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Meta-Analysis
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Meta-Analysis of The Effect of Heavy Lifting on Low Back Pain among Health Workers

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ABSTRACT

Background: Cases of low back pain are common in health workers including doctors, nurses, midwives and physiotherapists, due to the nature of their work. These health workers are often involved in tasks that involve heavy lifting. Manual handling of the patient, and awkward posture that is an integral part of the treatment may have an effect on musculoskeletal injuries. This study aims to analyze the effect of heavy weight lifting on low back pain among health workers.
Subject and Method: This was a systematic review and meta-analysis research. The search for articles was carried out in accordance with the eligibility criteria of the PICO Model which include: P= Health workers, I= Heavy weight lifting, C= No heavy weight lifting, O= Low back pain. The articles used come from 2 *databases*, namely: *PubMed* and *Science Direct*. The keywords used were "*heavy lifting*" AND "*low back pain*" OR "*musculoskeletal of low back pain*" AND "*healthcare professional*" OR "*healthcare workers*". The inclusion criteria in this study included *a full-text* article with a cross-sectional *study design*, the size of the relationship used was *adjusted Odds Ratio* (aOR), the article was published in the range of 2014-2022, and *the outcome* was low back pain. Articles are analyzed using the PRISMA digram and the Review Manager 5.4.1.
Results: 9 articles from Malaysia, Pakistan, Saudi Arabia, Uganda, Ethiopia, Nigeria and Japan. Healthcare workers who performed heavy weight lifting increased low back pain by 4.36 times compared to those who did not, and the results were statistically significant (aOR=4.36; CI 95%=3.07 to 6.20; p<0.001).
Conclusion: a meta-analysis of 9 cross-sectional studies concluded that heavy weight lifting increases low back pain disorders in healthcare workers.

Keywords: heavy weight lifting, low back pain, health workers

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BACKGROUND

According to the World Health Organization (WHO), the right of patients to receive the best health care is part of human rights and high-quality health care facilities. According to (Andini, 2015), health service facilities are identified as an environment where there are activities related to ergonomics, including lifting, pushing, pulling, reaching, carrying objects and in terms of patient handling.

Healthcare workers, especially those responsible for patient care, have the potential for more vulnerable hazards that can

lead to musculoskeletal disorders than in many other fields.

Health problems in workers related to musculoskeletal disorder, most commonly in Meet is low back pain, which is pain. The lower back area, can be in the form of localized pain or radial pain or both. This pain can be felt between the corners of the lower ribs to the lower buttocks, namely in the lumbar or lumbosacral area and is often accompanied by the spread of pain to the legs and legs (Boas, 2019)

Low back pain is the most common problem in musculoskeletal disorders and is a major public health challenge on a global scale (Latina et al., 2020). Low back pain is often caused by excessive workload and repeated workload. A high workload will cause work stress, lack of employee concentration, customer complaints and cause a high rate of employee absenteeism.

An estimated 619 million people live with LBP and are the leading cause of record loss worldwide (WHO, 2023), and provide a considerable burden on the health care system, including increased absenteeism, decreased work performance, and higher turnover rates (Fatoye et al., 2023), (Wami et al., 2019).

According to Rezaei et al. (2021) and Luckhaupt et al. (2017) explained that cases of LBP are common in health workers including doctors, nurses, midwives and physiotherapists, due to the nature of their work. These healthcare workers are often involved in tasks that involve heavy lifting, manual patient handling, and awkward postures that are integral to patient care but pose a significant risk of musculoskeletal injury (Richardson et al., 2019). The above statement is supported by the results of a study conducted by (Rezaee and Ghasemi, 2014) with the results of the study, namely the relationship between the frequency of carrying weights and the incidence of low back pain among nurses, the value of aOR = 2,513 was obtained; CI 95%= 1.45 to 4.34, p=0.001).

Understanding the exact impact of weight lifting on musculoskeletal health is necessary to design good workplace practices and policies. Therefore, the researcher is interested in conducting a research using systematic review and meta-analysis that can summarize the results of several primary studies or previous research with a systematic search to draw new conclusions. This study aims to estimate the effect of heavy weight lifting in the daily work of health workers on the occurrence of low back pain.

SUBJECTS AND METHOD

1. Study Design

This was conducted using meta-analysis methods and systematic reviews using PRISMA diagrams. The search for articles is carried out based on the eligibility criteria of the PICO Model. P=Health workers; I=Heavy weight lifting; C=No heavy lifting load; O=Low back pain. The articles used come from 2 databases, namely: Pubmed and ScienceDirect. The keywords include: "heavy lifting" AND "low back pain" OR "musculoskeletal of low back pain" AND "healthcare professional" OR "healthcare workers".

2. Five Steps of Meta-Analysis

Meta-analysis is carried out in 5 steps as follows:

a. Formulate research questions in PICO format (Population, Intervention, Comparison, and Outcome).
b. Search for primary study articles from various electronic and non-electronic databases, such as PubMed, ScienceDirect, Scopus, etc.
c. Conduct screening to determine inclusion and exclusion criteria, followed by a

critical assessment of selected research studies.

d. Extract data from primary studies and synthesize effect estimates by collecting results from primary studies using the RevMan application.
e. Interpret results and drawing conclusions.

3. Inclusion Criteria

Full paper article with cross-sectional research method, the research subject is health workers, multivariate analysis with adjusted Odds Ratio (aOR), the intervention used is heavy weight lifting, the research outcome is Musculoskeletal Disorder (LPB).

4. Exclusive Criteria

Articles published in languages other than English, articles whose results are reported in the form of bivariate analysis, articles published before 2014.

5. Definisi Operasional Variabel

Heavy weight lifting: the physical effort required to lift or move heavy objects or patients without the use of mechanical aids. Lifting heavy weights can cause lower back discomfort in healthcare workers. The recommendation regarding lifting weight should not exceed the rule, namely 15-20kg for adult men and 12-15kg for women.

Low back pain: Discomfort or pain in the lower back reported by health workers. This syndrome is often associated with a variety of variables such as standing for too long, lifting heavy weights, repetitive movements, and poor ergonomic procedures in healthcare work.

Health worker: Any person who is devoted to the health field and has knowledge and/or skills through education in the health field that for certain types requires the authority to carry out health efforts.

6. Research Instruments

The quality assessment in this study uses the Critical Appraisal Checklist for Cross sectional Study (IKMUN Scritical appraisal, 2023), which includes a total of 7 questions with each answer choice if "Yes score 2"; "Hesitant score 1"; and "No score 0" given each of these responses.

7. Data Analysis

This study selects articles based on certain criteria and is collected according to the flow of PRISMA diagrams. Data analysis used Review Manager 5.4.1 software to determine the magnitude of the effect and evaluate the heterogeneity consistency (I^2) value of the selected research results.

RESULTS

The search for articles in this study is through databases that include PubMed and Science Direct. With keywords including: online which includes PubMed, and Science Direct. The keywords used were "heavy lifting" AND "low back pain" OR "musculoskeletal of low back pain" AND "healthcare professional" OR "healthcare workers". The review process of related articles can be seen in the PRISMA flow diagram in Figure 1. Research related to the effect of heavy weight lifting on low back pain among health workers consisting of 9 articles. The initial search process on the database gave results of 1,153 articles, after the process of deleting duplicate articles, 575 were obtained with 391 of them eligible for full text review. Articles that meet the criteria that have been determined will be reviewed comprehensively and meet quantitative requirements. There are 9 eligible articles that will then be included in the RevMan software. It can be seen in Figure 2. that the main research articles originate from 4 African continents (3 Ethiopia and Uganda), and 5 Asian continents (Malaysia, Pakistan, Japan, Nigeria, and Saudi Arabia).

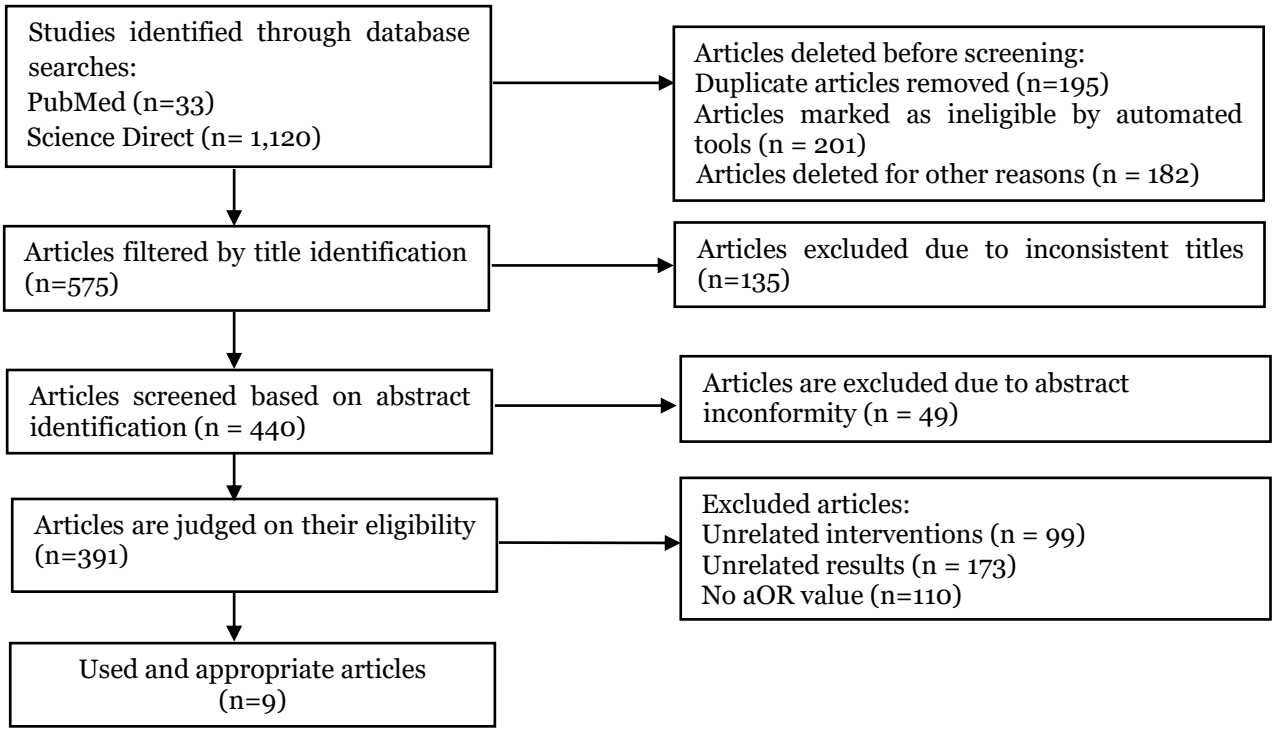

Figure 1. PRISMA Flow Diagram Research on the Effect of Heavy Weight Enhancement on Low Back Pain Among Health Workers

Figure 2. Map of the research area of the effect of heavy weight increase on low back pain among health workers

Table 1. Results of Quality Assessment of Case-Control Study on the Effect of Heavy Weight Lifting on Low Back Pain Among Health Workers

Autho (Year)	1				2		3		4	5	6		7	Total
	a	b	c	d	a	b	a	b			a	b		
Munabi et al., 2014	2	2	2	2	1	2	2	1	2	2	2	2	2	24
Belay et al., 2016	2	2	2	2	2	1	2	1	2	2	2	2	2	24
Ibrahim et al., 2019	2	2	2	2	2	1	2	1	2	2	2	2	2	24
Tanzil et al., 2019	2	2	2	2	1	2	2	1	2	2	2	2	2	24
Yoshimoto et al., 2019	2	2	2	2	1	2	2	1	2	2	2	2	2	24
Mijena et al., 2020	2	2	2	2	2	1	2	1	2	2	2	2	2	24
Ajayi et al., 2021	2	2	2	2	2	1	2	1	2	2	2	2	2	24
Elmannan et al., 2021	2	2	2	2	1	2	2	1	2	2	2	2	2	24
Negash et al., 2022	2	2	2	2	2	1	2	1	2	2	2	2	2	24

Answer score description:

0 = No

1 = Uncertain

2 = Yes

Description of Question Criteria:

1. Formulation of research questions in the PICO acronym

a. Is the population in the primary study the same as the population in the PICO meta-analysis?

b. Is the operational definition of intervention, i.e. the state of exposure in the primary study, the same as the definition intended in the meta-analysis?

c. Is the comparison, i.e. the unexposed status used by the primary study the same as the definition intended in the meta-analysis?

d. Are the outcome variables studied in the primary study the same as the definition intended in the meta-analysis?

2. Methods for selecting research subjects

a. In cross-sectional analytical studies, do researchers select samples from the population randomly (random sampling)?

b. Alternatively, if the cross-sectional analysis of the sample is not randomly selected, do the researchers select the sample based on the outcome status or based on the intervention status?

3. Methods for measuring exposure (intervention) and outcome

a. Are exposures and outcome variables measured with the same instruments in all primary studies?

b. If the variables are measured on a categorical scale, are the cutoffs or categories used the same between primary studies?

4. Design-related bias

If the sample is not randomly selected, has the researcher made efforts to prevent bias in selecting the research subjects? For example, in selecting subjects based on outcome status is not affected by the exposure status (intervention), or in selecting subjects based on exposure status (intervention) is not affected by outcome status .

5. Methods to control confounding

Whether the primary study researcher has made an effort to control the influence of confounding (e.g., conducting multivariate

analyses to control the influence of a number of confounding factors).

6. Statistical analysis methods

a. Did the researcher analyze the data in this primary study with a multivariate analysis model (e.g., multiple linear regression analysis, multiple logistic regression analysis).
b. Whether the primary study reported the effect size or relationship of the multivariate analysis results (e.g., adjusted OR, adjusted regression coefficient).

7. Conflict of interest

Is there no possibility of conflict of interest with the research sponsor, which causes bias in concluding the research results?

An extensive review of the main studies was conducted to assess the effect of heavy weight lifting on low back pain among healthcare workers. This study involved a meta-analysis of 9 articles with a cross sectional study. The article was then extracted and summarized according to the PICO study.

Table 2. Description of the Primary Study of the Effect of Heavy Weight Lifting on Low Back Pain Included in a Meta-Analysis

Author (Year)	Country	Sample	Population	Intervention	Comparison	Outcome
			P	I	C	O
Munabi *et al.*, 2014	Uganda	880	Nurses	Heavy lifting	No heavy lifting	Low back pain (LBP)
Belay *et al.*, 2016	Ethiopia	395	Health Personnel	Heavy lifting	No heavy lifting	Low back pain (LBP)
Ibrahim *et al.*, 2019	Malaysia	1,292	Nurses	Heavy lifting	No heavy lifting	Low back pain (LBP)
Tanzil *et al.*, 2019	Pakistan	300	Doctors, nurses, and paramedics	Heavy lifting	No heavy lifting	Low back pain (LBP)
Yoshimoto *et al.*, 2019	Japan	718	Nurses	Heavy lifting	No heavy lifting	Low back pain (LBP)
Ajayi *et al.*, 2021	Nigeria	336	Health Personnel	Heavy lifting	No heavy lifting	Low back pain (LBP)
Elamannan *et al.*, 2021	Saudi Arabia	323	Nurse	Heavy lifting	No heavy lifting	Low back pain (LBP)
Negash *et al.*, 2022	Ethiopia	423	Healthcare professionals	Heavy lifting	No heavy lifting	Low back pain (LBP)

Based on Table 2, a total of 9 articles with varying research locations, namely from Malaysia (1), Pakistan (1), Saudi Arabia (1), Uganda (1), Ethiopia (3), Nigeria (1), and Japan (1) with a total sample of 5,071. Similarities were found in the study, namely the design of cross-sectional research, the research subjects were health workers, interventions that were given heavy weight lifting with no heavy weight lifting. In this study, there was also a difference in the number of samples, the smallest was 300 and the most was 1,292 people.

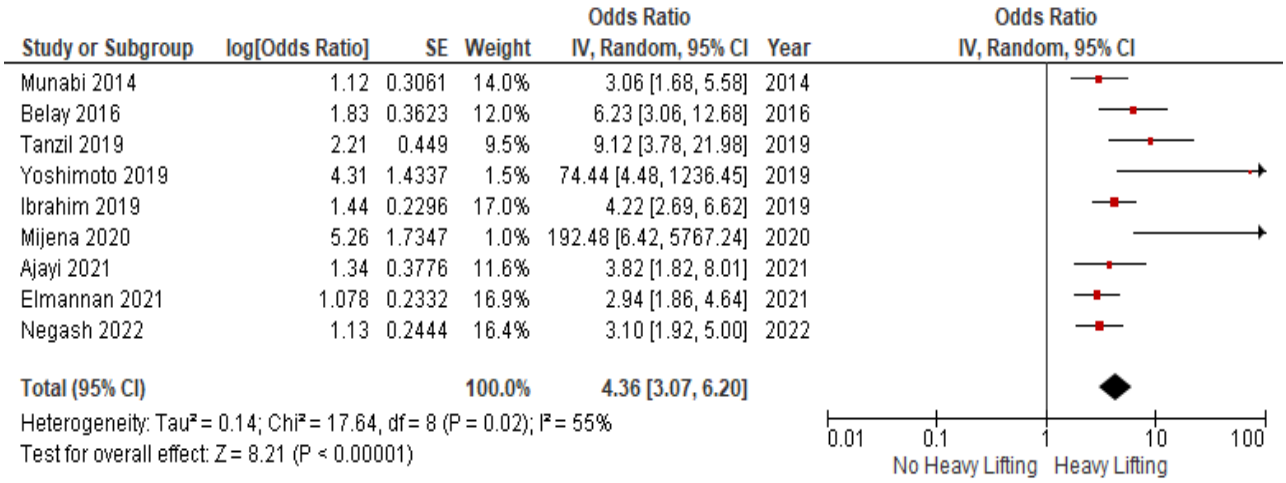

Figure 3. Effect of Heavy Lifting on Lower Back Pain Among Health Workers

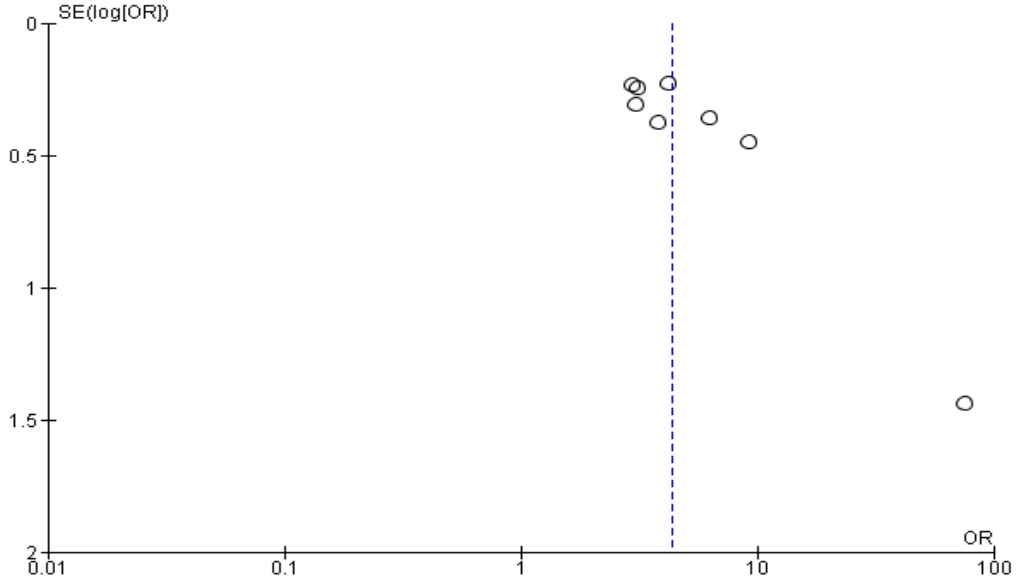

Figure 4. The Effect of Heavy Weight Lifting on Low Back Pain among Health Workers

The forest plot in Figure 3 shows that heavy lifting increases the risk of LBP in health workers. Healthcare workers who performed heavy weight lifting had a 4.36-fold risk of low back pain compared to those who did not, and the results were statistically significant (aOR=4.36; CI 95%=3.07 to 6.20; p<0.001). Heterogeneity of effect estimates among large studies (I^2= 55%; p=0.020). Thus, the calculation of the effect estimate is calculated using the Random Effect Model (REM) approach.

The funnel plot in Figure 4 shows that the effect estimates are more asymmetrically distributed on the left than on the right of the vertical line of the effect average, indicating the presence of publication bias. Because the point estimation is more distributed on the right side than on the left side of the vertical line of the average effect, which indicates the presence of a publication bias. Given the similarity between the distribution in the funnel plot and the position of the diamond in the

forest plot, the publication bias results in an overestimation of the actual effect.

DISCUSSION

Low back pain remains one of the most common occupational health problems among healthcare professionals, affecting a wide range of healthcare workers. A total of 9 case-control studies originating from the African continent and the Asian continent showed that heavy weight lifting increased the risk of low back pain by 4.36 times compared to those who did not, and the results were statistically significant (aOR= 4.36; CI 95%=3.07 to 6.20; p<0.001). Heterogeneity of effect estimates among large studies (I^2= 55%; p= 0.020). Thus, the calculation of the effect estimate is calculated using the Random Effect Model.

The prevalence of heavy lifting in healthcare settings can vary depending on various factors, including the type of work, healthcare facility infrastructure, occupational safety policies, and work culture in each country or region. To reduce the risk of injury, it is important for healthcare facilities to implement policies and procedures that promote good ergonomics, including the use of appropriate lifting aids, proper training in weight lifting, and a balanced workload distribution among staff. In addition, it is also important to pay attention to environmental factors, such as room design and equipment arrangement, to reduce the need for heavy lifting of heavy loads.

An unnatural work attitude can cause the position of body parts to move away from the natural position, for example, the movement of the hands is raised, the back is too bent, the head is raised, and so on. The farther the body part is positioned from the center of the body graffiti, the higher the risk of musculoskeletal complaints, including low back pain. This unnatural work attitude is generally due to the characteristics of the demands of tasks, work tools and work stations that are not in accordance with the abilities and limitations of workers (Tarwaka, 2015).

According to Martiyas et al. (2015), musculoskeletal complaints caused by unnatural work attitudes need to be minimized, because musculoskeletal complaints in workers cause workers to not be able to work optimally. Sumangando et al. (2017) mentioned that one of the risk factors that cause low back pain is occupational risk factors such as frequent bending and stopping, lifting heavy weights (11.3 - 15.8 kg), Fre-quent lifting (<3 seconds/force or 20 forces/ minute), Pushing and pulling (load > 22.5 kg), as well as Heavy carrying (load > 33% of body weight), especially when combined with vibration, and slipping or falling. It can conclude that most health workers experienced a high level of musculoskeletal complaints related to heavy weight lifting tasks.

AUTHORS CONTRIBUTION

Khairunnisa plays the role of a researcher who selects topics, searches and collects research data. Didik Gunawan Tamtomo and Bhisma Murti analyzed the data and reviewed the research documents.

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This study is self-funded.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

ABBREVIATION

WHO= World Health Organization
LBP= Low Back Pain

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