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Clinical and economic burden of low back pain in low- and middle-income countries: a systematic review

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ABSTRACT

Objectives Low back pain (LBP) is the leading cause of disability and work absenteeism globally, and it poses significant clinical and economic burden to individuals, health systems and the society. This study aimed to synthesise the clinical and economic burden of LBP in low-income and middle-income countries (LMICs).

Methods A systematic review following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines was performed. PubMed, Medline, CINAHL, PsycINFO, AMED, Embase and Scopus databases were systematically searched for studies that examined the clinical and economic burden of LBP in LMICs, published from inception to 10 December 2021. Only studies with clearly stated methodologies and published in English were eligible for review.

Results Nine studies met the inclusion criteria and were reviewed. Of these, three of them were clinical burden studies. The mean Newcastle–Ottawa Quality Assessment Scale (NOS) score of the included studies was 4, with an average from 3 to 6. The included studies were conducted in Argentina, Brazil, China, Ethiopia, Nigeria and Republic of Serbia. The rates of hospitalisation due to LBP ranged between 13.4% and 18.7%. Due to variation of methodological approaches, the reported cost estimates were inconsistent across the studies. A total cost of US$2.2 billion per population and US$1226.25 per patient were reported annually due to LBP.

Conclusion This systematic literature review suggests that LBP is associated with significantly high rates of hospitalisation and costs. As LBP is an important threat to the population, health professionals and policymakers are to put in place appropriate programmes to reduce the clinical and economic burden associated with LBP and improve the health outcomes of individuals with this condition in LMICs.

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STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This is the first study that summarises and critically appraises the current evidence base on clinical and economic impact of low back pain in low-income and middle-income countries and discusses the potential avenues for future research.
⇒ This review covers a wide variety of the literature and follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses.
⇒ The included literature were small and failed to fully report their data which impacted the quality ratings and the content of the meta-analyses.

INTRODUCTION

Low-back pain (LBP) is an important health problem and covers radicular, axial lumbosacral and referred pain.[1] The lifetime, 1 year and point prevalence of LBP worldwide ranged from 11% to 84%, 22% to 65% and 12% to 33%, respectively.[2] The 1-year incidence of people who have a first-ever episode and any episode of LBP ranged from 6.5% to 15.4% and 1.5% to 36%.[3] LBP is associated with increased healthcare costs, length of stay in hospitals, morbidity and mortality in both high-income and low-income countries.[4]

To reduce the clinical and economic burden associated with LBP, it is important that prevention and management strategies of LBP are implemented. Prevention and management strategies are aimed at controlling pain, maintaining function and prevention of exacerbation of LBP.[5] The American College of Physicians and the American Pain Society recommend that individual with LBP should remain active, and they provide information about effective self-care options, use of medications with proven benefits, interdisciplinary rehabilitation, exercise, acupuncture, massage, spinal manipulation, yoga, cognitive behavioural therapy or relaxation for the treatment of LBP.[6]

The implementation of these treatments remains a challenge for clinical practice and research.[7] Because of this challenge, LBP was listed among the top 10 diseases and injuries that account for the highest number of disability-adjusted life years worldwide.[8] The direct medical and indirect costs of LBP are more than US$50 billion per annum and could be as high as US$100 billion at the extreme.[9] Evidence suggests that as much as

80%–90% of the populations' work in low-income and middle-income countries (LMICs) entails heavy labour such as carrying heavy loads on the back or head.[10] The risk factors of LBP include low educational status, stress, anxiety, depression, job dissatisfaction, low levels of social support in the workplace and whole-body vibration.[3] The causes and risk factors for LBP in LMIC is substantial.[11] Thus, the likelihood of having LBP is higher in LMICs than in high-income countries.

Many studies have been published evaluating the clinical and economic burden of LBP in LMICs. However, to date there are no studies that have summarised literature on the clinical and economic burden of LBP in LMICs. Therefore, this systematic review critically evaluated and summarised the results of all available published systematic reviews that have investigated the clinical and economic burden of LBP in LMICs.

METHODS

Search protocol and registration

In this study, we used the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guideline. A protocol for this systematic review was prospectively registered on PROSPERO and can be found at https://www.crd.york.ac.uk/prospero/#recordDetails, ID=CRD42020196335.

Search strategy

The systematic review was carried out in the PubMed, Medline, CINAHL, PsycINFO, AMED, Embase and Scopus databases with studies published from inception to 10 December 2021. The following keywords were used in the search: low back pain, hospitalisation, cost of illness, absenteeism, ambulatory care, drug costs, emergency medical services, healthcare costs, nursing services, economics, physicians visit, clinical impact, utilisation, burden of illness, cost, nursing cost (online supplemental appendix 1). These search terms were combined using conjunctions words 'AND' or 'OR'. Further, a manual search of reference sections of the included studies was also checked for additional studies. The search was performed independently by two authors (TG and FF) to avoid the presence of bias in the selection and exclusion of studies. Any disagreement was resolved by discussion with the third the author (CEM).

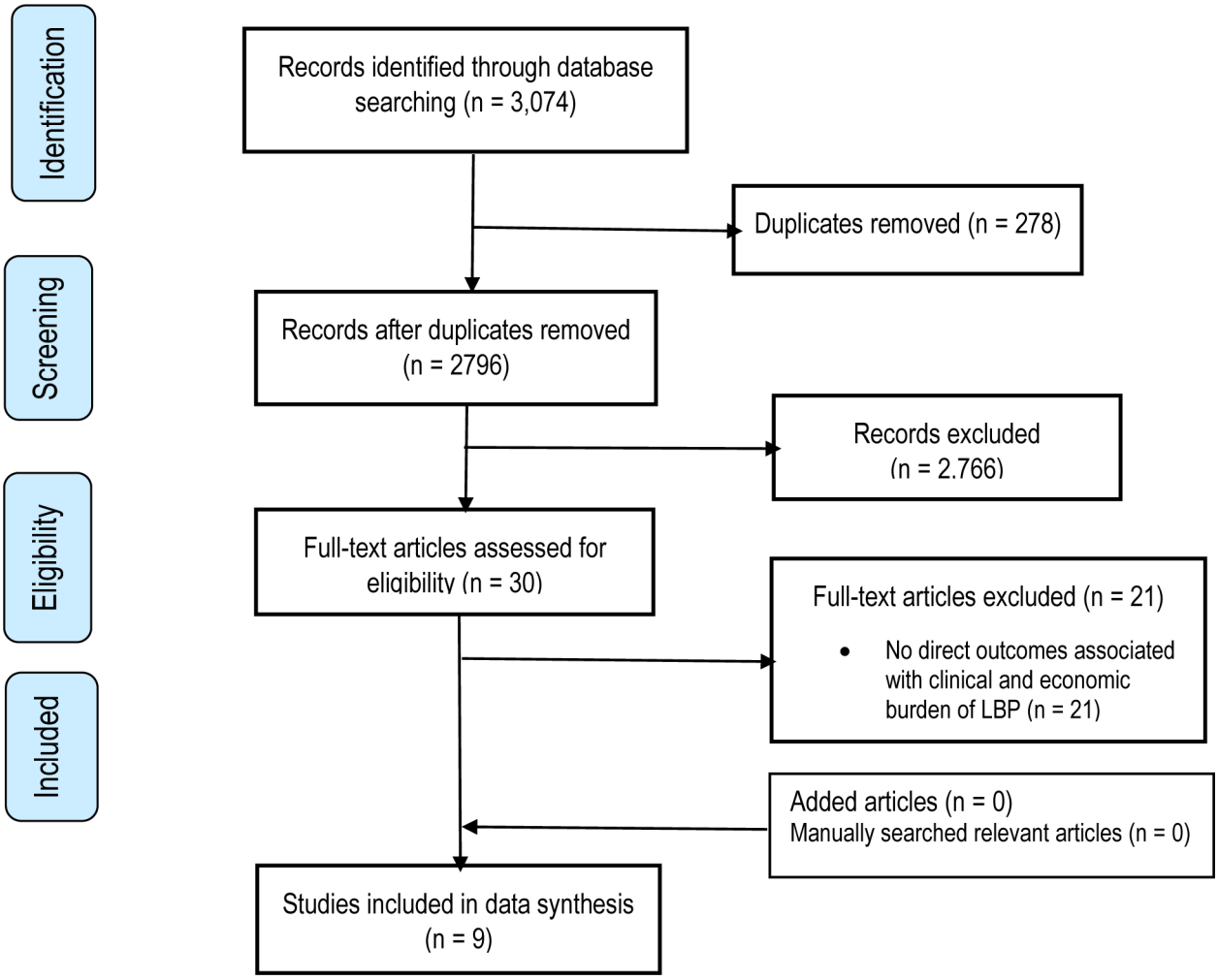

Figure 1 Flow diagram of publications included and excluded in the review. LBP, low back pain.

Table 1 Characteristics of clinical and economic burden studies included in the review

Reference/ country	Data source	Study objective	Inclusion criteria	Classification or diagnosis LBP	Conflict of interest	Funding source	NOS/9
Beyera *et al*[16]/ Ethiopia	Interview	To analyse hospital admission and associated factors	Individuals with LBP of ≥18 years of age. Presented to healthcare facility for LBP in the past 1 year	Not provided	No	Not stated	3
Carregaro *et al*[17]/Brazil	National databases, considering the period 2012–2016.	To estimate the healthcare expenditure and productivity losses related to LBP	≥19 years	ICD-10 codes	No	Yes	6
Laffont *et al*[18]/ Argentina	The Statistics and Information Department of the Ministry of Health	To analyse the impact of LBP on hospitalisations between 2006 and 2010.	Either adult LBP or lumbosciatica (≥18 years)	ICD-10 codes	No	No	6
Odole *et al*[19]/ Nigeria	Questionnaire	To determine the economic burden of LBP patients in Ibadan	Individuals with LBP receiving physiotherapy in Ibadan	Not provided	Not stated	Not stated	3
do Socorro Margarido *et al*[20]/Brazil	Questionnaire	To assess resource utilisation in the diagnosis, management and hospitalisation of patients	Participants were rheumatologists attending a national rheumatology medical congress.	Not provided	Not stated	No	4
Bello and Muhammad[22]/ Nigeria	Questionnaire	To estimate the cost of LBP management	Patients with LBP, allow them to carry out activities for daily living even under difficulties.	ICD-9 codes	No	No	3
Birabi *et al*[23]/ Nigeria	Medical records of hospitals (220 patients)	To report the results of a retrospective study on the direct cost burden of LBP between 2010 and 2013	Patients whose care commenced from acute care stages, admitted where necessary.	ICD-10 codes	Not stated	Not stated	5
Lin *et al*[24]/ Republic of China	Interview	To estimate the 12-month economic cost of LBP among female (1990 to 1991)	Nurses who had experienced LBP within the 12-month period	ICD-10 codes	No	No	3
Radoičic *et al*[21]/ Republic of Serbia	Interview (April 2016 to April 2017).	To estimate the cost of LBP	Diagnosed as M54, which refers to lumbar pain (dorsalgia)	ICD-10 codes	No	Partially funded	4

ICD, International Classification of Diseases; LBP, low back pain; NOS, Newcastle–Ottawa Quality Assessment Scale.

Inclusion and exclusion criteria

Included in this review were studies among patients with LBP; original research findings related to costs (direct and indirect) in LMIC as defined by WHO; the contexts of interest were hospitals, primary healthcare clinics and home settings; observational (cross-sectional or surveys) published in peer-reviewed journals. Review articles, editorials, letters to the editor, news reports, conference abstracts, comments, languages other than English, as well as the results of dissertations were excluded. For ease

Table 2 Definition of LBP in the included studies

Study	Definition of LBP
Beyera *et al*[16]	Individuals who reported at least one presentation to any of the health institutions for their LBP in the past 1 year.
Carregaro *et al*[17]	ICD-10 codes were used to define the presence of LBP: M40.4 (other lordosis); M40.5 (lordosis, unspecified); M51 (other intervertebral disc disorders); M54.1 (radiculopathy); M54.3 (sciatica); M54.4 (lumbago with sciatica); M54.5 (low back pain); M54.8 (other dorsalgia) and M54.9 (dorsalgia, unspecified).
Laffont *et al*[18]	Not provided.
Odole *et al*[19]	Patients with mechanical LBP who were receiving physiotherapy on an outpatient.
do Socorro Margarido *et al*[20]	Not provided.
Bello and Muhammad[22]	Participants diagnosed and managed for LBP in secondary and tertiary hospitals for at least 1 year duration. The pain was low in the back and allow them to carry out activities for daily living even under difficulties.
Birabi *et al*[23]	Patients whose ages ranged between 26 and 65 years and were managed from acute care period for LBP (without discharge against medical advice) as well as were followed up on outpatient basis without default within the study period.
Lin *et al*[24]	The following definition of pain were used: minor: pain occurs when carrying 20 kg of weight for 10 min or more; (2) moderate: pain occurs when lifting 20 kg of weight; (3) serious: pain occur; when lifting less than 20 kg of weight; (4) severe: pain occurs when doing any task; (5) maximum: pain occurs even while at rest.
Radoičic *et al*[21]	Patients should have been diagnosed as M54, which refers to lumbar pain (dorsalgia).

ICD, International Classification of Diseases; LBP, low back pain.

of interpretation, access and language barrier, reviews that were published or unpublished in another language were excluded.

Study selection and assessment of methodological quality

After selection of the articles by the search strategy in each database, duplicate articles were excluded. Following the removal of duplicates, titles and abstracts were screened by two reviewers (TG and FF) to identify eligible studies. Articles were selected for inclusion based on predefined criteria like relevant patient population (LBP), appropriate study design and outcome measures (patient-level and population-level). Studies assessing the efficacy or effectiveness of specific interventions were not included.

Discrepancies for study selection were resolved through discussion with other investigators (CEM and UU). Having retrieved the full text of studies that met the inclusion criteria, they were assessed for methodological quality using the Newcastle–Ottawa Quality Assessment Scale (NOS) for cohort studies.[12] The NOS contains nine items, categorised into three dimensions including selection and comparability. Studies were scored using a scale with a possible maximum of nine points where a score ≥6 indicated high-quality studies, a score between 3 and 6 as moderate and a score ≤3 as low quality.

Data extraction

Data were extracted by two independent review authors. The following information was extracted for each study: authors, country and year of publication, study objective, data source, inclusion criteria, LBP definition, population characteristics (size, % male and mean age), hospitalisation, average total annual cost per patient and annual population cost. Hospitalisation was defined as a primary discharge diagnosis of LBP, it could be obtained from hospital database records of discharge and admission date.[13] Summary table was used to display the extracted data. When there was disagreement, it was addressed through consultation with the third reviewer (CEM and UU).

Data analysis

Given the heterogeneity of included studies in the review, it was not possible to undertake a meta-analysis. Instead, a narrative synthesis of the extracted data was employed to analyse, integrate and synthesise review findings. Study characteristics were first tabulated along with extracted outcomes to support the narrative synthesis. A preliminary synthesis was then undertaken by categorising extracted data clusters by reference/country, data source, study objective, inclusion criteria, LBP definition and clinical and economic burden of LBP. Using the tabulated data, relationships within and between included studies were then examined visually.

If necessary, costs were converted to US$ using salary converter.[14] Most of costs have been converted to US$ using purchasing power party and then inflation adjustments were calculated using the suggested country-specific inflation index from the World Bank Website.[15] Conversions were performed in February 2022. Further, hospitalisation rates were the number of patients with LBP hospitalised in a given period of follow-up. The higher rate of hospitalisation could mean substantial clinical burden of the condition.

Patient and public involvement

Patients and the public were not involved in the design or planning of the study.

RESULTS

This systematic review generated 3074 records in Scopus (n=51), PubMed (n=2036), Embase (n=700) and Medline,

Table 3 Rate of hospitalisation for LBP patients

Study	Number of participants	Year	Hospitalisations for LBP
Beyera *et al*[16]	543 (M=316; F=205)	Between June and November 2018	14.4% (95% CI 11.4 to 17.3) with an average length of stay 7.4 days, 95% CI 6.4 to 8.8
Carregaro *et al*[17]	886 523 diagnostic imaging procedures for LBP	2012 to 2016	13.4% (inpatient admissions)
Laffont *et al*[18]	A total of 154 430 discharges in which patients of any age were hospitalised	2006 and 2010	18.7%, with an average length of stay in the hospital of 3.8 days
do Socorro Margarido *et al*[20]	207 rheumatologists (M=62%; F=38%)	N/A	An average of 574 patients with LBP were seen per year.

F, female; LBP, low back pain; M, male; N/A, not available.

AMED, CINAHL, PsycINFO (n=287) (figure 1). Of these, 278 were duplicates. Following screening by titles and abstracts, 2766 studies were excluded, leaving 30 articles for further full text review. No article was added through manual search of the bibliographies of relevant articles. After reading the full text, only nine met the inclusion criteria and were eligible for analysis. The list of the excluded studies was also reported (online supplemental appendix 2). The mean NOS score of the included studies was 4, with an average from 3 to 6 (table 1). The NOS score showed that all the included studies do not show comparability of cohorts on the basis of age, sex, the design and analysis.

Characteristics of the included studies

The characteristics of the included studies are presented in table 1. The clinical and economic burden of LBP studies were conducted in Nigeria (n=3), Ethiopia (n=1), Brazil (n=2), China (n=1), Republic of Serbia (n=1) and Argentina (n=1). Of the nine eligible studies included in our review, three studies[16–18] reported the clinical impact of LBP in LMICs. Whereas the remaining studies reported the economic burden of LBP. The data sources of the included studies were interviews, questionnaire, population-based cross-sectional study and medical records. Except three studies,[16 19 20] all the included studies reported LBP classification or diagnosis.

Definition of LBP

The definition of LBP adopted by the included studies is presented in table 2. Except two studies,[18 20] all the included studies provided the definition of LBP. The definition adopted by each included study is not the same. For example, two studies[17 21] used ICD-codes to define LBP. Other study[16] adopted the frequency of LBP report to health institution.

Table 4 Summary of studies that reported patient-level and population-level total costs for LBP

Reference	Age group (years)	Average annual cost per patient	Inflated 2022 $US
Carregaro *et al*[17]	≥19	Total costs=US$ 2.2 billion* Indirect cost=1.7 billion* (productivity losses)	Total cost=US$2.5 billion*
Odole *et al*[19]	30–80	Total cost=US$1125.27±623.39 Direct costs=US$927.20±600.26. Indirect cost=US$198.08±136.15	Total cost=US$5047.5±2796.3 Direct costs=US$4158.1±2691); Indirect cost=US$888±610.
do Socorro Margarido *et al*[20]	N/A	30% of patients with LBP would be absent from their work due to the condition.	N/A
Bello and Muhammad[22]	30–70	Total=US$763.27±543.97; Direct cost=US$647.28±438.99; Indirect cost=US$115.99±104.99	Total=US$ 3029.9±2159.1 Direct cost=US$2569.5±1742.6 Indirect cost=460.1 ± 416.5
Birabi *et al*[23]	26 and 65	Total cost=US$1226.25 (government hospitals); US$4884.37 (private hospitals)	#US$3192.53 (government hospitals) #US$12 716.41 (private hospitals)
Lin *et al*[24]	Mean age=32.2±9.2	Total costs=US$994.4 to US$1406.4.	N/A
Radoičic *et al*[21]	Median, 53.59 (28 – 85)	Total costs = €200.40 ± €86.65, Direct costs = €9.39 ± €6.66. Indirect costs = €182.00 ± €78.66	Total cost = €432.86 ± €187.2 Total indirect costs = €393.12 ± €169.99

*Per population.
LBP, low back pain; N/A, not available.

Hospitalisation

A total of three studies reported data on rates of hospitalisation for LBP (table 3). The rates of hospitalisation ranged between 13.4% and 18.7%. The highest rate of hospitalisation (18.7%) for LBP was reported in Argentina.[18]

Economic burden

The economic burden of the included studies is provided in table 4. A total of six studies reported average annual cost per patient.[16 19 21–24] One of the included studies reported annual cost per population.[18] Patients with the age range up to 85 years were included in the included studies. Due to variation in methodological approaches, the reported cost estimates were inconsistent across the studies. However, up to an average of annual costs of US$2.2 billion and US$1226.25 per population and per patient level, respectively, were reported. Up to US$1.7 billion indirect costs were also reported mainly due to work absenteeism.[18]

DISCUSSION

To our knowledge, this is the first systematic review to analyse the clinical and economic impact of LBP in LMICs. A total of nine studies from six LMICs were included. Our review indicates that the clinical and economic burden of LBP is substantial in LMICs. The rate of hospitalisation ranged between 13.4% and 18.7% of patients with LBP. The findings of the review also suggest that LBP is associated with an annual cost of US$2.2 billion per population in LMICs. A clearer understanding of the clinical and economic burden of LBP in LMICs is therefore important for policy makers that they may consider appropriate prevention and management strategies for LBP.

Rate of hospitalisation of female patients with LBP was higher (53.7%) than their male counterpart.[20] The reason for this could be epidemiological where the proportion of LBP in female is in a higher proportion than males.[25] The average length of stay in hospital due to LBP in Argentina and Ethiopia was 3.8 days[20] and 7.4 days,[17] respectively. The length of stay in hospital is directly associated with high financial impact of LBP, this is because of its healthcare and social costs.[26]

We collected evidence of both direct and indirect economic burden of LBP. The overall burden varied based on characteristics of patient populations, geographic region and the methodologies adopted by the studies, this includes the individual patient or the population-level perspective. For example, the societal annual costs amounted to US$ 2.2 billion per population where the productivity losses represented 79% of the costs reported in Brazil.[18] Overall, the considerable clinical and economic burden of LBP in LMICs could be due to its poorly equipped health and social system.[27]

There are certain strength and limitations to this study. The main strength of this review is the comprehensiveness of the search terms, screening of numerous data bases and assessment of methodological quality of the studies. Only English language studies were included. Therefore, it is possible that relevant literature published in other languages may have been excluded. Also, grey literature were not included in the current review, as a result, we cannot be certain that the findings of this review are representative of all the studies undertaken, negative results are less likely to be published which may result in publication bias. The quality of the included studies was evaluated using NOS as moderate; however, the instrument used has some limitations as important methodological issues pertaining to health economics might not have been fully assessed by scale. It was not possible to undertake a meta-analysis for most of the included studies due to the adoption of different time horizons, different clinical outcomes and lack of data regarding mean and SD for costs.[28] Further, the quality of the included studies indicates that there is a need to interpret the clinical and economic burden results with caution.

CONCLUSION

We found that LBP is associated with significantly high rate of hospitalisation with a clear impact on length of stay in hospital and treatment costs. The findings of our analysis can be used by clinicians and policymakers to better allocate resources for prevention and management strategies for LBP to improve health outcomes and reduce the substantial burden associated with the condition. We also hope our results will be of use to researchers planning to evaluate the cost-effectiveness of various strategies for preventing LBP in LMICs.

Contributors FF and TG performed electronic searches and assessed title and abstract. CEM and UU were consulted in case of disagreement. FF and TG performed the methodological quality assessment and extracted the data. TG and CEM wrote the original draft preparation. FF and UU reviewed, revised, and edited this paper. All authors read and approved the final draft of the manuscript. FF had full access to all of the data in the study, and takes responsibility for the integrity of the data and the accuracy of the data analysis. FF is the guarantor.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information. All data related to this work are available.

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REFERENCES

1 Urits I, Burshtein A, Sharma M, *et al*. Low back pain, a comprehensive review: pathophysiology, diagnosis, and treatment. *Curr Pain Headache Rep* 2019;23:23.
2 Tay M, Sian SCSH, Eow CZ, *et al*. Ultrasound-guided lumbar spine injection for axial and radicular pain: a single institution early experience. *Asian Spine J* 2021;15:216–23.
3 Hoy D, Brooks P, Blyth F, *et al*. The epidemiology of low back pain. Best Pract Res Clin Rheumatol 2010;24:769–81.
4 Dagenais S, Caro J, Haldeman S. A systematic review of low back pain cost of illness studies in the United States and internationally. *The Spine Journal* 2008;8:8–20.
5 Kuritzky L, Samraj GP. Nonsteroidal anti-inflammatory drugs in the treatment of low back pain. *J Pain Res* 2012;5:579–90.
6 Chou R, Qaseem A, Snow V, *et al*. Clinical efficacy assessment subcommittee of the American College of physicians and the American College of physicians/American pain Society low back pain guidelines panel*. Diagnosis and treatment of low back pain: a joint clinical practice guideline from the American College of physicians and the American pain Society. *Ann Intern Med* 2007;147:478–91.
7 Koes BW, van Tulder M, Lin C-WC, *et al*. An updated overview of clinical guidelines for the management of non-specific low back pain in primary care. *Eur Spine J* 2010;19:2075–94.
8 Vos T, Flaxman AD, Naghavi M, *et al*. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the global burden of disease study 2010. *Lancet* 2012;380:2163–96.
9 Hoy D, March L, Brooks P, *et al*. The global burden of low back pain: estimates from the global burden of disease 2010 study. *Ann Rheum Dis* 2014;73:968–74.
10 Louw QA, Morris LD, Grimmer-Somers K. The prevalence of low back pain in Africa: a systematic review. *BMC Musculoskelet Disord* 2007;8:1–4.
11 Stewart Williams J, Ng N, Peltzer K, *et al*. Risk factors and disability associated with low back pain in older adults in low- and middle-income countries. Results from the WHO study on global ageing and adult health (SAGE). *PLoS One* 2015;10:e0127880.
12 Stang A. Critical evaluation of the newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. *Eur J Epidemiol* 2010;25:603–5.
13 Suissa S, Ernst P, Kezouh A. Regular use of inhaled corticosteroids and the long term prevention of hospitalisation for asthma. *Thorax* 2002;57:880–4.
14 Salary converter. Purchasing power parities. 2017. Available: http://salaryconverter.nigelb.me/ [Accessed Feb 2022].
15 World Bank. World bank open data. 2022. Available: https://data.worldbank.org/indicator/FP.CPI.TOTL [Accessed Feb 2022].
16 Beyera GK, O'Brien J, Campbell S. Hospital admission and associated factors among individuals presenting to healthcare facilities for low back pain in Ethiopia. *Int J Rheum Dis* 2020;23:763–71.
17 Carregaro RL, Tottoli CR, Rodrigues DD, *et al*. Low back pain should be considered a health and research priority in Brazil: lost productivity and healthcare costs between 2012 to 2016. *PLoS ONE* 2020;15:e0230902.
18 Laffont M, Sequeira G, Kerzberg EM, *et al*. The non-silent epidemic: low back pain as a primary cause of hospitalisation. *Rheumatol Int* 2016;36:673–7.
19 Odole AC, Akinpelu AA, Adekanla BA, *et al*. Economic burden of low back pain on patients seen at the outpatient physiotherapy clinics of secondary and tertiary health institutions in Ibadan. *J Nig Soc Physiother* 2011;18:43–8.
20 do Socorro Margarido M, Kowalski SC, Natour J, *et al*. Acute low back pain: diagnostic and therapeutic practices reported by Brazilian rheumatologists. *Spine (Phila Pa 1976)* 2005;30:567–71.
21 Radoičić MJ, Božović BV, Ilić KD, *et al*. Pharmacoeconomic aspects of low back pain treatment: cost of illness study in the Republic of Serbia. *Acta Med Port* 2019;32:272–8.
22 Bello B, Muhammad IT. Estimation of economic cost of low back pain management in Kano, Nigeria. *Adv Life Sci Med* 2017;3:01–8.
23 Birabi BN, Oke KI, Dienye PO, *et al*. Cost burden of low back pain Amon adults in southern Nigeria. *Int J Med Appl Sci* 2014;3:24–9.
24 Lin MR, Tsauo JY, Wang JD. Determinants of economic cost related to low back pain among nurses at a university hospital. *Int J Occup Environ Health* 1996;2:257–63.
25 Hoy D, Bain C, Williams G, *et al*. A systematic review of the global prevalence of low back pain. *Arthritis Rheum* 2012;64:2028–37.
26 Anema JR, Schellart AJM, Cassidy JD, *et al*. Can cross country differences in return-to-work after chronic occupational back pain be explained? An exploratory analysis on disability policies in a six country cohort study. *J Occup Rehabil* 2009;19:419–26.
27 Hartvigsen J, Hancock MJ, Kongsted A, *et al*. What low back pain is and why we need to pay attention. *Lancet* 2018;391:2356–67.
28 Higgins MD, Green RJ, Leeson MS. 2011 Optical wireless for intravehicle communications: a channel viability analysis. *IEEE Trans Veh Technol*;61:123–9.

Appendix 1: Clinical and economic burden search strategy

Appendix 1a: Medline, CINAHL, Embase and AMED (inception to 10th December/2021

Search ID	Search Terms
S23	S21 AND S22
S22	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20
S21	AB low back pain
S20	AB hospitalization
S19	AB cost of illness
S18	AB absenteeism
S17	AB ambulatory care
S16	AB drug cost
S15	AB emergency medical services
S14	AB healthcare services
S13	AB nursing services
S12	AB economics
S11	AB physician
S10	AB burden
S9	AB clinical impact
S8	AB utilization
S7	AB burden of illness
S6	AB cost
S5	AB nursing costs
S4	AB physician cost
S3	AB physician visits
S2	AB emergency department visits
S1	AB years lived with disability

Appendix 1b: Scopus (inception to 10th December/2021

Search ID	Search Terms
1	TITLE-ABS-KEY (low AND back AND pain)
2	TITLE-ABS-KEY (hospitalisation)
3	TITLE-ABS-KEY (cost AND of AND illness)
4	TITLE-ABS-KEY (absenteeism)
5	TITLE-ABS-KEY (ambulatory AND care)
6	TITLE-ABS-KEY (drug AND costs)
7	TITLE-ABS-KEY (emergency AND medical AND services)
8	TITLE-ABS-KEY (healthcare AND costs)
9	TITLE-ABS-KEY (nursing AND services)
10	TITLE-ABS-KEY (economics)
11	TITLE-ABS-KEY (physicians)
12	TITLE-ABS-KEY (burden)
13	TITLE-ABS-KEY (clinical AND impact)
14	TITLE-ABS-KEY (utilization)
15	TITLE-ABS-KEY (burden AND of AND illness)
16	TITLE-ABS-KEY (cost)
17	TITLE-ABS-KEY (nursing AND cost)
18	TITLE-ABS-KEY (physician AND cost)
19	TITLE-ABS-KEY (physician AND visit)
20	(TITLE-ABS-KEY (hospitalisation)) OR (TITLE-ABS-KEY (cost AND of AND illness)) OR (TITLE-ABS-KEY (absenteeism)) OR (TITLE-ABS-KEY (ambulatory AND care)) OR (TITLE-ABS-KEY (drug AND costs)) OR (TITLE-ABS-KEY (emergency AND medical AND services)) OR (TITLE-ABS-KEY (healthcare AND costs)) OR (TITLE-ABS-KEY (nursing AND services)) OR (TITLE-ABS-KEY (economics)) OR (TITLE-ABS-KEY (physicians)) OR (TITLE-ABS-KEY (burden)) OR (TITLE-ABS-KEY (clinical AND impact)) OR (TITLE-ABS-KEY (utilization)) OR (TITLE-ABS-KEY (burden AND of AND illness)) OR (TITLE-ABS-KEY (cost)) OR (TITLE-ABS-KEY (nursing AND cost)) OR (TITLE-ABS-KEY (physician AND cost)) OR (TITLE-ABS-KEY (physician AND visit))
21	(TITLE-ABS-KEY (low AND back AND pain)) AND ((TITLE-ABS-KEY (hospitalisation)) OR (TITLE-ABS-KEY (cost AND of AND illness)) OR (TITLE-ABS-KEY (absenteeism)) OR (TITLE-ABS-KEY (ambulatory AND care)) OR (TITLE-ABS-KEY (drug AND costs)) OR (TITLE-ABS-KEY (emergency AND medical AND services)) OR (TITLE-ABS-KEY (healthcare AND costs)) OR (TITLE-ABS-KEY (nursing AND services)) OR (TITLE-ABS-KEY (economics)) OR (TITLE-ABS-KEY (physicians)) OR (TITLE-ABS-KEY (burden)) OR (TITLE-ABS-KEY (clinical AND impact)) OR (TITLE-ABS-KEY (utilization)) OR (TITLE-ABS-KEY (burden AND of AND illness)) OR (TITLE-ABS-KEY (cost)) OR (TITLE-ABS-KEY (nursing AND cost)) OR (TITLE-ABS-KEY (physician AND cost)) OR (TITLE-ABS-KEY (physician AND visit)))

Appendix 1c: PubMed (inception to 10th December/2021

Query	Search Details
((((((((((((((((Hospitalisation[Title/Abstract] AND ((humans[Filter]) AND (english[Filter]))) OR (cost of illness[Title/Abstract] AND ((humans[Filter]) AND (english[Filter])))) OR (Absenteeism[Title/Abstract] AND ((humans[Filter]) AND (english[Filter])))) OR (Ambulatory care[Title/Abstract] AND ((humans[Filter]) AND (english[Filter])))) OR (Drug costs[Title/Abstract] AND ((humans[Filter]) AND (english[Filter])))) OR (Emergency medical services[Title/Abstract] AND ((humans[Filter]) AND (english[Filter])))) OR (healthcare costs[Title/Abstract] AND ((humans[Filter]) AND (english[Filter])))) OR (nursing services[Title/Abstract] AND ((humans[Filter]) AND (english[Filter])))) OR (economics[Title/Abstract] AND ((humans[Filter]) AND (english[Filter])))) OR (physicians[Title/Abstract] AND ((humans[Filter]) AND (english[Filter])))) OR (burden[Title/Abstract] AND ((humans[Filter]) AND (english[Filter])))) OR (clinical impact[Title/Abstract] AND ((humans[Filter]) AND (english[Filter])))) OR (Utilization[Title/Abstract] AND ((humans[Filter]) AND (english[Filter])))) OR (burden of illness[Title/Abstract] AND ((humans[Filter]) AND (english[Filter])))) OR (cost[Title/Abstract] AND ((humans[Filter]) AND (english[Filter])))) OR (nursing cost[Title/Abstract] AND ((humans[Filter]) AND (english[Filter])))) OR (physician visit[Title/Abstract] AND ((humans[Filter]) AND (english[Filter])))) AND (low back pain[Title/Abstract] AND ((humans[Filter]) AND (english[Filter]))))	((("Hospitalisation"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language])) OR ("cost of illness"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language])) OR ("Absenteeism"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language])) OR ("ambulatory care"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language])) OR ("drug costs"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language])) OR ("emergency medical services"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language])) OR ("healthcare costs"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language])) OR ("nursing services"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language])) OR ("economics"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language])) OR ("physicians"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language])) OR ("burden"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language])) OR ("clinical impact"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language])) OR ("Utilization"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language])) OR ("burden of illness"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language])) OR ("cost"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language])) OR ("nursing cost"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language])) OR ("physician visit"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language]))) AND ("low back pain"[Title/Abstract] AND ("humans"[MeSH Terms] AND "english"[Language]))) AND ((humans[Filter]) AND (english[Filter]))
low back pain[Title/Abstract]	("low back pain"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
physician visit[Title/Abstract]	("physician visit"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
nursing cost[Title/Abstract]	("nursing cost"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
cost[Title/Abstract]	("cost"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
burden of illness[Title/Abstract]	("burden of illness"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
utilization[Title/Abstract]	("Utilization"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
clinical impact[Title/Abstract]	("clinical impact"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
burden[Title/Abstract]	("burden"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
physicians[Title/Abstract]	("physicians"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
economics[Title/Abstract]	("economics"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
nursing services[Title/Abstract]	("nursing services"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
healthcare costs[Title/Abstract]	("healthcare costs"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
emergency medical services[Title/Abstract]	("emergency medical services"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
Drug costs[Title/Abstract]	("drug costs"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
Ambulatory care[Title/Abstract]	("ambulatory care"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
Absenteeism[Title/Abstract]	("Absenteeism"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
cost of illness[Title/Abstract]	("cost of illness"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))
hospitalisation[Title/Abstract]	("Hospitalisation"[Title/Abstract]) AND ((humans[Filter]) AND (english[Filter]))

Appendix 2: List of excluded studies

Study	Country	Design	Aim	Justification for exclusion
Safiri et al., 2021	Global	Model	To determine the burden of other musculoskeletal disorders between 1990 and 2017 at the global, regional and national level across 195 countries and territories	Estimate not for low back pain
Barreto & Sá, 2019	Brazil	Questionnaire	To estimate indirect cost related to chronic pain from an employer's perspective	Estimate not for low back pain
Du et al., 2019	China	CR	To systematically explore the correlates of emotional distress in patients with chronic low back pain	Not clinical or economic burden study.
Driscoll et al., 2014	Global	Servery	To quantify the burden arising from low back pain (LBP) due to occupational exposure to ergonomic risk factors.	Not clinical or economic burden study.
Hoy et al., 2014	Global	Survey	To estimate the global burden of LBP.	Not related to the research topic
Smith et al., 2014	Global	Systematic reviews	To estimate disability from the remainder of musculoskeletal (MSK) disorders	Not clinical or economic burden study
Vos et al., 2012	Worldwide	Model	To describe the approach to undertaking past burden of disease assessments with the available evidence.	Not related
Moradi-Lakeh et al., 2017	EMR	Systematic analysis	To report the burden of musculoskeletal disorders in the Eastern Mediterranean Region.	Not clinical or economic burden study
de David et al., 2020	Brazil	Model	To describe the current status and trends of the burden due to LBP in Brazil	Prevalence and incidence
Amaefule et al., 2021	Nigeria	CR	To estimate the burden of chronic musculoskeletal Disorders amongst patients attending orthopaedic outpatients' clinic	Ful article not available
Aminde et al., 2020	Cameroon	CR	To evaluate health-related quality of life (HRQoL) and its determinants in chronic low back pain patients in Cameroon.	Not clinical or economic burden study
Dagenais et al., 2008	USA	CR	To conduct a systematic review of LBP cost of illness studies	A systematic review
Wu et al., 2019	China	CR	To quantify the prevalence and years lived with disability (YLDs) caused by LBP in China	Not clinical or economic burden study
Dienye et al., 2016	Nigeria	CR	To determine the prevalence of LBP	Prevalence and incidence
Galukande et al., 2006	Uganda	CR	To assess and document the disability associated with low back pain in terms of sick leave	Not clinical or economic burden study
Faezi et al., 2020	Iran	Interviews	To evaluate health-care access and utilization among patients with LBP in Iran	Not clinical or economic burden study
Igwesi-Chidobe et al., 2019	Nigeria	Questionnaire	To assess self-reported disability in a low-literate population with chronic LBP	Not clinical or economic burden study
Michalik et al., 2015	Poland	CR	To present the epidemiology data on back pain in Poland	Prevalence and incidence
Carregaro et al., 2019	Brazil	Prevalence-based	To estimate the direct healthcare costs of spinal disorders in Brazil over 2016.	Not low back pain
Kisa et al., 2020	Global	Systematic analysis	To provides an overview of the influence of occupational risk factors on the global burden of disease	Not low back pain
Maetzel & Li, 2002	N/A	Systematic review	To gain a better understanding of the societal costs of LBP	A review of studies

EMR = Eastern Mediterranean Region; CR = Cross sectional