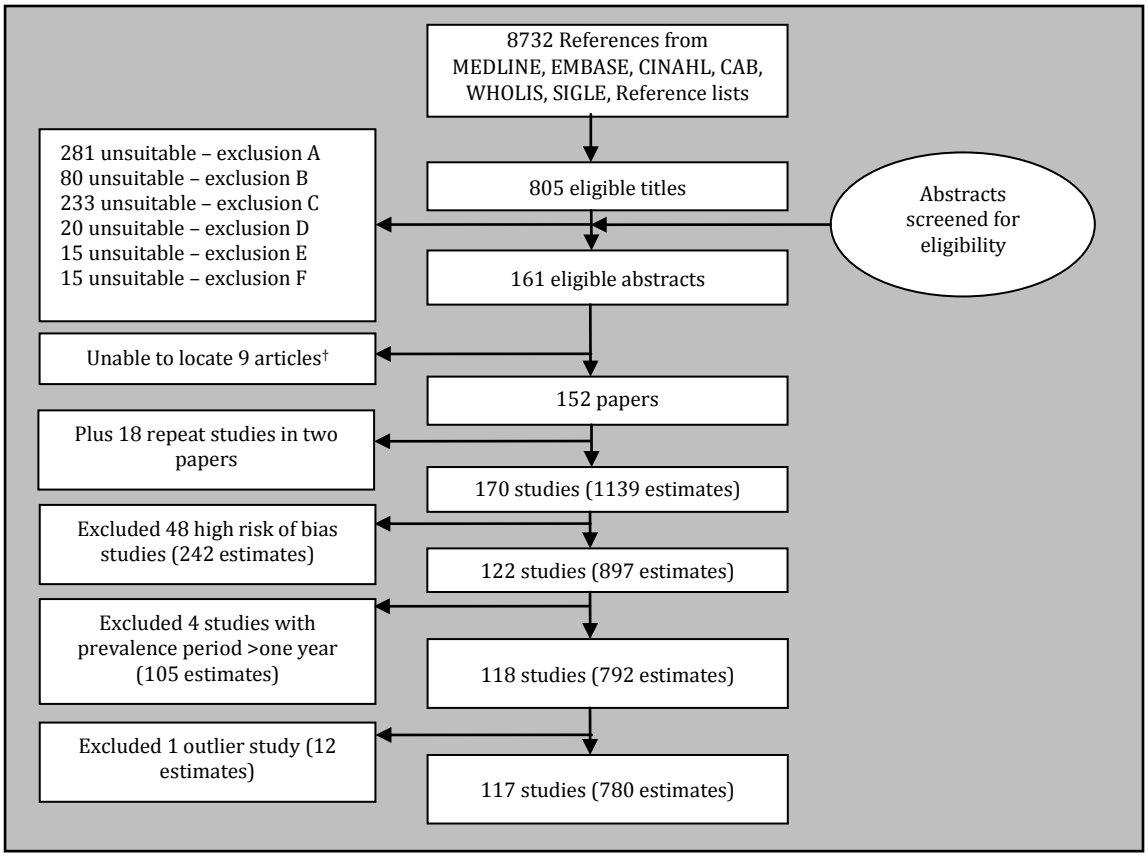
- A: Studies clearly not representative of the national population e.g. judo athletes, pregnant women, miners, or military
- B: Studies that were not population-based e.g. hospital or clinic-based studies
- C: Studies that provided no prevalence or incidence data e.g. a commentary piece or risk factor analysis
- D: Studies on a specific type of low back pain e.g. vertebral fractures
- E: Studies with a sample size less than 150
- F: Reviews.

The electronic database search yielded 8,732 studies (Figure S1.1). Irrelevant titles (n=7,927) were excluded leaving 805 eligible titles. Of these, 141 abstracts met the inclusion criteria. An additional 20 eligible papers were identified from inspection of the reference lists of included papers. Of these, full text articles of nine could not be located. Thus, in total, 152 papers met the inclusion criteria and were retrievable. One paper contained data from 18 country studies [4], and another from two country studies [5]. Thus, there were 170 studies in total, and these consisted of 1139 estimates. Of these, 37 studies (22%) were rated as having a low risk of bias (415 estimates), 85 (50%) a moderate risk of bias (482 estimates), and 48 (28%) a high risk of bias (242 estimates).

A major challenge in synthesising these data was the extent of between-study methodological heterogeneity, particularly relating to the prevalence period and case definition, namely the minimum episode duration, the anatomical location, and whether or not cases had to experience activity limitation. In an initial attempt to deal with this heterogeneity, high risk of bias estimates (n=242) were excluded leaving a total of 897 estimates from 122 studies. Estimates with a prevalence period greater than one year were then excluded, which left 792 estimates (118 studies). The data were then checked for outliers and 12 estimates (from one study) were removed. This was a German study [6] - it contained outlier data (point prevalence ranging from 77% to 92% in elderly Germans), and estimates (point prevalence ranging from 20% to 50%) that were more consistent with most other studies were available in two further German studies of equal or lower risk of bias [7, 8].

This left a total of 117 studies (from 100 papers) and 780 estimates, which were from 47 countries (Table S1.2 and S1.3). All studies had cross-sectional designs, and ascertained data through an interview or self-completed questionnaire. The majority of studies included both genders, a broad age range in the adult population, and both urban and rural populations.

Figure S1.1: Steps taken in the systematic review for low back pain prevalence data.



†Article did not exist (n=2); journal was no longer in circulation and attempts at retrieving the article through a Document Delivery service and/or directly from the author were unsuccessful (n=7).

Table S1.2: Countries with eligible studies retrieved from prevalence systematic review

Country	Estimates	%
Australia	22	2.82
Bangladesh	24	3.07
Belgium	11	1.41
Brazil	19	2.43
Canada	18	2.30
China	10	1.28
China, Hong Kong SAR	13	1.66
Colombia	1	0.13
Croatia	10	1.28
Cuba	2	0.26
Czech Republic	1	0.13
Denmark	98	12.55
Egypt	9	1.15
Finland	62	7.94
France	7	0.90
Germany	72	9.22
Greece	5	0.64
Hungary	3	0.38
Iceland	2	0.26
India	5	0.64
Indonesia	4	0.51
Iran (Islamic Republic of)	36	4.61
Israel	2	0.26
Italy	3	0.38
Japan	1	0.13
Kuwait	1	0.13

Lebanon	1	0.13
Malaysia	2	0.26
Mexico	13	1.66
Netherlands	16	2.05
New Zealand	4	0.51
Nigeria	25	3.20
Norway	11	1.41
Philippines	2	0.26
Saudi Arabia	2	0.26
Singapore	28	3.59
South Africa	1	0.13
Spain	21	2.69
Sudan	5	0.64
Sweden	33	4.23
Switzerland	22	2.82
Thailand	1	0.13
Turkey	19	2.43
Ukraine	1	0.13
United Kingdom	117	14.98
United States of America	14	1.79
Viet Nam	1	0.13
Total	780	100

Table S1.3: Eligible papers retrieved from prevalence systematic review (n=100)

1. Al-Arfaj, A. S., S. S. Al-Saleh, et al. (2003). "How common is back pain in Al-Qaseem region." Saudi Medical Journal 24(2): 170-3.
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17. Chaiamnuay, P., J. Darmawan, et al. (1998). "Epidemiology of rheumatic disease in rural Thailand: A WHO-ILAR COPCORD study." Journal of Rheumatology 25(7): 1382-1387.
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98. Watson, K. D., A. C. Papageorgiou, et al. (2002). "Low back pain in schoolchildren: occurrence and characteristics." Pain 97(1-2): 87-92.
99. Waxman, R., A. Tennant, et al. (2000). "A prospective follow-up study of low back pain in the community." Spine 25(16): 2085-90.
100. Woo, J., S. C. Ho, et al. (1994). "Musculoskeletal complaints and associated consequences in elderly Chinese aged 70 years and over." Journal of Rheumatology 21(10): 1927-31.

Additional information was then derived from the World Health Surveys (50 countries, 1495 data points) [9]; Australian National Health Surveys (1995, 2001, 2003/04 and 2007/08; 43 data points) [10]; Australian Surveys of Disability, Ageing and Carers (2003 and 2009; 41 data points) [11]; and the US National Health Information surveys (2001-2008, 168 data points) [12] and NHANES (2009; 20 data points) [13].

Incidence

Ovid MEDLINE, EMBASE, CINAHL, CAB abstracts, WHOLIS, and SIGLE databases were searched using the following terms: *back pain, lumbar pain, back ache, backache, and lumbago* individually and combined with each of the following terms: *incidence, cohort study, and longitudinal study*. Searches were limited to studies from 1980 to 2009 and had no language limits. Reference lists of full papers of eligible abstracts from the original search were examined and any eligible titles were added to the search.

Inclusion and exclusion criteria were the same as those of the prevalence systematic review. There were 1485 results. The titles were examined for eligibility and 1303 were excluded. Duplicates were removed (n=41) and the abstracts of the remaining titles (n=141) were further examined for eligibility and those abstracts not relevant were excluded (n=126). Similar to the prevalence review, the most common reasons for exclusion of abstracts were that they referred to studies that were clearly not representative of the national population, or they contained no incidence data (Table S1.4).

Table S1.4: Exclusion of abstracts in low back pain incidence systematic review

Exclusion criteria	Frequency
A: Studies clearly not representative of the national population e.g. judo athletes, pregnant women, miners, or military	43
B: Studies that were not population-based e.g. hospital or clinic-based studies	26
C: Studies that provided no prevalence or incidence data e.g. a commentary piece or risk factor analysis	51
D: Studies on a specific type of low back pain e.g. vertebral fractures	1
E: Studies with a sample size less than 150	1
F: Reviews	4
Total	**126**

The full papers of the eligible abstracts were downloaded for all abstracts except two, which could not be located (Figure S1.2). The reference list for included studies is shown in Table S1.5.

Key and unadjusted results

There were few studies on incidence and substantial heterogeneity between them. Incidence of a *first-ever* episode of LBP (regardless of activity-limitation) was measured in five studies. Three of the studies measured one-year incidence, which ranged from 6.3% to 15.4% (mean: 9.7%) [14-16]; one measured two-year incidence (17.8%) [17], and one measured three-year incidence (18.1%) [18]. The mean one-year incidence from the five studies was 8.8%. None of the studies measured incidence of a first-ever episode of activity-limiting LBP, which is likely to be somewhat lower than the incidence of a first-ever episode of *any* LBP.

Six studies measured the incidence of an episode of LBP, and included both *first-ever and recurrent* episodes. One of the six studies measured the incidence of an episode that lasted or was expected to last greater than six months – annual incidence was 4.3% [19]. Of the remaining five studies, the annual incidence of any episode of LBP (regardless of activity-limitation) ranged from 1.5% to 45% (mean: 18.6%) [15, 20-23]. Two studies measured the incidence of activity-limiting LBP. The one-year incidence of activity-limiting LBP ranged from 15.9% to 18.4% (mean: 17.2%) [24, 25].

All retrieved incidence studies counted the number of *people* as the numerator rather than number of incident *episodes*. To account for those people who have more than one episode per year, the mean incidence of activity-limiting LBP (17.2%) would need to be multiplied by the average number of episodes of activity-limiting LBP a person with activity-limiting LBP will experience per year. Thus, the literature was searched for data on the recurrence of activity-limiting LBP.

Again, there was considerable methodological variation between study populations. Most studies were clinic-based, and some were occupational studies. Thus, they are unlikely to be representativeness of the general population; however, these were included in the absence of general population data. There is also vast variation in relation to what constitutes recurrence. Some studies define recurrence as time off work, some as *any* LBP, and others as *activity-limiting LBP*. Variation also exists in relation to the time that a case has to be pain and/or disability-free between episodes, and the time that a case has to have had pain and/or disability in their current episode before it is counted.

Seven studies were found that measured recurrence of *any* LBP. At one year from recovery, the proportion of people who had a recurrence ranged from 33% to 79% (mean: 60.3%; median: 62.3%) [20, 26-30]. For GBD 2010, recurrence was defined as a repeat episode of activity-limiting LBP. Only one study was found on recurrence of activity-limiting LBP. Trends from this indicated that approximately 20% of cases have a recurrent episode by one year, 27% by two years, and 33% by five years [31]. In this study, recurrence was defined as being unable to perform one's usual daily activities for more than one day.

Two studies were found that reported the average number of recurrences for *any* LBP (i.e., both activity-limiting and non-activity-limiting). One study reported 1.59 recurrences per year [27], and the other reported 0.62 per year [32]. These averages reflect the mean number of recurrences for all cases irrespective of whether they have a recurrence. All of these studies were clinic-based. Data on the average number of recurrences of activity-limiting LBP was not found, and consequently, incidence was unable to be used in the burden estimates.

Figure S1.2: Steps taken in the systematic review for low back pain incidence data.

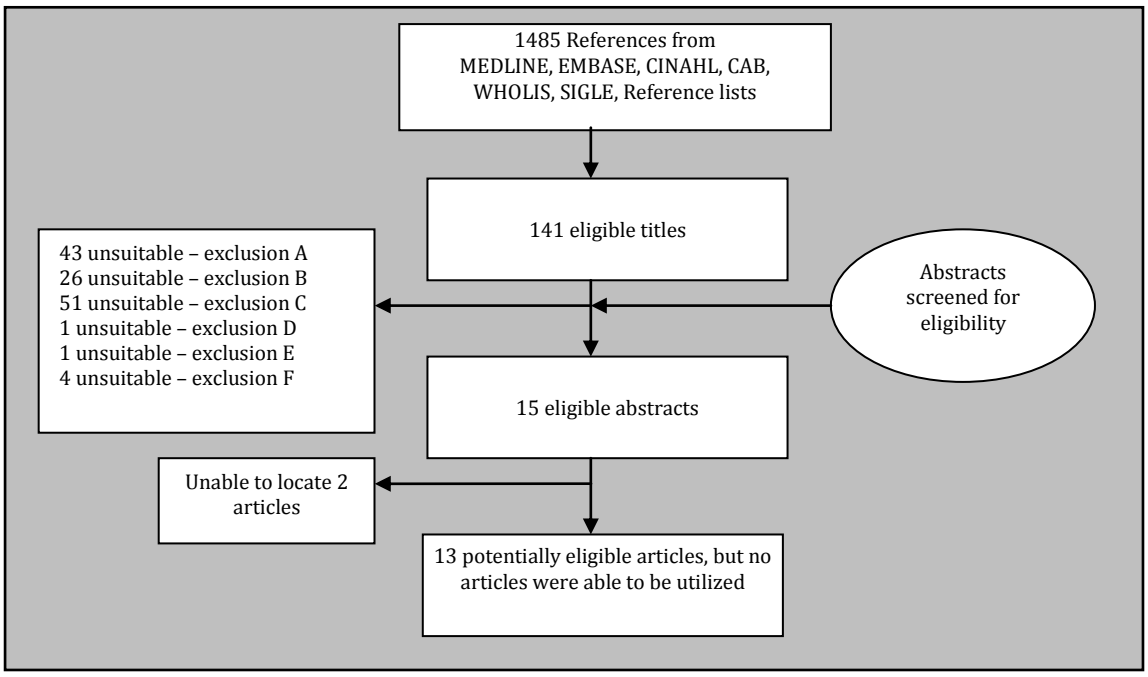


Table S1.5: Eligible studies retrieved from incidence systematic review (n=13)

1. Al-Awadhi AM, Olusi SO, Al-Saeid K, Moussa M, Shehab D, Al-Zaid N, et al. Incidence of musculoskeletal pain in adult Kuwaitis using the validated Arabic version of the WHO-ILAR COPCORD core questionnaire. Annals of Saudi Medicine. 2005;25(6):459-62.
2. Biering-Sorensen, F. (1982). "Low back trouble in a general population of 30-, 40-, 50-, and 60-year-old men and women. Study design, representativeness and basic results." Danish Medical Bulletin 29(6): 289-299.
3. Brattberg G. The incidence of back pain and headache among Swedish school children. Quality of Life Research. 1994 Dec;3 Suppl 1:S27-31.
4. Cassidy JD, Cote P, Carroll LJ, Kristman V. Incidence and course of low back pain episodes in the general population. Spine. 2005 Dec 15;30(24):2817-23.
5. Croft PR, Papageorgiou AC, Thomas E, Macfarlane GJ, Silman AJ. Short-term physical risk factors for new episodes of low back pain. Prospective evidence from the South Manchester Back Pain Study. Spine. 1999 Aug 1;24(15):1556-61.
6. George C. The six-month incidence of clinically significant low back pain in the Saskatchewan adult population. Spine. 2002 Aug 15;27(16):1778-82.
7. Haq S, Darmawan J, Islam N, Ahmed M, Banik S, Rahman A, et al. Incidence of musculoskeletal pain and rheumatic disorders in a Bangladeshi rural community: a WHO-APLAR-COPCORD study. International Journal of Rheumatic Diseases 2008;11:216-23.

8. Hestbaek L, Leboeuf-Yde C, Engberg M, et al. The course of low back pain in a general population: results from a 5-year prospective study. J Manipulative Physiol Ther 2003;26:213–9.
9. Jacob T, Zeev A. Are localized low back pain and generalized back pain similar entities? Results of a longitudinal community based study. Disability & Rehabilitation. 2006 Mar 30;28(6):369-77.
10. Kopec JA, Sayre EC, Esdaile JM. Predictors of back pain in a general population cohort. Spine. 2003 Jan 1;29(1):70-7; discussion 7-8.
11. Mustard CA, Kalcevich C, Frank JW, Boyle M. Childhood and early adult predictors of risk of incident back pain: Ontario Child Health Study 2001 follow-up. American Journal of Epidemiology. 2005 Oct 15;162(8):779-86.
12. Szpalski M, Gunzburg R, Balague F, Nordin M, Melot C. A 2-year prospective longitudinal study on low back pain in primary school children. European Spine Journal. 2002 Oct;11(5):459-64.
13. Waxman R, Tennant A, Helliwell P. A prospective follow-up study of low back pain in the community. Spine. 2000 Aug 15;25(16):2085-90.

Duration and remission

Ovid MEDLINE, EMBASE, CINAHL, CAB abstracts, WHOLIS, and SIGLE databases were searched using the following terms: *back pain, lumbar pain, back ache, backache, and lumbago* individually and combined with each of the following terms: *duration, remission, cohort study, and longitudinal study.* Searches were limited to studies from 1980 to 2009 and had no language limits. Reference lists of full papers of eligible abstracts from the original search were examined and any eligible titles were added to the search. Inclusion and exclusion criteria were the same as those of the prevalence systematic review, except Exclusion Criterion C referred to remission and duration studies not incidence or prevalence studies. There were 2109 results. The titles of these results were examined for eligibility and 1921 were excluded. Duplicates were removed (n=50) and the abstracts of the remaining titles (n=138) were further examined for eligibility. All abstracts were excluded (n=138).

The most common reason for exclusion of abstracts was that they contained no duration or remission data. Table S1.6 shows the distribution of exclusion across the

exclusion criteria. While no studies were found that measured duration or remission of an episode of activity-limiting LBP in the *general population*, a number of studies were found that measured the remission of an episode of LBP presenting to *primary care* (see Figure S1.3, and Table S1.7). However, the information was later considered too weak to generalize to all regions of the world.

Table S1.6: Exclusion of abstracts in low back pain duration and remission systematic review

Exclusion criteria	**Frequency**
A: Studies clearly not representative of the national population e.g. judo athletes, pregnant women, miners, or military	9
B: Studies that were not population-based e.g. hospital or clinic-based studies	18
C: Studies that provided no remission or duration data e.g. a commentary piece or risk factor analysis	97
D: Studies on a specific type of low back pain e.g. vertebral fractures	1
E: Studies with a sample size less than 150	5
F: Reviews	8
Total	**138**

Figure S1.3: Steps taken in the systematic review for low back pain duration and remission data.

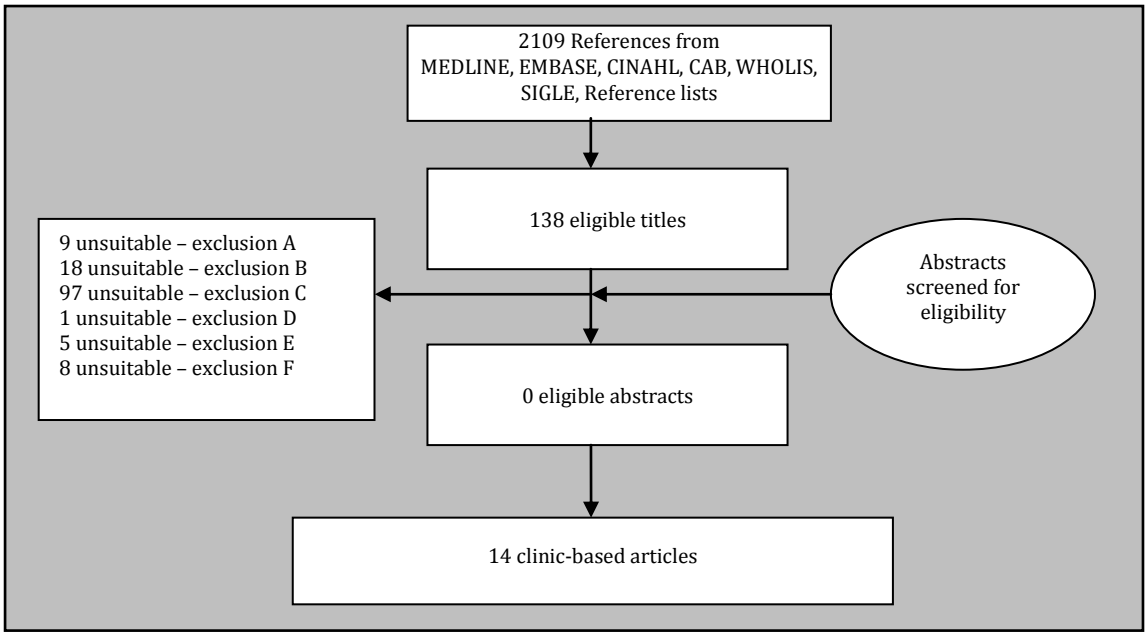


Table S1.7: Studies retrieved from duration/remission systematic review

1. Dunn KM, Jordan K, Croft PR. Characterizing the course of low back pain: a latent class analysis. American Journal of Epidemiology. 2006 Apr 15;163(8):754-61.
2. Jones GT, Johnson RE, Wiles NJ, Chaddock C, Potter RG, Roberts C, et al. Predicting persistent disabling low back pain in general practice: A prospective cohort study. British Journal of General Practice. 2006;56(526):334-41.
3. Hancock MJ, Maher CG, Latimer J, Herbert RD, McAuley JH. Can rate of recovery be predicted in patients with acute low back pain? Development of a clinical prediction rule. European Journal of Pain: Ejp. 2009 Jan;13(1):51-5.
4. Van den Hoogen HJM, Koes BW, Deville W, Van Eijk JTM, Bouter LM. The prognosis of low back pain in general practice. Spine. 1997;22(13):1515-21.
5. Schiottz-Christensen B, Nielsen GL, Hansen VK, Schodt T, Sorensen HT, Olesen F. Long-term prognosis of acute low back pain in patients seen in general practice: a 1-year prospective follow-up study. Family Practice. 1999 Jun;16(3):223-32.
6. Carey TS, Garrett J, Jackman A, et al. The outcomes and costs of care for acute low back pain among patients seen by primary care practitioners, chiropractors, and orthopedic surgeons. New Engl J Med 1995;333:913–7. AND Carey TS, Garrett JM, Jackman AM. Beyond the good prognosis. Examination of an inception cohort of patients with chronic low back pain. Spine. 2000 Jan;25(1):115-20. AND Personal communication T Carey 26/02/2010
7. Enthoven P, Skargren E, Oberg B. Clinical course in patients seeking primary care for back or neck pain: A prospective 5-year follow-up of outcome and health care consumption with subgroup analysis. Spine. 2004;29(21):2458-65.
8. Dunn KM, Croft PR, Main CJ, Von Korff M: A prognostic approach to defining chronic pain: replication in a UK

primary care low back pain population. Pain 2008, 135:48-54.

9. Nyiendo J, Haas M, Goldberg B, et al. Pain, disability, and satisfaction outcomes and predictors of outcomes: a practicebased study of chronic low back pain patients attending primary care and chiropractic physicians. J Manipulative Physiol Ther 2001;24:433–9.
10. Thomas E, Silman AJ, Croft PR, Papageorgiou AC, Jayson MIV, Macfarlane GJ (1999) Predicting who develops chronic low back pain in primary care: a prospective study. BMJ 318:1662– 1667
11. Von Korff M, Miglioretti DL: A prognostic approach to defining chronic pain. Pain 2005, 117:304-313.
12. Henschke N, Maher CG, Refshauge KM, Herbert RD, Cumming RG, Bleasel J, et al. Prognosis in patients with recent onset low back pain in Australian primary care: inception cohort study. BMJ. 2008;337:a171.
13. Costa Lda C, Maher CG, McAuley JH, Hancock MJ, Herbert RD, Refshauge KM, et al. Prognosis for patients with chronic low back pain: inception cohort study. Bmj. 2009;339:b3829.
14. Leboeuf-Yde C, Gronstvedt A, Borge JA, Lothe J, Magnesen E, Nilsson O, et al. The Nordic back pain subpopulation program: a 1-year prospective multicenter study of outcomes of persistent low-back pain in chiropractic patients. Journal of Manipulative & Physiological Therapeutics. 2005 Feb;28(2):90-6.

Mortality

There was no consistent and conclusive evidence that LBP is associated with an increased risk of mortality compared with the general population. Zhu et al. found those with back pain had a greater overall mortality risk (hazards ratio = 2.03; 95% confidence interval: 1.14 to 3.60) and a greater risk for death from coronary heart disease than those without back pain [33]. However, in two further studies, no relationship was found between mortality and back pain [34, 35]. Similarly, no evidence was found on case fatality, and cause-specific mortality. Further research is needed in this area.

Online supplementary file 2: Summary statistics for LBP case definition and prevalence period variations derived from systematic review and regression analysis

Variable	Observations	Prevalence			Regression results		
		Mean (%)	95% CI LL	95% CI UL	Coefficient	95% CI LL	95% CI UL
Prevalence period							
Point	185	18.2	16.7	19.7			
One day	8	16.9	8.9	24.9	-0.089	-0.249	0.072
One week	97	25.6	22.0	29.2	0.142	0.070	0.215
Two weeks	22	34.3	29.1	39.5	0.341	0.237	0.444
One month	150	27.6	25.2	30.0	0.345	0.285	0.405
Two months	1	35.1	.	.	0.353	-0.089	0.794
Three months	21	35.5	28.8	42.2	0.494	0.381	0.607
Six months	35	50.8	45.1	56.4	0.576	0.490	0.661
One year	254	38.7	36.3	41.0	0.490	0.443	0.538
Anatomical case definition							
Back	166	29.6	27.2	32.0			
Low back	246	26.8	24.6	29.1	0.048	-0.008	0.104
Lumbar	26	11.5	8.5	14.6	-0.441	-0.557	-0.326
Lumbar or sacro-iliac joint(s)	8	15.7	13.6	17.8	-0.120	-0.301	0.061
Neck or back	18	22.3	19.5	25.0	-0.760	-1.039	-0.481
C7 to lower GFs[*]	28	56.8	49.3	64.2	0.565	0.448	0.683
R12 to lower GFs[†]	235	32.5	30.2	34.8	0.152	0.080	0.224

Thoracic or lumbar	18	48.0	43.9	52.2	0.306	0.179	0.433
Thoraco-lumbo-sacral	27	28.9	22.6	35.2	0.214	0.087	0.340
Minimum episode duration							
Not specified	515	32.9	31.2	34.6			
One day	154	27.6	25.3	30	-0.126	-0.179	-0.074
Three days	1	67.8	.	.	0.332	-0.105	0.770
One week	28	23.8	21	26.5	-0.459	-0.567	-0.350
Seven weeks	8	4.4	2.7	6.1	0.041	-0.161	0.243
Three months	30	19.6	17.1	22	-0.214	-0.305	-0.123
Chronic	21	23.9	19.5	28.2	0.365	0.105	0.626
Six months	15	11.6	8.6	14.6	-0.432	-0.552	-0.312

[*]'Posterior aspect of the body from the seventh cervical vertebra to the lower gluteal folds'

[†]'Posterior aspect of the body from the lower margin of the twelfth ribs to the lower gluteal folds'

Online supplementary file **3: Modeling low back pain in DisMod-MR**

All LBP prevalence data from the systematic review (780 estimates) as well as the additional information derived from the World Health Surveys (1495 estimates), Australian National Health Surveys (1995, 2001, 2003/04 and 2007/08; 43 data points), Australian Surveys of Disability, Ageing and Carers (2003 and 2009; 41 data points), and the US National Health Information surveys (2001-2008, 168 data points) and NHANES (2009; 20 data points) were entered into DisMod-MR.

Dataset	**LOW BACK PAIN**
Model number	#41426
Priors set by	Theo Vos
Link	http://winthrop.ihme.washington.edu/dismod/summary/41426
	Input Prevalence; Set mortality to zero; Set the bounds around remission.

PRIOR SETTINGS

	Smoothness			**Heterogeneity**	**Level Value**			**Level Bounds**		**Increasing**		**Decreasing**		**Unimodal**	
	Degree	**Age Start**	**Age End**	**Degree**	**Value**	**Age Before**	**Age After**	**Lower**	**Upper**	**Age Start**	**Age End**	**Age Start**	**Age End**	**Age Start**	**Age End**
Prevalence	Slightly	0	100	Very	0.0	5	100	0	1.0	0	0	0	0	0	0
Incidence	Slightly	0	100	Slightly	0.0	0	100	0	1.0	0	0	0	0	0	0
Remission	Slightly	0	100	Slightly	0.0	0	100	1.36	2.06	0	0	0	0	0	0
Excess Mortality	Slightly	0	100	Slightly	0.0	100	100	0	1.0	0	0	0	0	0	0
Duration	No Prior	0	100	Slightly	10.0	0	100	0	100.0	0	0	0	0	0	0
Relative Risk	No Prior	0	100	Slightly	1.0	100	100	1	1000.0	0	0	0	0	0	0

Prevalence period and case definition variations were dealt with using the Bayesian approach to ensure estimates were aligned to how LBP is defined in GBD 2010. For example, a ratio of 2.39 for ‘period prevalence (3 months to 1 year): point prevalence’

means that estimates for studies pertaining to a period prevalence of 3 months to 1 year were 2.39 times higher than for point prevalence. DisMod accordingly adjusts such data points down by 139%. Note that these adjustments are applied in the prior calculation phase in DisMod-MR but the final results are evaluated based on the adjusted priors and the actual data for each country and region. Thus, while the coefficient for sex indicates that male estimates are 15% higher than for females, the actual results show a smaller sex differential.

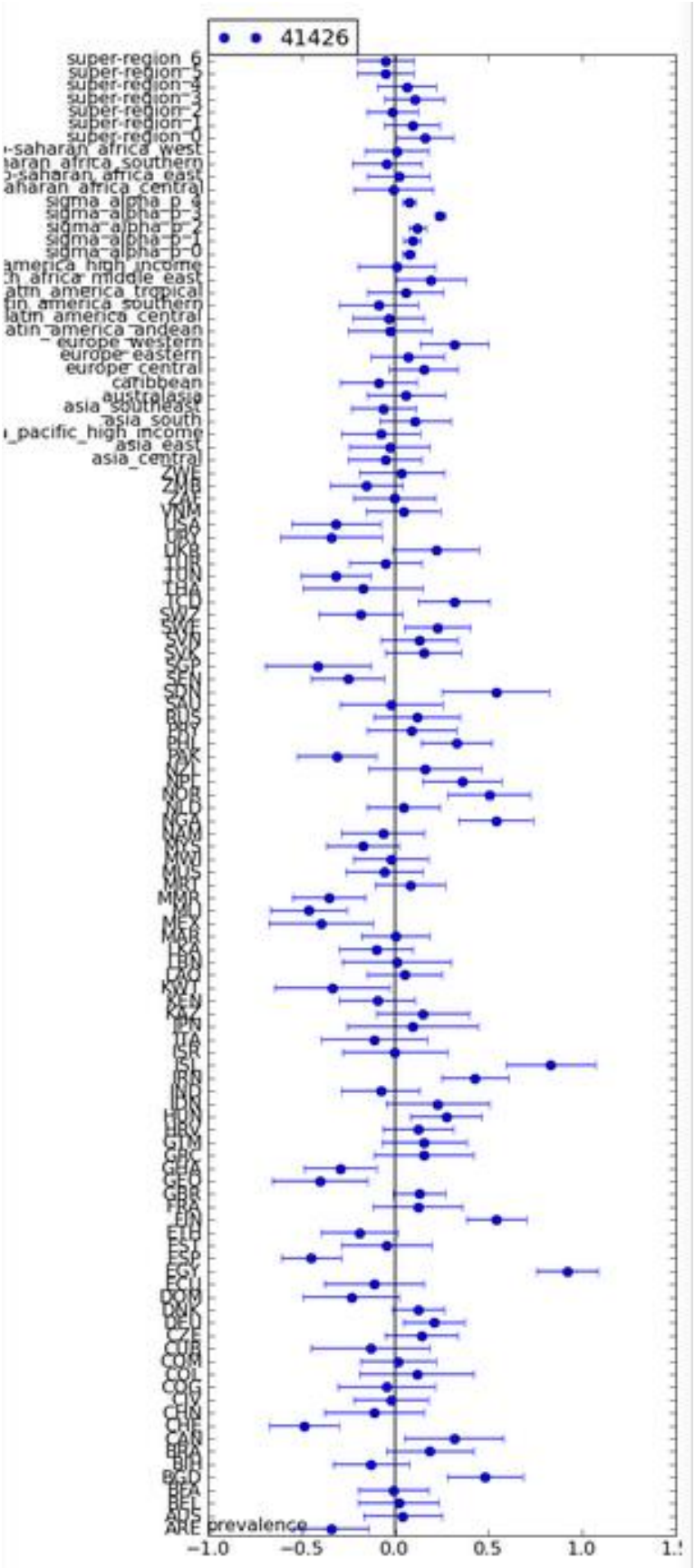
Table S3.2: The ratios generated from the Bayesian meta-regression to convert all low back pain estimates to align with the desired case definition*, GBD 2010

Description	**Ratio (95% CI)**
Male: female	1.15 (1.11-1.19)
Period prevalence (3 months to 1 year): point prevalence	2.39 (2.27-2.52)
Period prevalence (1 week to 2 months): point prevalence	1.28 (1.20-1.35)
Minimum episode duration (3 months or more): desirable minimum episode duration	0.72 (0.65-0.79)
Thoraco-lumbar region: desirable anatomical location	1.38 (1.11-1.19)
Lumbar, 'lumbar or SIJs', 'neck or back': desirable anatomical location	0.67 (0.60-0.75)
Activity limiting: activity **and** non-activity limiting	0.50 (0.43-0.57)

*Point prevalence of LBP lasting >1 day

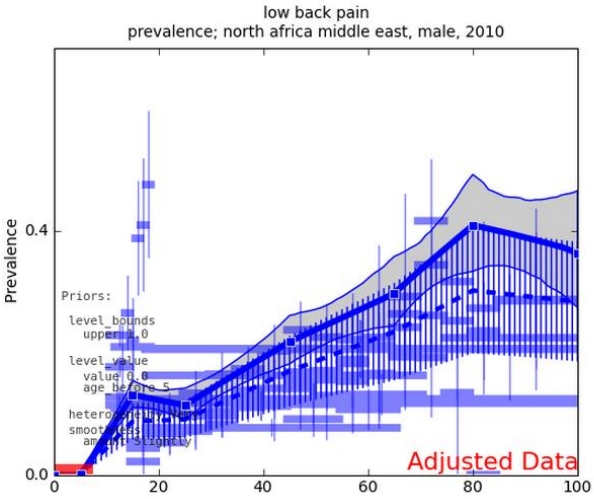
The ‘empirical prior’ was then estimated, which involved generating an age pattern for each parameter independently and by imputing regional estimates from the data supplied. It is a line of best fit through the data, and generates an age pattern for each sex/region/year grouping (e.g., males, Europe, Western, 1990; females, Asia, Southeast, 2010 etc.). The posteriors were then run, which involved deriving an internally-consistent full set of disease parameters for each age/sex/region/year grouping using the empirical priors, whilst also estimating values for the missing parameters.

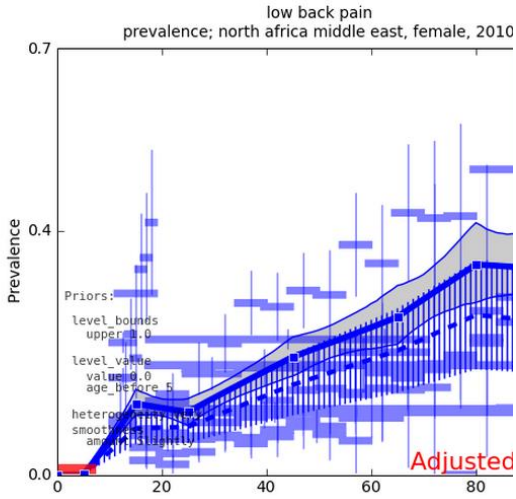
Random effects for countries, regions and *super-regions* are shown below. It shows that most of the variation is driven by country random effects apart from a bit higher random effect for all of Western Europe and the high income region. The higher prevalence estimates for the North Africa Middle East region are driven by high prevalence data points from Egypt and Iran. In Western Europe, Finland, Sweden and Germany are pushing up the regional estimates.

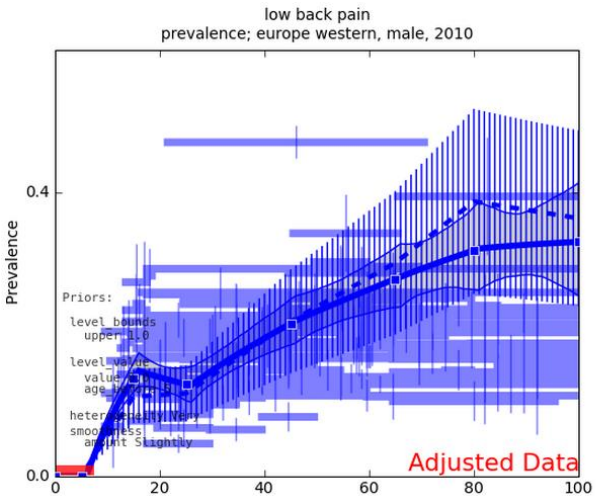

41426
super-region_6
super-region_5
super-region_4
super-region_3
super-region_2
super-region_1
super-region_0
sigma_alpha_p_4
sigma_alpha_p_3
sigma_alpha_p_2
sigma_alpha_p_1
sigma_alpha_p_0
europe_western
europe_eastern
europe_central
caribbean
australasia
asia_southeast
asia_south
asia_east
asia_central
prevalence
−1.0
−0.5
0.0
0.5
1.0

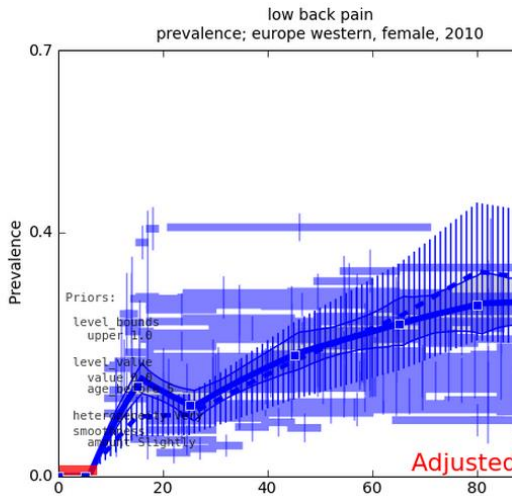
A selection of high and low regional prevalence plots for 2010 are shown below. The horizontal bars indicate study data points and their age range; the vertical line through each reflects the 95% confidence interval. The dashed line reflects the prior, a Bayesian statistical term, which reflects the internally consistent estimates of each parameter at the level of the world taking into account the covariates at study and country level. The solid line represents the posterior, another Bayesian statistical term, which reflects the final calculation after updating the prior with data for that region and time period. The grey area around the solid line of the posterior represents the 95% uncertainty interval, which can be interpreted as a confidence interval in traditional statistics.

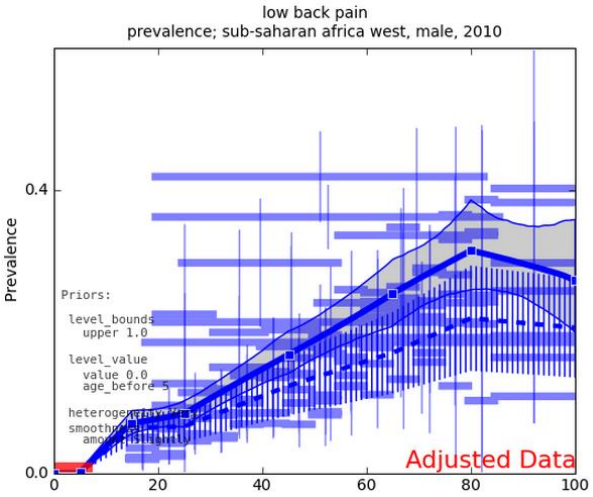
It is important to note the uncertainty intervals are around the estimates. This reflects the heterogeneity in prevalence estimates even after taking into account variations in measurement by applying the covariate 'crosswalks' to adjust data points with measurement characteristics that deviated from our GBD 2010 case definition. Note, the crosswalk is used to describe adjustments to data points that are affected by a systematic bias upwards or downwards due to non-reference study methods

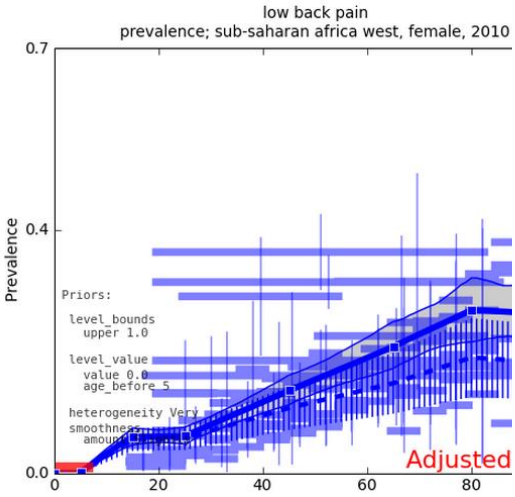


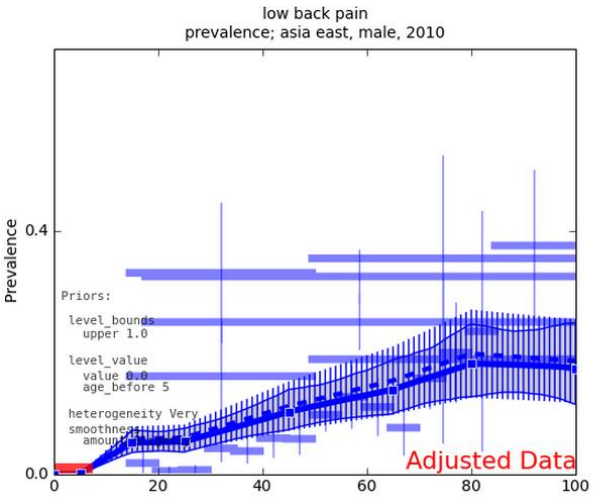


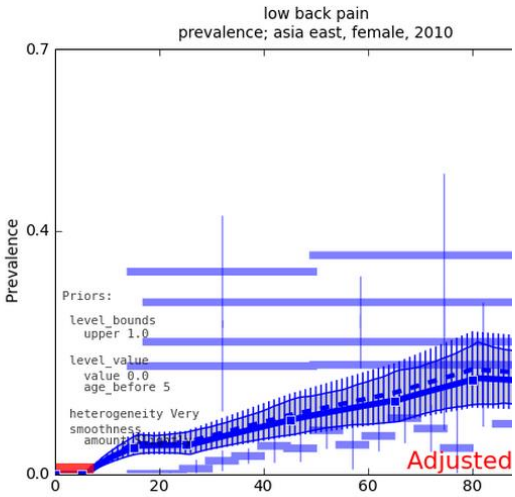

low back pain
prevalence; europe western, male, 2010
Prevalence
0.0
0.4
0
20
40
60
80
100
Priors:
level_bounds
upper 1.0
level_value
value 0.0
age_before 5
heterogeneity Very
smoothness
amount Slightly
Adjusted Data


low back pain
prevalence; europe western, female, 2010
Prevalence
0.0
0.4
0.7
0
20
40
60
80
Priors:
level_bounds
upper 1.0
level_value
value 0.0
age_before 5
heterogeneity Very
smoothness
amount Slightly
Adjusted


low back pain
prevalence; sub-saharan africa west, male, 2010
Prevalence
0.0
0.4
0
20
40
60
80
100
Priors:
level_bounds
upper 1.0
level_value
value 0.0
age_before 5
heterogeneity Very
smoothness
amount Slightly
Adjusted Data


low back pain
prevalence; sub-saharan africa west, female, 2010
Prevalence
0.0
0.4
0.7
0
20
40
60
80
Priors:
level_bounds
upper 1.0
level_value
value 0.0
age_before 5
heterogeneity Very
smoothness
amount Slightly
Adjusted


low back pain
prevalence; asia east, male, 2010
Prevalence
0.0
0.4
0
20
40
60
80
100
Priors:
level_bounds
upper 1.0
level_value
value 0.0
age_before 5
heterogeneity Very
smoothness
amount Slightly
Adjusted Data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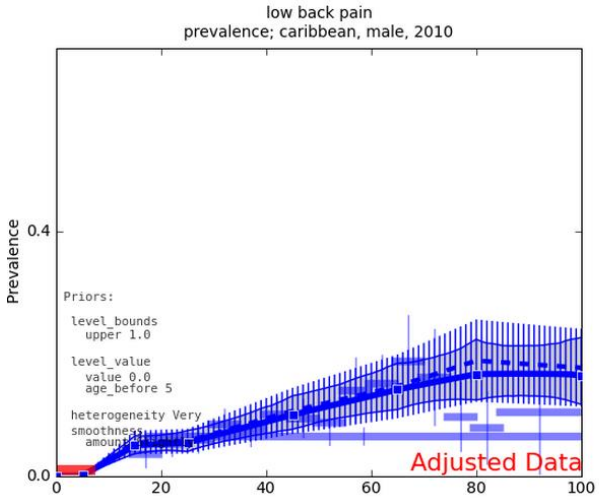

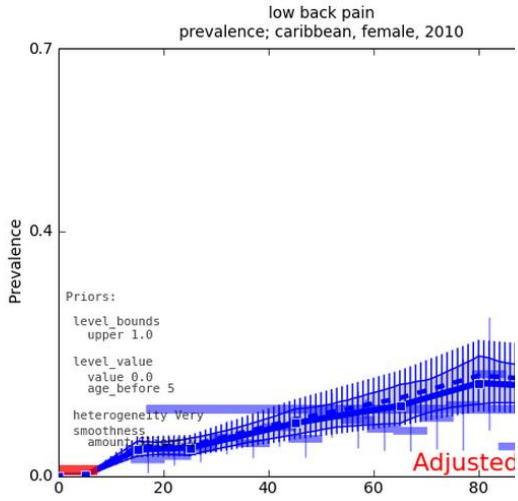

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