Neurotoxicity in Construction Painters: A Systematic Review

Occupational Exposure to Solvents and Associated Neurotoxicity

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BACKGROUND

Existing evidence suggests that occupational exposure to solvents can have devastating and adverse effects on cognitive function.1 Individuals in the construction industry, specifically construction painters, often come in contact with these harmful chemicals on a regular basis. A solvent is a liquid that can dissolve, suspend, or extract other materials without chemical change to the solvent itself. They are present in a wide range of industries and can be used for extraction of fats and oils, degreasing, or manufacturing of paints and plastics. Their main routes of exposure are through inhalation and skin absorption, and they have a tendency to accumulate in lipid-rich tissues like the brain.2 It is estimated that 49 million metric tons of solvents are produced every year in the United States, and approximately 10 million people are exposed daily.3 Many solvents used in occupational settings have been shown to adversely affect the central nervous system (CNS), causing a wide range of neurotoxic effects. Symptoms can range from mild nausea, dizziness, and irritability to more serious cases of impaired memory and behavior or alterations to the nervous system.3

THE NAVIGATION GUIDE

A systematic method developed to bridge the gap between clinical and environmental health while evaluating the quality of evidence and providing support for making evidence-based decisions.4

METHODS

Systematic Search and Study Selection

241 records identified from PubMed and Scopus
207 titles and abstracts screened
23 full-text articles assessed for eligibility
184 records excluded for:
  - Irrelevance
  - Nonhuman subjects
  - Unspecified occupation
34 duplicates removed
16 records excluded for:
  - Different health outcome
  - Exposure to another chemical
7 total studies included
  - 1 case-control
  - 1 prospective cohort
  - 5 cross-sectional

Risk of Bias Domains

<table>
<thead>
<tr>
<th>Recruitment strategy</th>
<th>Blinding</th>
<th>Exposure assessment</th>
<th>Confounding</th>
</tr>
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<tbody>
<tr>
<td>Incomplete outcome data</td>
<td>Selective outcome reporting</td>
<td>Other bias</td>
<td>Conflict of interest</td>
</tr>
</tbody>
</table>

Quality of Evidence Factors

Downgrades (-1) | Upgrades (+1)
--- | ---
Risk of bias | Large magnitude of effect
Indirectness | Minimizes effect
Inconsistency | Dose response
Imprecision | --
Publication bias | --

RESULTS

Table 1. Study Results

<table>
<thead>
<tr>
<th>Study Author</th>
<th>Key Finding</th>
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<tr>
<td>Brackbill et al. 1990</td>
<td>Positive association between neuropsychiatric disability and those employed as a construction painter (OR 1.47)</td>
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<tr>
<td>Fidler et al. 1987</td>
<td>96.2% of participants reported symptoms of neurotoxicity. Acute intoxication positively associated with working in the past month (p=0.01)</td>
</tr>
<tr>
<td>Kaukiainen et al. 2004</td>
<td>Dose response relationship of long term solvent exposure and neurotoxic effects. Significant in mood, memory, and concentration (p&lt;0.001)</td>
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*Only three of seven studies included in this table.

CONCLUSIONS

- "Moderate" quality of evidence across all included studies. Some concern with risk of bias and inconsistency.
- "Sufficient" evidence supporting the association between occupational solvent exposure and neurotoxicity in construction painters. A positive relationship was observed between exposure and outcome, and the evidence was from well-designed, well-conducted studies. Future studies are likely to have similar results.
- Future research should focus on identifying other vulnerable populations with past and current solvent exposure. Focusing on the cumulative dose as well as amount of time exposed will help evaluate exposure in terms of intensity of outcome. Long term follow-up studies such as cohort studies are ideal, and large sample sizes and robust exposure assessment methods are key.
- Preventing exposure is critical to employee health, therefore, we must take action immediately to protect our workers.
- Update outdated OSHA standards for solvents
- Educate and train employers on how to properly implement and enforce the hierarchy of controls

REFERENCES