**REVIEW ARTICLE**

# A Weak Five Years Global Trend on Low Back Pain Prevention: A Bibliometric Analysis from Past to Now

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## ABSTRACT

**Background.** Low back pain is a serious condition that causes burdens on functional working people, and preventing low back pain is an important theme that needs to be persistently emphasized by the government in any country. There is an urgency to see the trend of low back pain prevention, and up to now, no bibliometric study has been written on low back pain prevention. **Objectives.** Hopefully, this study could give more information to the decision-makers of developing countries to be aware of the burden of lower back pain. **Methods.** This bibliometric study used the Scopus database to obtain articles published until 2023. All articles were included in the bibliometric analyses using the VOSviewer version 1.6.16 package program. The Pearson correlation analysis of the statistical correlation between gross domestic product per capita and the publishing countries of authors was performed with the Jamovi 2.3.13 package program. **Results.** The researchers found 73 publications on LBP (low back pain) prevention published between 1959 and 2023. Authors from developed countries wrote the majority of articles. There are 742 keywords in the most cited articles; the most used keywords are low back pain, human, and article. In 2020, many keywords used in the publication were health assistive devices, design and development, active lifestyle, and occupational hazards. **Conclusion.** The global upward trend of low back pain prevention in the next five years was weak, and the developed countries had the highest publications on low back pain prevention.

**KEYWORDS:** *Bibliometric, Study, Economically Developed Nations, Lumbalgia, Precaution, Tendency.*

## INTRODUCTION

The Lancet low back pain series emphasized the need for managing the burden of low back pain with support from governments, policymakers, and broader society as it continued to be a significant cause of disability globally from 1990 to 2017 (1). With the introduction of the WHO (World Health Organization) agenda, there was a shift towards prioritizing community health, environmental sanitation, health education, and prevention, while before 1940, the main focus of healthcare was on curing diseases. Well-financed economic countries are more likely to develop health systems to reduce the burden of LBP (low back pain); however, low-income and middle-income countries, on the other hand, lack the resources to diminish the burden of LBP. As the burden of LBP is still high, the focus is on the prevention of LBP. Developed countries have shown that prevention is more cost-effective than treating illnesses, which is an essential lesson for developing countries (2).

Several papers discussed the prevention of degenerative diseases, such as a paper published on the prevention of cardiovascular disease, founded

in 1944 (3). Moreover, a paper on diabetes mellitus prevention was found in 1924 (4). A paper on preventing stroke was found in 1956, discussing whether relieving nocturnal leg cramps would reduce stroke incidence (5).

Regarding studying pain, in the early days, most papers focused on managing pain after surgical procedures. Examples include pain in the limbs after amputation (6), pain in the head and eyes after prolonged periods of dwelling (7), and after an operation for internal piles (8).

Low back pain is a common complaint among patients visiting outpatient departments (9); the first paper on low back pain prevention was written quite late compared to other diseases in 1959 (10). Low back pain is a disease that burdens functional people, especially in low and middle-income countries. According to SDG (sustainable developmental goals) three, it is essential to maintain good health and well-being. To prevent the burden of this disease, in line with the aims of SDG number three, it is crucial to monitor the trend of low back pain prevention worldwide to prevent the global burden of low back pain.

One of the types of study to monitor the trend of a disease is a bibliometric study. As far as the author knows, no bibliometric studies have been conducted on low back pain prevention. Hopefully, this study could give more information to the decision-makers of developing countries to be aware of the burden of lower back pain.

### MATERIALS AND METHODS

**Data selection.** The researchers used the Scopus database to obtain articles published until 2023. The keywords used are (TITLE-ABS-KEY ("low back pain prevention") OR TITLE-ABS-KEY ("lower back pain prevention"). The search was performed on December 26, 2023. A team of three authors screened all the articles and concluded that all articles were included in the bibliometric analyses. Scopus database was chosen because it covers over 20000 million open-access articles and more than 6000 open-access journals.

**Statistical analysis.** After screening from Scopus databases, we used Bibliometric 1.6.16 software. The correlation between the author's countries and GDP per capita was performed by the Jamovi 2.3.13 package program (Pearson Correlation Coefficient). The GDP per capita was downloaded from the World Bank website. The correlation was significant when p<0.05. The exclusion criteria are 1) no full papers available and 2) the article did not discuss the prevention of LBP. The inclusion criteria are the articles from 1959 to 2023.

The results are presented in the Microsoft Excel program bar graph. We used a forecast menu to predict the number of publications in the next five years. We also used a world map to show the density of the articles published in each country. We used the Data Wapper website (https://app.datawrapper.de).

### RESULTS

The articles that resulted from screening from Scopus databases were 73 publications on LBP prevention published between 1959 and 2023 (Figure 1); the study was performed on December 31, 2023. None of the articles are excluded. Among these publications, 50 (68.5%) were Articles, 10 (13.7%) were conference papers, 7 (9.6%) were reviewed, 2 (2.7%) were book chapters, 2 (2.7%) were erratum, 1 (1.4%) were editorial, and letters. All articles were analyzed in Vosviewer software.
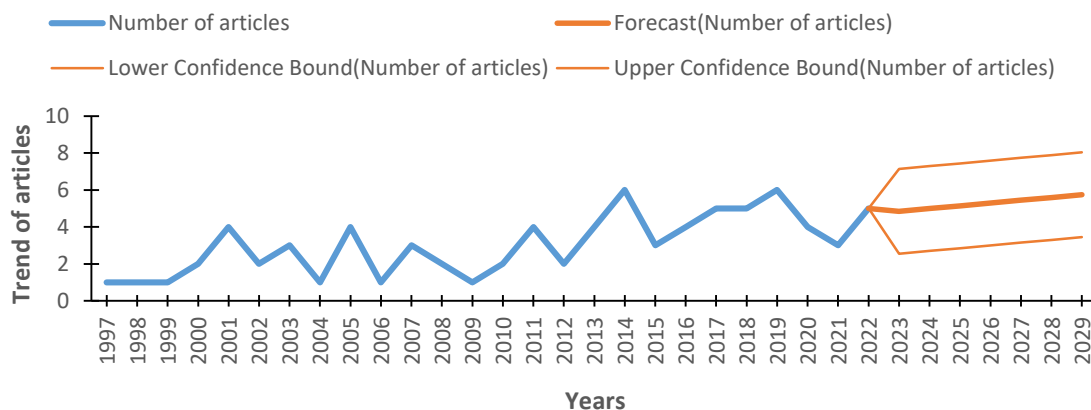


**Figure 1.** Trend of articles about low back pain prevention from 1997 to 2029 (forecast from 2023).

Most articles were in medicine science subject journals (73 subjects), 45 non-medicine subjects index journals, and 10 social subjects index journals (Figure 2).

The majority of articles were in English (62 articles), and the rest were in other languages (Italian, French (n=3)), (Spanish, Persian, Japanese, Hungarian, German, Croatian, Chinese, (n=1)).
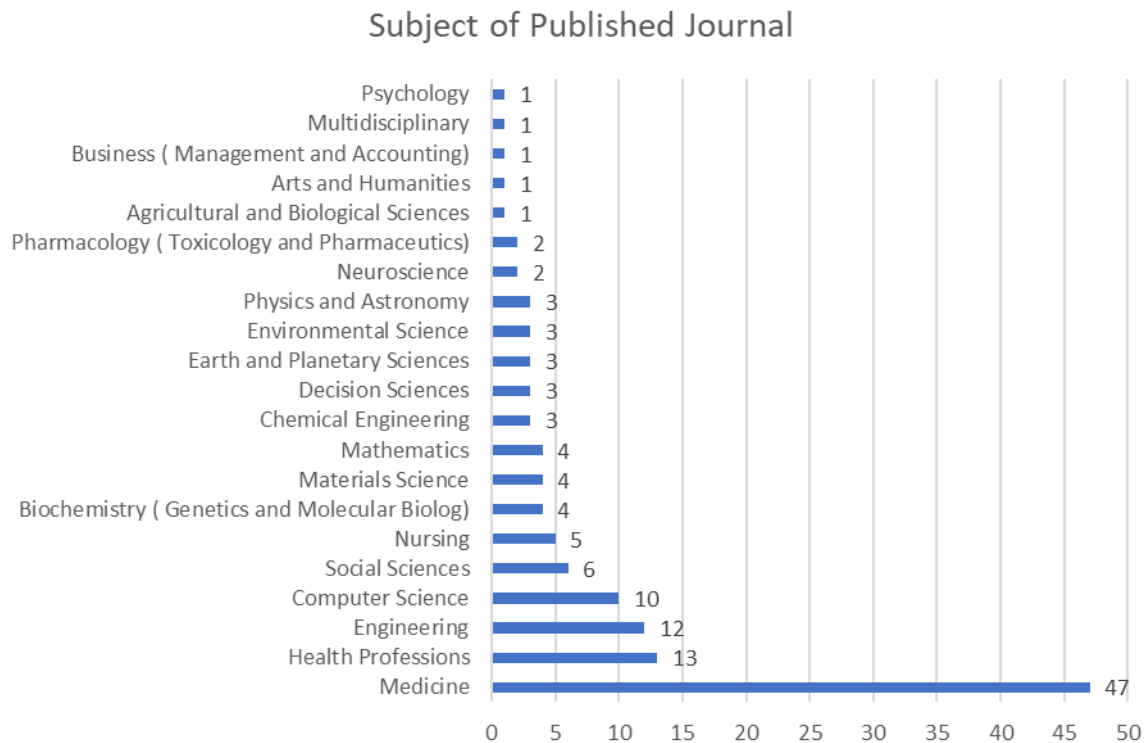


**Figure 2.** A bar graph shows the subject of the published article with the most published articles in the medicine science subject journal.

**Increased number of articles: Research trend of low back pain prevention from past to future.** According to the prediction, around 5 (Confidence Interval 95%: 3–7) articles will be published on low back pain prevention in 2024. Similarly, approximately 6 (95% CI: 3–8) studies will be published on the same topic in 2029 (Figure 1). However, the forecast suggests there will be weak growth in the number of articles and studies published, with less than 20 percent growth.

**Prolific countries on low back pain prevention.** The bar graph shows the countries' contributors to the literature on low back pain prevention, and the world map showing the color intensity according to the number of articles is given in Figure 3. The countries with the most publication were Japan (9, 12.3%), France (8, 11%), Germany (7, 9.6%), Australia and USA (6, 8.2%), China (5, 6.8%), Belgium, Italy, Netherland, Spain (4, 5.5%), Iran, Slovenia, UK, Austria (3, 4.1%), Austria, Canada, Greece,

Poland (2, 2.7%), Croatia, Denmark, Egypt, Hungary, Israel, Malaysia, Mexico (1, 1.4%).

After performing statistical analysis, we concluded that there was no significant correlation between the number of articles on low back prevention and the GDP per capita values, which are indicators of the economic development of the countries R=0.0198, P=0.332 (95% CI: -0.205-0.544).

**Prominent institutions regarding low back pain prevention.** The ten prominent institutions that published more than 25 articles in the literature on low back prevention were the University of Primorska, Vrije Universiteit Amsterdam, Universität Heidelberg, Institut Jožef Stefan, Ottobock SE & Co. KGaA, Amsterdam Movement Sciences (Number of articles=3), Hachiohji Health Cooperative Shiroyama Hospital, Research Institute of Health Science and Education, Faculty of Medicine and Health, Iranian Institute for Health Sciences Research, Universidad de Jaén (Number of articles=2).

**Featured authors regarding low back prevention.** Some authors who wrote two or more articles were Babič J, Houdjik H, Mombaur K, Sarabon N (Number of articles=3), Batrusch S, Bornmann J, Campbell A, Cardon G, Esteban G (Number of articles=2).

**Past and present keywords used on low back prevention.** Vosviewer, using a network visualization map, yielded the trends of keywords in published articles in past and present research (as in Figure 4a). There were six clusters from 742 keywords built. The keywords most used are low back pain, human, and article.

In 2020, many keywords used in the publication were health assistive devices, design and development, active lifestyle, and occupational hazards (Table 1, Figure 4b).
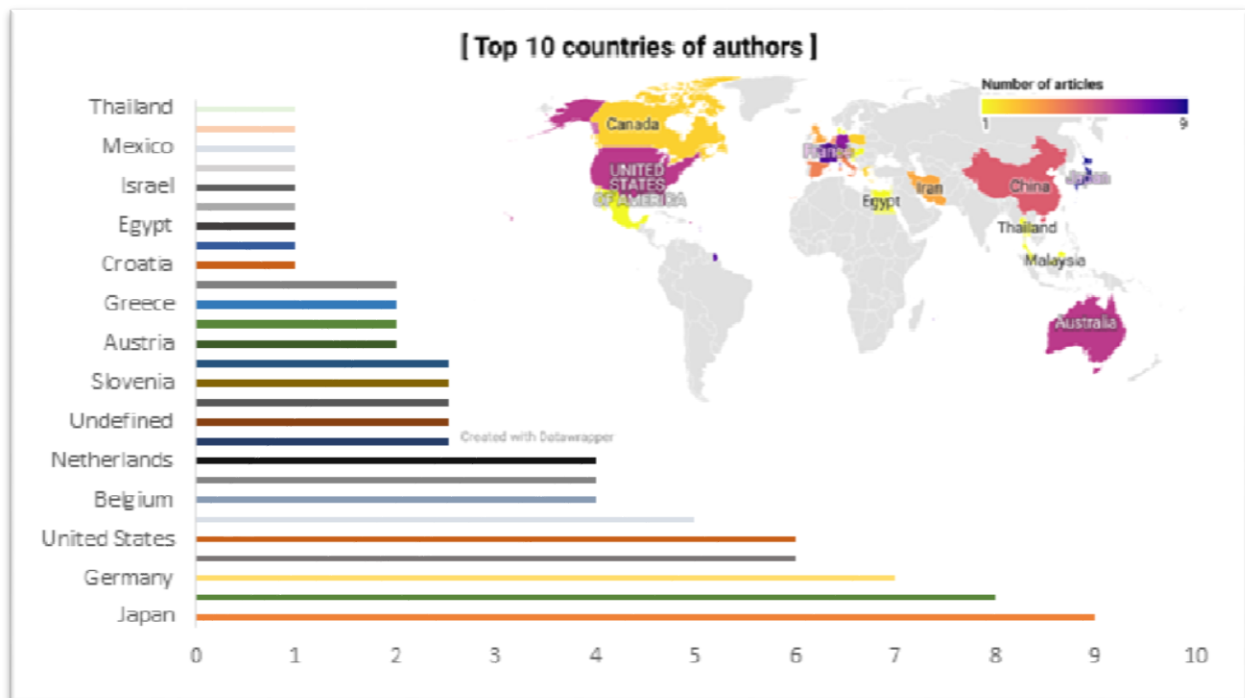


**Figure 3.** Map of countries with the most publications on low back pain prevention. Japan has the highest number of publications.
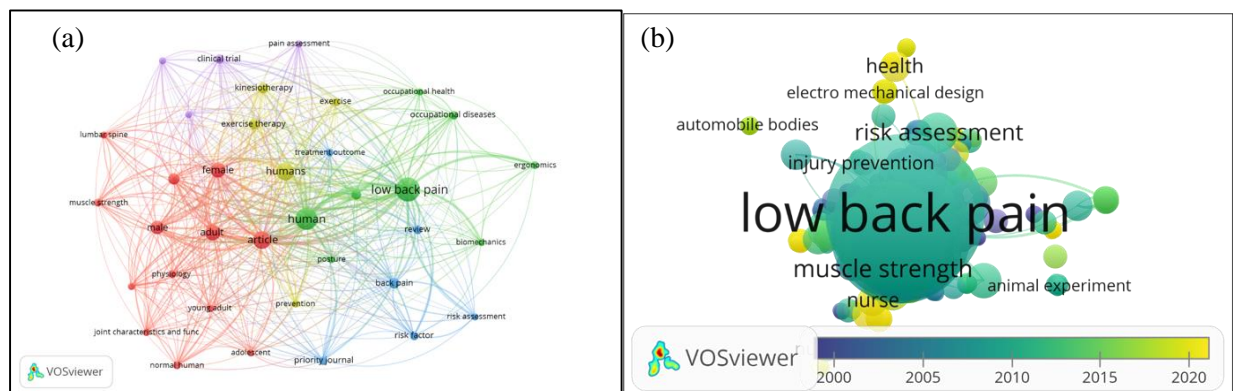


**Figure 4.** Network visualization map. (a). Illustrating clustering trends of low back pain prevention. Different colors identified each cluster. The larger circle determines the highest number of keywords used. Many articles used the keywords low back pain, and article. (b) Overlay visualization based on keywords. In 2020, many keywords used in the publication were health assistive devices, design and development, active lifestyle, and occupational hazards.

**Table 1. The most frequently used keywords in the publication of LBP prevention.**

| Keywords | Number | Keywords | Number | Keywords | Number |
|---|---|---|---|---|---|
| Low back pain | 52 | back pain | 10 | physiology | 6 |
| Human | 42 | body posture | 9 | normal human | 6 |
| Humans | 27 | clinical trial | 8 | muscle strength | 6 |
| Article | 27 | risk factor | 7 | ergonomics | 6 |
| Adult | 21 | review | 7 | young adult | 5 |
| Female | 18 | priority journal | 7 | risk assessment | 5 |
| Male | 11 | occupational diseases | 7 | RCT | 5 |
| Controlled study | 11 | exercise | 7 | posture | 5 |
| Kinesiotherapyexercise Therapy | 10 | treatment outcome | 7 | pain assessment | 5 |
| Exercise therapy | 10 | prevention | 6 | occupational health | 5 |

**Citation analysis on low back pain prevention.** Table 2 shows the citations from the top highest-cited article (640 out of 73). The author, Power C et al., has gained the highest number of citations (140) until 2023. The youngest article, which was published in 2019, has 49 citations. It discusses the utilization of body lifting aids to reduce low back pain. Figure 5 shows the 4 clusters of citations based on authors and the countries with links based on the citation. The authors (from a total of 264 authors) from France, Belgium, and Switzerland are in one cluster and separated from the other cluster (United Kingdom and Egypt).
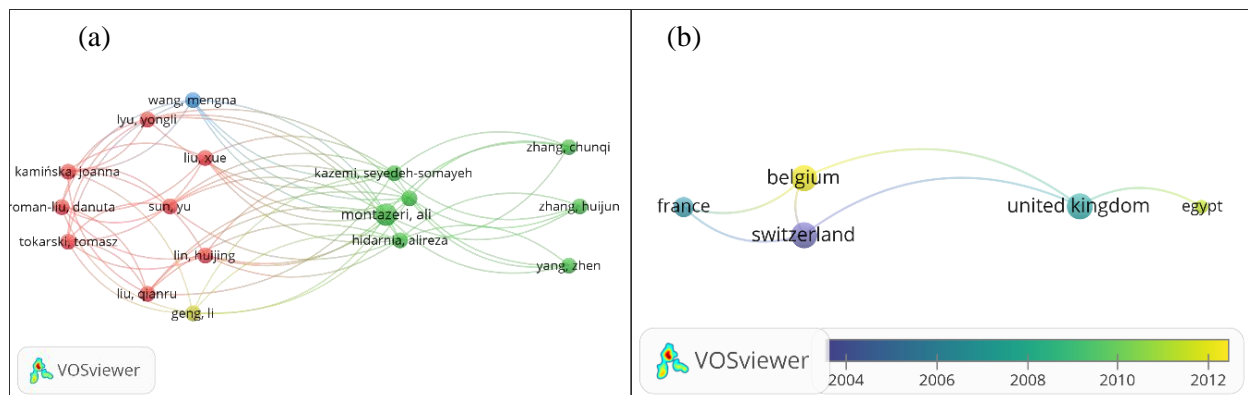


**Figure 5.** Visualization based on citation. (a) The first visualization shows a network of connected authors based on their citations. There are 264 authors, but not all of them are connected. The most connected author is Ali Montazeri. There are four clusters in the network, with 61 links. The first cluster includes authors Wang, Mengna, and CL, while the second cluster includes authors Geng and Li, with no other authors in their cluster. (b) The second visualization shows citations based on the countries of the authors. There are only two clusters with six links in total. The first cluster includes France, Belgium, and Switzerland, while the second includes the UK and Egypt.

## DISCUSSION

To prevent the burden of this disease, it is crucial to monitor the trend of low back pain prevention. As far as the author knows, no bibliometric studies have been conducted on low back pain prevention. Examining the distribution of LBP prevention articles from 1959 to 2022, multiple peaks were found, but the number of articles at the top of the peak stayed constant (6 publications in 2014 and 2019). The estimation results for 2023 and the following years indicated that the researchers expected a weak upward trend in LBP prevention research.

China was a developing nation with a sizable economy and a low GDP per capita, even though the top 10 countries that stood out in the LBP prevention publication were developed nations (Japan, Germany, the USA, Belgium, and the Netherlands). The publication amount and the countries' GDP per capita values did not significantly correlate. This means that the financial aspect did not determine the productivity of the LBP prevention articles. However, we can see that most of the ten countries that wrote about LBP prevention were developed countries.

**Table 2. The most cited article on Low Back Pain Prevention.**

| No | Publication Year | Document Title | Authors | Journal Title | total 946 |
|---|---|---|---|---|---|
| 1 | 2001 | Predictors of low back pain onset in a prospective British study | Power C., Frank J., Hertzman C., Schierhout G., Li L. | American Journal of Public Health | 140 |
| 2 | 2015 | Interventions for preventing and treating low-back and pelvic pain during pregnancy | Liddle S.D., Pennick V. | Cochrane Database of Systematic Reviews | 116 |
| 3 | 2008 | Lumbar support for prevention and treatment of low back pain | Van Duijvenbode I.C.D., Jellema P., Van Poppel M.N.M., Van Tulder M.W. | Cochrane Database of Systematic Reviews | 100 |
| 4 | 2004 | Low back pain prevention's effects in schoolchildren. What is the evidence? | Cardon G., Balague F. | European Spine Journal | 84 |
| 5 | 2019 | Effectiveness of an on-body lifting aid (HAL® for care support) to reduce lower back muscle activity during repetitive lifting tasks | von Glinski A., Yilmaz E., Mrotzek S., Marek E., Jettkant B., Brinkemper A., Fisahn C., Schildhauer T.A., Gessmann J. | Journal of Clinical Neuroscience | 46 |
| 6 | 2012 | Investigation of spinal posture signatures and ground reaction forces during landing in elite female gymnasts | Wade M., Campbell A., Smith A., Norcott J., O'Sullivan P. | Journal of Applied Biomechanics | 44 |
| 7 | 2011 | The role of instability rehabilitative resistance training for the core musculature | Behm D.G., Drinkwater E.J., Willardson J.M., Cowley P.M. | Strength and Conditioning Journal | 32 |
| 8 | 2008 | Effect of wearing a lumbar orthosis on trunk muscles: Study of the muscle strength after 21 days of use on healthy subjects | Fayolle-Minon I., Calmels P. | Joint Bone Spine | 29 |
| 9 | 2010 | Changes in Transversus Abdominis Thickness With Use of the Abdominal Drawing-In Maneuver During a Functional Task | McGalliard M.K., Dedrick G.S., Brismee J.M., Cook C.E., Apte G.G., Sizer Jr. P.S. | PM and R | 27 |
| 10 | 2014 | TPLUFIB-WEB: A fuzzy linguistic Web system to help in the treatment of low back pain problems | Esteban B., Tejeda-Lorente A., Porcel C., Arroyo M., Herrera-Viedma E. | Knowledge-Based Systems | 22 |

The articles published reported on prevention measures for health in 1959, with the first article written about the prevention of LBP in medical examinations and selective job placement. However, in contrast, papers from developing countries were found in 2011 in Thailand (11), Malaysia (12), and Iran (13).

The institutions contributing to the global literature were the University of Primorska, Vrije Universiteit Amsterdam, Universität Heidelberg, Institute Jožef Stefan, Ottobock SE & Co. KGaA, Amsterdam Movement Sciences. The authors from Belgium, Switzerland, and France collaborated on the publication of low back prevention.

The article with the highest number of citations is from Power C et al. The American Journal of Public Health published the study "Predictors of low back pain onset in a prospective British study." The second most cited article was by Liddle et al. (2015) in the Cochrane Database of Systematic Reviews titled "Interventions for preventing and treating low-back and pelvic pain during pregnancy." The Cochrane Database of Systematic Reviews is the journal with the two most cited articles among the top 10. This journal is from the United States, with the second-highest publications.

No bibliometric study on the prevention of lower back pain (LBP) has been published until now. This article is unique in demonstrating the publication trend on LBP prevention. It also suggests that the emphasis on disease prevention may not have been fully implemented in countries, especially developing countries. The weak trend in the publication of low back pain prevention in the next five years indicates the need to alarm the government and other stakeholders to be cautious in this prevention to overcome the burden of this disease, especially for functional persons.

We chose to utilize the Scopus database as it contains thousands of journals, and all published articles undergo a review process (14).

However, we must acknowledge that our study's limitation is that we could not capture the results of screening articles from different databases. Future studies should include different and large-scale databases to get more information about the trend of LBP prevention.

## CONCLUSION

This bibliometric study indicates publications from 1959 to the present with a weak upward trend projected for the next five years. In 2020, many publications focused on health assistive devices, design and development, active lifestyles, and occupational hazards. It could be predicted that assisted devices would be prominent in reducing low back pain. So far, developed countries continue leading in the number of publications, and developing countries started writing in the year after 2020.

## APPLICABLE REMARKS

- There is a projected weak trend in the publication of LBP prevention.
- The assisted devices in LBP prevention will be a dominant topic in the publication of LBP prevention.

## AUTHORS' CONTRIBUTIONS

Study concept and design: Feda Anisah Makkiyah, Septi Panca Sakti. Acquisition of data: Feda Anisah Makkiyah. Analysis and interpretation of data: Feda Anisah Makkiyah. Drafting the manuscript: Feda Anisah Makkiyah. Critical revision of the manuscript for important intellectual content: Zulkifli. Statistical analysis: Feda Anisah Makkiyah. Administrative, technical, and material support: Feda Anisah Makkiyah. Study supervision: Feda Anisah Makkiyah.

## CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

## ETHICAL CONSIDERATION

Because of this literature review, we do not need ethical approval.

## ROLE OF THE SPONSOR

We do not have any sponsors.

## ARTIFICIAL INTELLIGENCE (AI) USE

The authors utilize Quillbot to refine their writing significantly in terms of grammar.

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