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Review Paper

Prevalence of low back pain in professional drivers: a meta-analysis

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ABSTRACT

Objective: This meta-review aimed to investigate the prevalence of low back pain (LBP) in professional drivers.
Study Design: This study is a meta-analysis.
Methods: PubMed, Scopus, Embase, and Web of Science were searched for cross-sectional studies on the prevalence of LBP in professional drivers up to August 2023. The Agency for Healthcare Research and Quality was utilized for cross-sectional analytical studies. Statistical analysis of the included outcome indicators was conducted using Stata 16.0. The prevalence of LBP among professional drivers was measured using the random effects model, and heterogeneity was evaluated utilizing subgroup analysis. This meta-analysis review was registered with PROSPERO on April 28, 2023, under the registration number CRD42023422205.
Results: In total, 1, 558 results met the inclusion and exclusion criteria, and 53 studies were included. The meta-analysis results indicated that professional drivers had a LBP prevalence of 35.0%, 95%CI (0.266, 0.433) for one week, 33.80%, 95%CI (0.233, 0.443) for one month, and 55.30%, 95%CI (0.503,0.603) for one year. In the global population of professional drivers, the prevalence of LBP was 56.0%, 95%CI (0.472, 0.648) and 54.5%, 95%CI (0.488, 0.602) without and with a history and high risk of LBP, respectively.
Conclusions: LBP remains prevalent among international drivers and has multiple contributing factors, highlighting the urgent need for increased awareness and prevention strategies.

Introduction

Transportation connects production and consumption, integrates industries, capital and population, provides strong support, and guarantees for the stable growth of regional economy.[1] Growing reliance on transportation has led to an increase in professional drivers, who face health hazards such as musculoskeletal disorders (MSDs).[2] Joseph et al.[3] found that the prevalence of MSDs among professional drivers varied from 43.1% to 93.0%, with the most common occurrence of LBP among 9998 drivers ranging from 17.0% to 82.9%. Research has shown a correlation between daily driving time and LBP.[4–7] LBP is a frequent work-related MSD. An estimated 619 million (95%CI, 554 to 694) people globally reported experiencing LBP in 2020, and in 2050, 843 million (95%CI, 759 to 933) individuals are projected to suffer from LBP, representing a 36.4% (95%CI, 29.9% to 43.2%) increase compared with 2020.[8]

Occupational ergonomic factors are risk factors for LBP.[9] Such factors involve physical effort, whole-body vibration (WBV), manual handling of heavy loads (MMH), awkward postures, repetitive movements, hand-arm vibration, and squatting.[10] Among professional drivers performing long-term driving tasks, physical effort, WBV, MMH, and awkward postures are the primary influencing factors for LBP.[11] Epidemiological research indicates a connection between long-term occupational exposure to WBV and LBP.[12,13] Tiemessen et al.[14] and Bovenzi et al.[15] demonstrate a dose–response relationship between WBV and LBP in professional drivers, suggesting that WBV exposure may contribute to driving-related LBP. Vibration causes nutritional impairment, increased pressure on the lumbar disc, neuropeptide release, and increased muscle fatigue.[16] Meanwhile, continuous low-load vibration worsens soft tissue 'creep' and generates additional metabolism.[17] All of these biomechanical changes suggest a link between WBV and LBP. Additionally, the combined exposure to awkward posture and vibration is more strongly associated with LBP.[12]

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Single driving activity does not impose a significant physical burden. However, maintaining a stable driving posture over extended periods necessitates the continuous static muscle tension of the neck, back, shoulders, and arms, leading to local muscle fatigue and soreness.[18,19] Drivers who sit and work continuously for a long time are more likely to adopt awkward postures related to ergonomic factors such as seat comfort, lumbar support, and cushioning, which can lead to excessive pressure on the spine and increase the risk of LBP.[20–22] Furthermore, prolonged sitting while driving reduces mobility, coordination, and motor control, leading to poor circulation, static muscle contractions and degenerative changes or injuries such as annular tears and herniated discs.[23] Therefore, some studies have shown that driving duration is associated with LBP.[4,24] Adaptable lumbar support can effectively reduce vibration and muscle activity, promote blood flow, and alleviate driver discomfort.[25–28]

Psychosocial factors are also major risk factors for LBP, including poor social support, work dissatisfaction, stress, and high effort–reward imbalance.[29–31] Javier et al.[32] found a statistically significant correlation between psychological factors, such as fear of pain, anxiety, fear-avoidance beliefs, and chronic musculoskeletal pain. Research has demonstrated a correlation between LBP in professional drivers and negative emotions, including depression.[29,33] This confirms the link between psychosocial factors and LBP.

LBP is a common worldwide problem and a leading cause of years lived with disability (YLDs).[8] Around 690 million (95%CI, 47.9 to 88.9) cases are estimated to occur in 2020, with 40% attributed to modifiable factors.[8] Occupational ergonomic factor caused 126.1 million prevalent cases and 15.1 million YLDs in individuals aged 15–84 years globally in 2019, resulting in economic losses of $216.1 billion.[34] This period represents the prime of an individual's life, encompassing a significant amount of activity, including social and work-related engagements.[35] Therefore, the frequent occurrence of LBP or absence from work at this stage not only affects their operational capability and efficiency but also has a significant impact on their daily life and social activities, resulting in economic losses and burden to families and society.[36–39]

Professional drivers are susceptible to LBP due to physical and psychosocial factors, but the exact cause is unclear. The biopsychosocial model is widely accepted for recognizing the multidimensional nature of LBP and associated risks. It provides valuable insights for preventing, controlling, and treating LBP.[40] Understanding the prevalence and biopsychosocial risk factors for LBP and raising occupational safety awareness among the working population can facilitate the identification of high-risk groups and promote timely preventive interventions. This will result in significant economic and social benefits, as well as the organization of health services and investment in symptom prevention and control.[41]

In summary, professional driving is a risk factor for LBP. This study aims to investigate the prevalence of LBP among professional drivers, raise awareness of the potential impact of LBP, enhance ergonomic awareness and self-protection measures, and suggest research avenues for future studies on LBP.

Methods

The meta-analysis followed the Preferred Reporting Items for Systematic Reviews (PRISMA) guidelines.[42] The review protocol was registered on April 28, 2023, in the International Prospective Register of Systematic Reviews with registration number CRD42023422205.

Search strategy

The meta-analysis searched cross-sectional studies on the prevalence of LBP in professional drivers from the date of database inception to August 16, 2023, using databases (PubMed, Scopus, Embase, and Web of Science). MeSH and Emtree terms were used: ‘low back pain’, ‘driving’, ‘prevalence’, ‘risk’, etc. LBP is defined as ache, pain, numbness, or discomfort between the 12th rib and the gluteal folds, with or without leg pain.[43] The detailed search strategies are provided in Supplementary Table S1.

Study selection

After searching the data, the results were imported into Endnote X9.1, and search results of non-original articles were excluded. Duplicates were removed. Any studies not relevant to this review and not available in full text were excluded, and the remaining studies were initially screened for relevance to this article by title and abstract. Lastly, we closely read the remaining studies and assessed them against the eligibility criteria. The final review only included studies that met the eligibility criteria (Table 1). This process was carried out independently by two reviewers. If two reviewers disagreed, a third reviewer reached consensus.

Data extraction

In the final included literature, key data of the studies in this review were extracted, including information on the study author, year, country of study, vehicle type, survey tool, history and high risk of LBP, sample size, and LBP prevalence. Two reviewers independently entered the data, which were later compared. A third reviewer resolved any disagreements, and a consensus was reached.

Quality assessment

The review assessed the studies using the Agency for Healthcare Research and Quality's (AHRQ) quality assessment criteria for cross-sectional analytical studies.[44] AHRQ comprises 11 items, and responses are classified as ‘yes’, ‘no’, or ‘unclear’, with a ‘yes’ response worth 1 point and a ‘no’ or ‘unclear’ response worth 0 points. Two reviewers evaluated all scores independently based on the final literature, and a third reviewer made the final assessment in case of disagreement. The scores were summarized and recorded in the Supplementary Table S2. The scoring criteria for this questionnaire are based on the quality of the literature. Scores range from low ($\leq$3), medium (4–7), to high (8–11).

Statistical analysis

The meta-analyses were performed using Stata 16.0 software to determine the prevalence of single groups. Heterogeneity between included studies was assessed using the I^2 statistic. If $P > 0.1$ and $I^2 < 50\%$, the heterogeneity was low, and we used a fixed-effects model analysis. If not, we used a random-effects analysis. Egger's linear regression was utilized to evaluate publication bias. If $P > 0.1$, publication bias was low. If not, publication bias was high.

Results

Literature search

A summary of the search results is provided in the PRISMA diagram (Fig. 1).[42] Out of the initial 1558 studies identified, 172 studies were screened based on their title and abstract. After applying inclusion and exclusion criteria, 53 studies were included. Fig. 1 illustrated the search and selection process, including the reasons for exclusion.

Table 1
Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
The title or abstract should mention LBP or MSDs and driving.	Documents with non-English texts were excluded.
The target population of the included studies were drivers (occupational, professional, work or commercial), including truck, taxi, bus, tractor, work, three-wheeled, and car drivers.	Literature with incomplete information such as unknown literature, journal information, inability to obtain the original text or complete data, etc., was excluded.
Health outcomes were annual, weekly, or monthly prevalence of LBP.	Articles with poor data quality from consistent data sources were excluded.
Published original articles about LBP.	Literature without annual, weekly, or monthly prevalence of LBP was excluded.
Studies must be original peer-reviewed research.	Document types for cohort studies, case–control studies, review, and clinical trials were excluded.
Document type is cross-sectional study.	

Characteristics of included studies

A total of 53 studies, all cross-sectional, were included. Four studies[12,45–47] reported the monthly prevalence of LBP in professional drivers ($n = 2528$), 20 studies[7,11,18,30,48–63] reported the weekly prevalence of LBP ($n = 5692$), and 47 studies[4–7,11–13,18,24,29,30,33,48–52,54–57,59,60,62–85] reported the annual prevalence of LBP (n = 19,040). Additionally, when discussing the prevalence of LBP in professional drivers, 30 papers[4,6,12,13,29,30,33,45–47,49–56,58,59,61,65,66,68,72,73,76,79,80,83] did not explicitly exclude a history and high risk of LBP and 23 papers[5,7,11,18,24,48,57,60,62–64,67,69–71,74,75,77,78,81,82,84,85] explicitly excluded a history and high risk of LBP. Data extracted from the included studies are presented in Supplementary Table S3.

Critical appraisal results

The mean critical appraisal score using the AHRQ checklist was 6.87 ± 1.65. One item scored 3[55], the lowest of all the literature, and the quality was poor. Thirty-three items scored 4–7,[5,6,11,12,18,29,33,45,48–53,56–65,67,72–76,79,82,83] which was moderate, and nineteen items scored 8–11,[4,7,13,24,30,46,47,54,66,68–71,77,78,80,81,84,85] which was high. Two articles scored 10[24,69], the highest score. Overall, the literature quality was above average. The results of the literature quality assessment are shown in Supplementary Table S2.

Meta-analysis

In our meta-analyses, we chose the weekly, monthly, or annual prevalence of LBP among professional drivers as the outcome measure and performed heterogeneity tests using random effects models. The subsequent meta-analysis showed that LBP prevalence was 35.0%, 95%CI (0.266, 0.433) in the past week ($P < 0.0001$, $I^2 = 98.7\%$), 33.80%, 95%CI (0.233, 0.443) in the past month ($P < 0.0001$, $I^2 = 96.5\%$), and 55.30%, 95%CI (0.503, 0.603) in the past

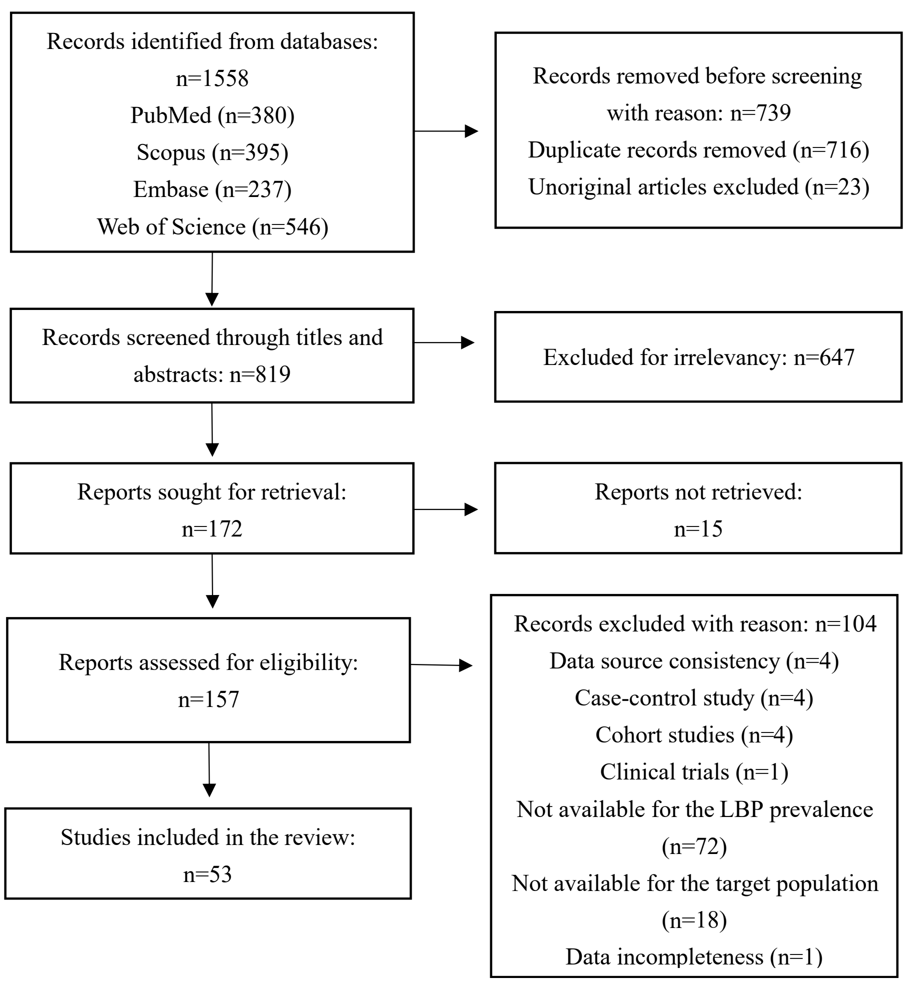

Fig. 1. PRISMA diagram detailing the identification, screening, and final inclusion of studies.

year ($P < 0.0001$, $I^2 = 98.1\%$). Figs. 2–4 display comprehensive results.

Publication bias and subgroup analysis

Vehicle type

We found that the one-year prevalence of LBP in the six subgroups of bus, taxi/car, truck, tractor, tricycle, and work vehicle ($P < 0.001$) was 53.2%, 95%CI (0.430, 0.634); 56.8%, 95%CI (0.492, 0.644); 52.0%, 95%CI (0.415, 0.625); 59.8%, 95%CI (0.458, 0.737); 30.6%, 95%CI (0.218, 0.395); and 68.4%, 95%CI (0.591, 0.776), respectively. No significant publication bias was detected by Egger's linear regression test ($P = 0.861$).

History and high risk of LBP

A subgroup analysis of the prevalence of LBP in the past year among professional drivers based on the exclusion of a history and high risk of LBP showed that the prevalence of LBP in the past year was 56.0%, 95%CI (0.472, 0.648) among professional drivers who excluded a history and high risk of LBP and 54.5%, 95%CI (0.488, 0.602) among professional drivers who did not exclude a history and high risk of LBP ($P < 0.001$). Egger's linear regression test showed no significant publication bias ($P = 0.756$).

Discussion

This study is a meta-analysis that examines the prevalence of LBP among professional drivers worldwide. The results indicate that professional drivers have a high prevalence of LBP in the past year, month, and week. The study also finds that the prevalence of LBP may be associated with factors such as driving time, type of vehicle driven, and a history and high risk of LBP.

Our study used 47 studies with 19,040 participants to estimate the prevalence of LBP in professional drivers in the past year. We found that the prevalence of LBP in the past year was higher among professional drivers than in the past week or month, which may be related to the short observation time in the past week or month, thus missing part of the positive patients. Additionally, extended periods of driving can cause LBP due to a combination of biopsychosocial factors. Hence, subsequent studies adopt the annual prevalence of LBP as a measure of LBP prevalence. Joseph et al.[3] found that the prevalence of LBP among 9998 professional drivers was 53%, generally consistent with the high prevalence of LBP reported in our study. Compared with the age-adjusted global prevalence of LBP [7.46%, 95%UI (6.69%, 8.37%)][8], the prevalence among professional drivers is significantly higher, suggesting drivers are at high risk for LBP and essential to investigate its prevalence of LBP and formulate interventions.

This research revealed a significant prevalence of LBP among drivers, with the highest percentage in work vehicles drivers (68.40%), followed by tractor drivers (59.80%), taxi/car drivers (56.80%), bus drivers (53.20%), truck drivers (52.0%), and three-wheeled vehicle drivers (30.60%). The likelihood of developing LBP varied depending on the type of vehicle driven. Okunribido et al.[50] identified that the total level of vibration exposure and postural load experienced by tractor and working drivers were greater than those experienced by other drivers, placing them in

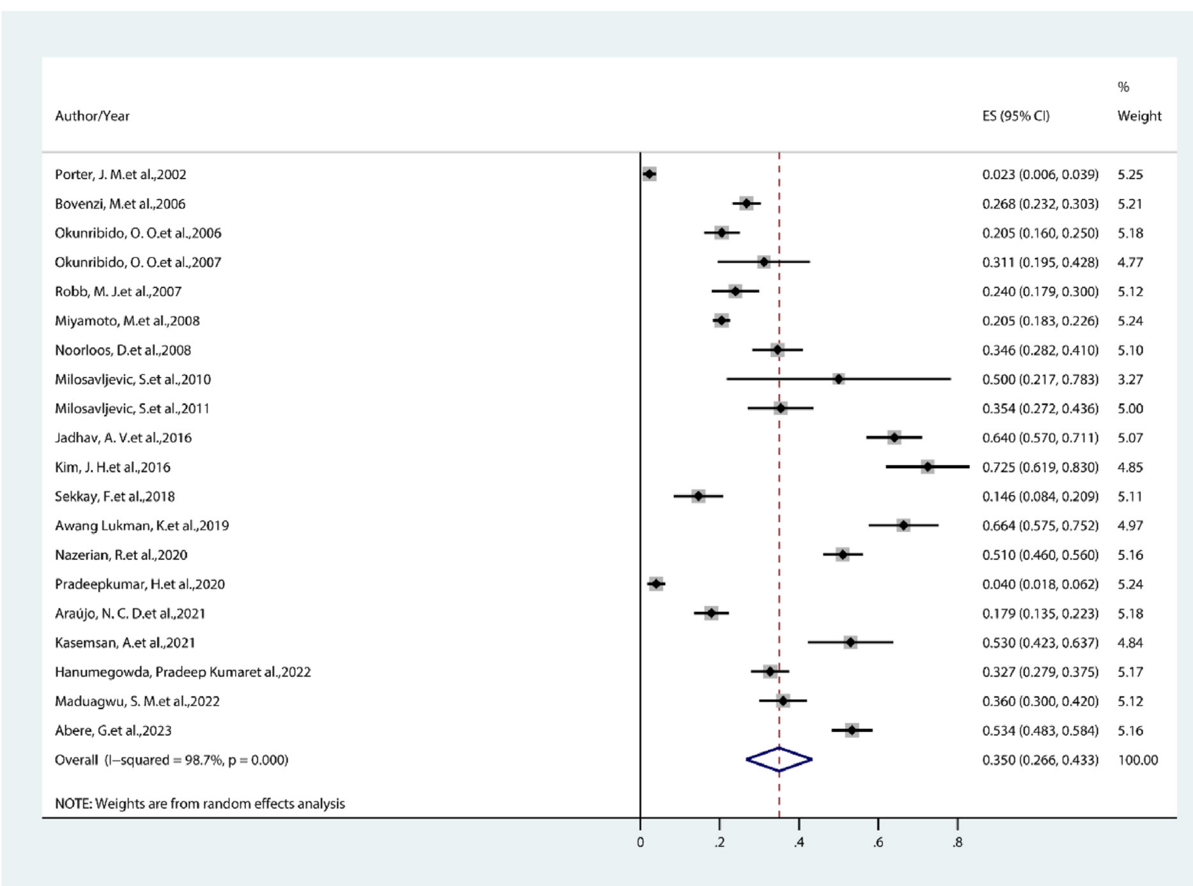

Fig. 2. Forest plot illustrating the meta-analysis of the weekly prevalence of LBP.

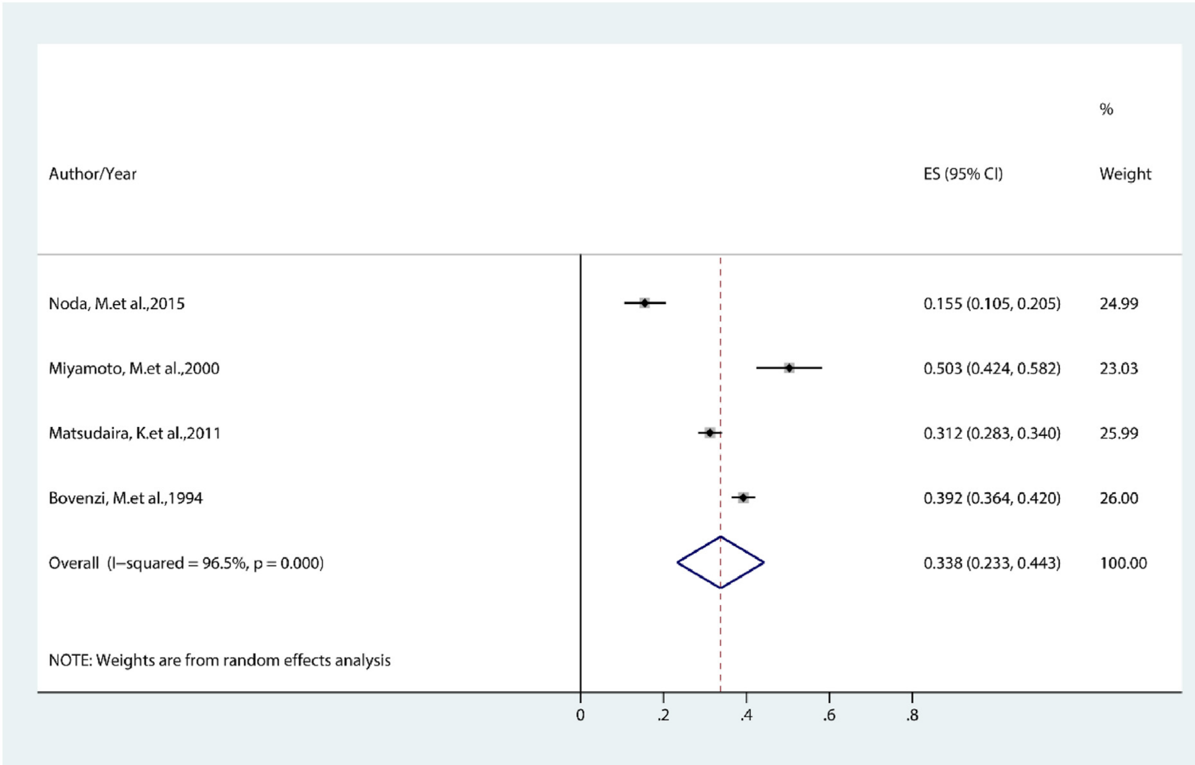

Fig. 3. Forest plot illustrating the meta-analysis of the monthly prevalence of LBP.

the high-risk group for LBP. It was found that the increased prevalence of LBP was mainly due to the combined exposure of WBV, posture, and MMH. Rufa'i et al.[24] discovered that truck drivers had a lower prevalence of LBP when contrasted with bus and taxi/car drivers, which is in line with the findings of this investigation. Moreover, truckers have more stopover places while driving and are not required to lift heavy loads. Furthermore, both age and driving time are positively correlated with the prevalence of LBP. Yitayal et al.[85] found that taxi/car drivers who worked 12 or more hours daily were 2.3 times more likely to experience LBP compared to the general population. In contrast, Sekkay et al.[30] revealed that performing various driving tasks and maintaining a positive psychological state can reduce the risk of developing LBP. Drivers who sit behind the wheel for extended periods feel stress and endure poor posture and WBV for more than half a working day may experience cumulative fatigue in the lumbar spine due to reduced extension.[4,86–88] This abnormal strain on the neuromuscular system can eventually lead to LBP.[4,87–89] Additionally, Yitayal et al.[85] found that taxi drivers who did not utilize waist support or practice proper ergonomics had double and 2.5 times the risk of experiencing LBP compared to their colleagues. Given the high prevalence of LBP among professional drivers and the unknown etiology of LBP, drivers should avoid extended exposure to vibration, stressful, repetitive, and monotonous tasks. Furthermore, they should acquire and implement ergonomic knowledge and self-protective measures at work.

The prevalence of LBP was slightly higher among drivers who did not report a history and high risk of LBP, compared with those who did not. According to Bovenzi et al.,[90] drivers with a history of lumbar injury and lumbar disc herniation were more likely to have LBP than healthy drivers, with estimated adjusted odds ratios ranging from 3.6 to 13.5 in a transition model. Our study showed that there may be a difference in the prevalence of LBP among professional drivers compared to the ‘healthy worker effect’. To address this, it's important to regularly assess the health of drivers pre- and post-employment to quickly identify those with LBP and provide effective interventions to reduce its prevalence in this group.

LBP is the most common MSDs in modern society, and its prevalence and disabled population increases with age.[21,91] MSDs were the biggest beneficiaries of rehabilitation, with over 1.067 billion people already benefiting.[92] To protect the well-being of professional drivers, it is essential to ensure all LBP high-risk and vulnerable populations are incorporated into the healthcare system as much as possible. This includes strengthening their primary and secondary healthcare services and providing rehabilitation services according to the needs of the disease.

There are some limitations to the findings in this review. First, all of the studies included were non-random and cross-sectional, which may have caused a high degree of selection bias. Additionally, 34 out of the 53 studies included were of poor-moderate quality. Third, there is significant heterogeneity among studies due to the complicated and unclear mechanism of LBP in professional drivers.

Despite the limitations of this article, it is crucial to present evidence of evidence-based medicine because of the growing number of professional drivers and their health concerns. Through this study, professional drivers, employers, society, and the country will have a better understanding of LBP. Increased awareness of LBP will help professional drivers adopt healthy behavior patterns, encourage the country to formulate and improve the corresponding social security system and medical system, and motivate employers to improve and adopt a management system conducive to occupational health. Meanwhile, driving is a component of life and drivers' LBP may arise in other settings akin to the driving environment. Hence, this study may also offer suggestions for researching comparable groups, such as professional office workers. This study also provides potential ideas for the automobile

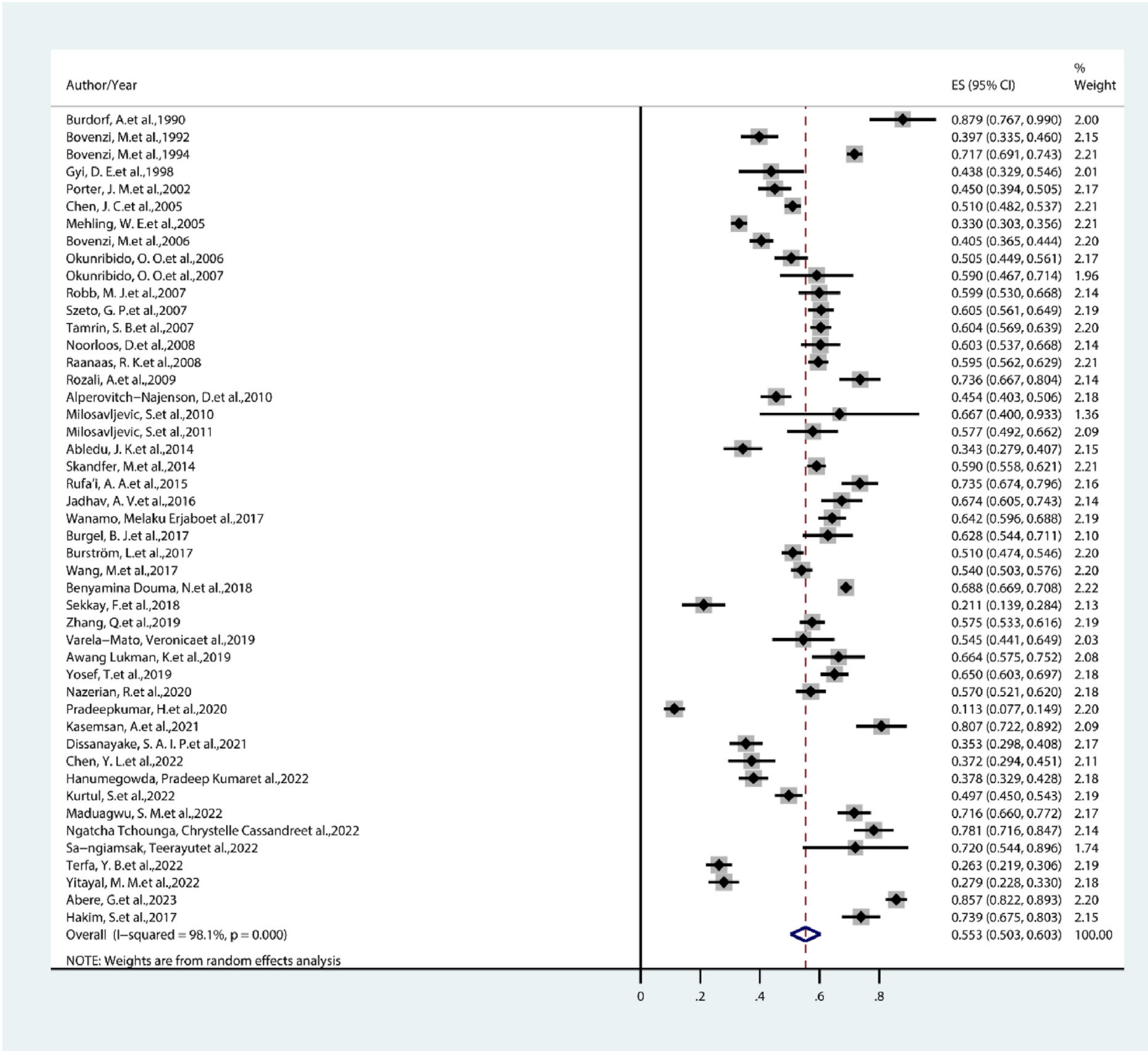

Fig. 4. Forest plot illustrating the meta-analysis of the annual prevalence of LBP.

manufacturing industry and automobile design from an ergonomic perspective. By paying attention to ergonomics and health during the design and production process, the industry can produce driving tools that are more comfortable and more suitable for human use. Furthermore, this is currently the most complete meta-analysis of worldwide prevalence of LBP in professional drivers, making this paper a valuable contribution to the field.

Author statements

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Ethical approval and consent to participate

No ethical approval and patient consent are required since this study data is based on published literature.

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Competing interests

There was no conflict of interest.

Consent for publication

Not applicable.

Authors' contributions

Maosheng Yan had complete access to all data in the study and is responsible for the integrity of the data and the accuracy of the data analysis. Wrote the primary manuscript text: Chunshuo Chen and Maosheng Yan. Formulated the search strategy: Chunshuo Chen and Bin Xiao. Retrieval tests: Junle Wu, Wankang Li, Bin Xiao. Data extraction: Xiongda He, Chunshuo Chen. Data analysis: Chunshuo Chen. Interpretative analysis: Chunshuo Chen, Maosheng Yan, Xiongda He. Final draft: All. The corresponding author confirms that all listed authors meet the authorship criteria and that no other authors meeting the criteria have been omitted. The authors read and approved the final manuscript.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2024.03.007.

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