

Occupational Exposure to Wood Dust and Risk of Lymphoma: A Protocol for Systematic Review and Meta-Analysis

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Abstract

Background: Occupational exposure to wood dust is common in industries such as carpentry, furniture manufacturing, construction, and sawmilling. Wood dust is a well-established risk factor for sinonasal cancers; however, its potential association with lymphoma remains unclear. Epidemiological studies have reported inconsistent findings, possibly due to differences in exposure assessment, lymphoma classification, study design, and confounding control. **Objective:** This protocol outlines the methodology for a systematic review and meta-analysis to evaluate the association between occupational exposure to wood dust and risk of lymphoma, including non-Hodgkin lymphoma (NHL), Hodgkin lymphoma (HL), and specific lymphoma subtypes where data permit. **Methods:** A comprehensive search of PubMed/MEDLINE, Embase, Web of Science, Scopus, and the Cochrane Library will be conducted from inception to the date of search. Observational studies (cohort and case-control designs) reporting quantitative effect estimates for wood dust exposure and lymphoma will be included. Two reviewers will independently screen studies, extract data, and assess risk of bias using the Joanna Briggs Institute (JBI) critical appraisal tools. Random-effects meta-analysis will be performed using Stata version 17. Heterogeneity will be assessed using I^2 and τ^2 statistics. Subgroup, sensitivity, and publication bias analyses will be conducted where appropriate. **Conclusion:** This study will provide a comprehensive synthesis of the available evidence regarding wood dust exposure and lymphoma risk, helping clarify inconsistencies and informing occupational health policies.

Keywords: Wood Dust- Lymphoma- Occupational Exposure- Systematic Review

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Introduction

Wood dust is a widespread occupational exposure affecting millions of workers worldwide in industries such as carpentry, cabinet making, furniture production, sawmilling, and construction [1, 2]. Exposure occurs during cutting, sanding, machining, and processing of hardwood and softwood materials [3, 4]. Wood dust has been classified as a human carcinogen for sinonasal adenocarcinoma, with strong evidence supporting its carcinogenic potential in the upper respiratory tract [5-7]. However, the possible relationship between wood dust exposure and hematological malignancies, particularly lymphoma, remains uncertain.

Lymphoma comprises a heterogeneous group of malignancies arising from lymphoid tissues and includes

two main categories: Hodgkin lymphoma (HL) and non-Hodgkin lymphoma (NHL), the latter encompassing multiple B-cell and T-cell subtypes [8, 9]. The etiology of lymphoma involves complex interactions between genetic susceptibility, immune dysregulation, infections, and environmental exposures [10]. Chronic immune stimulation and inflammatory responses, which may occur following prolonged inhalation of organic dusts [11], represent plausible biological mechanisms linking wood dust exposure to lymphomagenesis [12].

Epidemiological studies investigating wood dust and lymphoma have yielded inconsistent results. Differences in study design, exposure assessment methods (e.g., self-reported job history versus job-exposure matrices),

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lymphoma subtype classification, and adjustment for confounders such as solvents or pesticides may contribute to these inconsistencies. A systematic synthesis of available evidence is therefore necessary to clarify the magnitude and direction of this association.

This protocol describes the planned methodology for a systematic review and meta-analysis evaluating occupational wood dust exposure and lymphoma risk.

Methods

Study Design

This systematic review and meta-analysis will be conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P). The final review will follow the PRISMA 2020 guidelines. The protocol will be registered in PROSPERO prior to study selection.

Eligibility Criteria

We will include observational epidemiological studies, specifically cohort studies, nested case-control studies, and case-control studies. Eligible studies must evaluate occupational exposure to wood dust and report quantitative effect estimates (odds ratios [OR], relative risks [RR], hazard ratios [HR], standardized incidence ratios [SIR], or standardized mortality ratios [SMR]) for lymphoma outcomes.

The population of interest includes adult workers or general populations with occupational exposure to wood dust. The comparator group will consist of individuals without exposure or with the lowest exposure category. Outcomes of interest include overall lymphoma, non-Hodgkin lymphoma, Hodgkin lymphoma, and specific lymphoma subtypes where reported.

We will exclude case reports, case series, ecological studies without individual-level exposure assessment, review articles, editorials, and conference abstracts lacking sufficient quantitative data.

Information Sources and Search Strategy

A comprehensive search will be conducted in the following electronic databases from inception to the search date:

- PubMed/MEDLINE
- Embase
- Web of Science
- Scopus
- Cochrane Library

The search strategy will combine controlled vocabulary terms and free-text keywords related to “wood dust,” “woodworking,” and occupational exposure, along with terms related to “lymphoma,” “non-Hodgkin lymphoma,” and “Hodgkin lymphoma.” No initial language restrictions will be applied. Reference lists of included studies and relevant reviews will be manually screened to identify additional eligible studies.

Study Selection

All retrieved records will be imported into a reference

management software, and duplicates will be removed. Two independent reviewers will screen titles and abstracts for relevance. Full texts of potentially eligible studies will then be assessed independently for inclusion. Disagreements will be resolved by discussion or consultation with a third reviewer. The study selection process will be documented using a PRISMA flow diagram.

Data Extraction

Data extraction will be performed independently by two reviewers using a standardized and piloted data extraction form. Extracted information will include:

- First author, publication year, and country
- Study design and study period
- Sample size and number of cases
- Population characteristics (age, sex)
- Lymphoma type and diagnostic criteria (e.g., ICD codes, pathology confirmation)
- Exposure assessment method (self-report, job title, job-exposure matrix, expert assessment, environmental measurements)
- Exposure metrics (ever/never, duration, intensity, cumulative exposure)
- Effect estimates and 95% confidence intervals
- Variables adjusted for in multivariable models

When multiple estimates are reported, the most fully adjusted estimate will be extracted.

Risk of Bias Assessment

Risk of bias will be evaluated using the Joanna Briggs Institute (JBI) critical appraisal tools appropriate for each study design (JBI Checklist for Cohort Studies and JBI Checklist for Case-Control Studies). Two reviewers will independently assess each study across domains including selection bias, exposure measurement validity, outcome assessment reliability, confounding control, and statistical analysis. Discrepancies will be resolved through discussion. Studies will be categorized as having low, moderate, or high risk of bias based on overall appraisal.

Statistical Analysis

All statistical analyses will be conducted using Stata version 17. Effect estimates (OR, RR, HR) will be pooled on the logarithmic scale and reported as pooled relative risks with 95% confidence intervals. Because lymphoma is relatively rare, ORs and HRs will be considered approximations of RRs.

Random-effects meta-analysis models will be used to account for anticipated between-study heterogeneity. Between-study variance will be estimated using restricted maximum likelihood (REML). Statistical heterogeneity will be assessed using Cochran's Q test, I² statistic, and τ^2 .

Subgroup analyses will be conducted, where data permit, according to:

- Lymphoma type (overall, NHL, HL)
- Study design (cohort vs case-control)
- Exposure assessment method
- Geographic region
- Risk of bias category

Sensitivity analyses will include exclusion of high-risk

studies and leave-one-out analyses. Publication bias will be evaluated using funnel plots and Egger's regression test when at least ten studies are available.

Results (Planned)

The results section will present the study selection process using a PRISMA flow diagram, followed by descriptive summaries of included studies in tabular format. Characteristics will include study design, geographic location, exposure assessment methods, outcome classification, and adjustment variables.

Quantitative synthesis will provide pooled risk estimates for overall lymphoma, NHL, HL, and subtypes when sufficient data are available. Forest plots will illustrate individual and pooled estimates. Heterogeneity statistics will be reported, and subgroup analyses will be presented where applicable. Results of publication bias and sensitivity analyses will also be described.

Discussion

This systematic review and meta-analysis aims to clarify the association between occupational wood dust exposure and lymphoma risk. Given the biological plausibility of immune-mediated mechanisms and chronic inflammatory processes, wood dust exposure may contribute to lymphomagenesis. However, inconsistencies across epidemiological studies necessitate careful synthesis.

Potential limitations of the evidence base may include exposure misclassification, particularly in studies relying on job titles or self-reported occupational history. Confounding by other occupational exposures, such as solvents, formaldehyde, or pesticides, may also influence observed associations. Differences in lymphoma subtype classification over time further complicate comparisons across studies.

Despite these limitations, this review will provide the most comprehensive and methodologically rigorous synthesis of available evidence to date. The findings may have important implications for occupational health regulations, workplace exposure standards, and future research directions, particularly regarding subtype-specific risks and exposure-response relationships.

Acknowledgments

Statement of Transparency and Principles

- The authors declare no conflict of interest.
- The study was approved by the Research Ethics Committee of the authors' affiliated institution.
- The study data are available upon reasonable request.
- All authors contributed to the implementation of this research.

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