PEER REVIEW HISTORY

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ARTICLE DETAILS

<table>
<thead>
<tr>
<th>TITLE (PROVISIONAL)</th>
<th>Hearing loss in workers exposed to epoxy adhesives and noise: a cross-sectional study</th>
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<tbody>
<tr>
<td>AUTHORS</td>
<td>Yang, Hsiao-Yu; Shie, Ruei-Hao; Chen, Pau-Chung</td>
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VERSION 1 - REVIEW

<table>
<thead>
<tr>
<th>REVIEWER</th>
<th>Thais C Morata</th>
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<tbody>
<tr>
<td></td>
<td>National Institute for Occupational Safety and Health</td>
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<td></td>
<td>USA</td>
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<tr>
<td>REVIEW RETURNED</td>
<td>01-Dec-2015</td>
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</tbody>
</table>

GENERAL COMMENTS

The study addresses a relevant topic, and it was well designed and conducted.
I am not familiar with the exposure scenario of the study participants to understand if there were other risk factors that could explain the findings. I encourage the authors to describe if there are other hazards in such environments in their introduction.

While I remember hearing that dust has been reported to be associated with hearing loss I could not find such reference, but I ask the authors to include this citation: Scand J Work Environ Health. 1975 Jun;1(2):109-16. A health survey of granite workers in Finland: radiographic findings, respiratory function, hearing, electric sensory thresholds of the fingers and subjective symptoms. Ahlman K, Backman AL, Partanen T.

Minor edits:
Page 7, line 7: deleted sentence which is a repetition of a statement made in the previous page "however the effect of epoxy adhesive..."  
Page 7, line 33: it should say scale, instead of scaled.
Page 7, line 39, please clarify what "previous study" means. is there a reference to that that you can cite?

In the discussion the authors should mention that a limitation of their study is that the participants were volunteers, and they might have volunteered because they experience some hearing concerns, what limits the generalizability of their findings.

I encourage the authors to examine the chapter on Mixtures from the document below, as it is very pertinent to their study, and consider adding it as a reference:
https://gupea.ub.gu.se/handle/2077/23240
<table>
<thead>
<tr>
<th>REVIEWER</th>
<th>Adrian Fuente</th>
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<tr>
<td>Université de Montréal</td>
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<td>REVIEW RETURNED</td>
<td>06-Dec-2015</td>
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<tr>
<th>GENERAL COMMENTS</th>
<th>This is an interesting study. However, the way how the manuscript has been prepared does not meet the standards for scientific publications. Specific comments below.</th>
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<tr>
<td>Introduction</td>
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<td>Again, this section is very hard to read. There is no use of subheadings. It is very difficult to follow the ideas. This section has to be re-organised. I encourage the authors to use subheadings.</td>
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Reviewer: 1
Comments to the Author

1) The study addresses a relevant topic, and it was well designed and conducted. I am not familiar with the exposure scenario of the study participants to understand if there were other risk factors that could explain the findings. I encourage the authors to describe if there are other hazards in such environments in their introduction.

Response: Thank you for your comments. This study was conducted based on an occupational cohort of the stone-processing industry in Hualien, Taiwan. Most of the workers in the industry are self-employed or work in small enterprises with less than 5 workers. They are typically insured through the stone laborers' union in Hualien. Funded by the Taiwan Council of Labor Affairs, we conducted a basic occupational health service program for the stone workers between 2006 and 2015. We established the study cohort since 2009 and provided health examination for this cohort every three years. Based on the walk-through survey, there are 7 types of jobs in the stone-processing industry in Hualien, including processing gemstones, crafting large decorations, making vases, making urns, crafting small decorations, making sculptures, and manufacturing building materials. The occupational hazards in the stone industry of Hualien include: (1) Safety hazards: the risk of being pulled into the grinding machine, cutting, falls, eye splash injuries; (2) Physical hazards: noise, use of vibrating tools such as drillers, handheld carving machines, or pneumatic hammers; (3) Ergonomic hazards: repetitive movements and lifting heavy stones; (4) Chemical hazards: dusts, oxalic acid, epoxy resin, and organic solvents. Please see page 7, line 12-17, and page 8, line 17 to page 9, line 9.

2) While I remember hearing that dust has been reported to be associated with hearing loss I could not find such reference, but I ask the authors to include this citation:

Response: Thank you for your comments. We have cited this important study of health effects in stone workers. Please see page 7, line 2, and reference 11.

3) Minor edits:
Page 7, line 7: deleted sentence which is a repetition of a statement made in the previous page "however the effect of epoxy adhesive..."
Page 7, line 33: it should say scale, instead of scaled.
Page 7, line 39, please clarify what "previous study" means. Is there a reference to that that you can cite?
Response: Thank you for your comments. We have deleted the repetition sentence in original page 7, line 7. The word "scaled" has been corrected to "scale". Please see page 7, line 14. This study was conducted based on an occupational cohort of the stone-processing industry in Hualien, Taiwan. Most of the workers in the industry are self-employed or work in small scale enterprises with less than 5 workers. They are typically insured through the stone laborers' union in Hualien. Funded by the Taiwan Council of Labor Affairs, we conducted a basic occupational health service program for the stone workers between 2006 and 2015. An explanatory paragraph for our previous study has been added in page 7, line 12-17 and reference 12.

4) In the discussion the authors should mention that a limitation of their study is that the participants were volunteers, and they might have volunteered because they experience some hearing concerns, which limits the generalizability of their findings.
Response: Thank you for your comments. We have addressed the limitation in page 22, line 15-18.

5) I encourage the authors to examine the chapter on Mixtures from the document below, as it is very pertinent to their study, and consider adding it as a reference: Johnson AC, Morata TC (2010). 142.
Response: Thank you for your comments. We have cited this important reference in reference 10. Please see page 6, line 17.

Reviewer: 2
Comments to the Author
1) Introduction
It is not well organised. It would be good to introduce with full details the organic solvent components founds in epoxy adhesives. In addition, a summary of previous studies may help. Finally, it would be great to describe with full details the uses of epoxy adhesives.
Response: Thank you for your comments. Epoxy adhesive formulations include a combination of epoxy monomers, curing agents (hardeners), diluents, and a vast number of chemical ingredients. Many composite materials in epoxy systems can cause asthma and contact dermatitis. Styrene, chlorobenzene, and carbon disulphide are commonly used as diluents for epoxy adhesives and are more volatile than other components. However, the organic solvents used in epoxy resins are complex. Stone workers use numerous types of epoxy adhesives, and the containers are not labeled. Stone workers generally call them "AB glue" without knowing their components. Please see page 6, line 13 to page 7, line 2, and page 9, line 11-13.

2) Method
This section is not well organised either. First of all, it is very important to explain how the three groups of subjects were selected. When the authors mention noise exposure, which levels are they considering? Above 85 dBA TWA?
Response: Thank you for your comments. The METHODS has been largely revised. Study subjects were stratified into three exposure groups: (1) stone workers with epoxy adhesive exposure, (2) stone workers without epoxy adhesive exposure, and (3) administrative staff. Administrative staff was used as the reference group to assess the dose-response relationship for hearing losses greater than 25 dB at each frequency. The mean 8-hour time-weighted noise exposure measured in 40 representative stone-processing workplaces was 87.7 dBA. We stratified the study subjects by stone workers and administrative staff. Please see page 16, line 12-15, and page 17, line 12-13.

3) There are a number of issues that are not clear. People were contacted directly. I believe businesses' owners agreed to participate in the study. The number of businesses is not mentioned. Were all male subjects?
Response: Thank you for your comments. We have added the number of business and percentage of male gender in the following sentence: "A total of 316 workers from 310 stone-processing workplaces were included in the final analysis, the majority of whom (94%) were self-employed. Their mean age was 51.3 years (SD 8.5), and 41% of the subjects were male." Please see page 19, line 6 to 9.

4) Regarding measurements for noise exposure levels, the authors mention that 40 representative noise assessments were conducted in 15 workplaces. Details about how these workplaces were selected should be given. How do we know that 15 workplaces are representative for the entire sample?
Response: Thank you for your comments. Between 2006 and 2009, we conducted a total of 40 representative noise assessments in 15 representative workplaces that covered all types of jobs for the study subjects (please see Table 1), including one gemstone-processing workplace, one that constructed large decorations, three vase-producing workplaces, two urn-producing workplaces, five that made small decorations, one that focused on sculptures, and two that manufactured building materials (please see Supplementary Table 1). We have added the sentence in METHOD. Please
5) Noise levels were obtained between 2006 and 2009. However, airborne solvent concentrations were obtained in 2014. Why was this?
Response: The study was based on a basic occupational health service program for stone workers in Hualien. We performed consecutive walk-through surveys of stone-processing workplaces of Hualien between 2006 and 2015. The noise exposure measurements were taken between 2006 and 2009. Based on our walk-through surveys in the stone industry, workers used various epoxy adhesives during specific procedures, such as attaching stones and coating stone’s surface, and these procedures were performed differently on different days. We then performed the volatile organic compounds samplings in 2014. Since most stone industries are small businesses where workers use basic equipment, and there have been no important changes in processing methods during this time period. We thus tentatively believe that measurements taken in different years would not have influenced the results of the exposure assessment. We have added the description in Discussion. Please see page 21, line 18 to page 22, line 7.

6) When was pure-tone audiometry obtained? What do the authors mean by national standard for pure-tone audiometric testing?
Response: All of the participants received a health examination between 2009 and 2010, which included the pure-tone audiometry (PTA). Subjects were prevented from noise exposure for 14 hours before the hearing examination. The physician performed otological examinations on all of the subjects to rule out any otic diseases. The PTA was obtained using test frequencies of 0.5, 1, 2, 3, 4, 6, and 8 kHz. Tests at each frequency were performed separately in each ear. Audiometric examinations were administered in a qualified audiometric test room in accordance with the national standard of Taiwan, which states that the background noise levels for audiometric tests must be less than 30 dB across the frequency range and that the audiometric tests must be performed by a certified hearing specialist. We have added the sentence in page 15, line 8-15.

7) The authors mentioned “types of jobs”. These types of jobs must be clearly specified.
Response: Thank you for your comments. Based on our walk-through survey, there are 7 types of jobs in stone-processing industry in Hualien, including processing gemstones, making large decorations, making vases, making urns, making small decorations, making sculptures, and manufacturing building materials. We have clearly specified the type of job in page 10, line 7-10.

8) How was occupational hearing loss defined? A notch for one or two frequencies? This is a major comment as this study is about hearing loss associated with epoxy adhesive exposure.
Response: The occupational hearing loss was defined using the following criteria: (1) a confirmed occupational history of stone carving, (2) confirmation that no other work could result in hearing loss except for processing stone, (3) no past history of otitis media or congenital or drug-induced hearing loss, (4) the presence of a notch at 4 or 6 kHz and hearing threshold levels at a frequency greater than 25 dB, and (5) symmetrical hearing loss. Please see page 15, line 15 to page 16, line 3.

9) I suggest the authors should better organise this section. Information about the use of epoxy adhesive in this particular industry should be given with details. Then, information about different job categories should be addressed. Aspects such as use of personal protective equipment may be also given in this section. Alternatively, it can be given within the results section but using the appropriate subheading.
Response: Thank you for your comments. Based on our walk-through survey, there are 7 types of jobs in stone-processing industry in Hualien, including processing gemstones, making large decorations, making vases, making urns, making small decorations, making sculptures, and manufacturing building materials. Epoxy adhesives are commonly used to fix rocks to lathes, to stick different stones together, to caulk cracks, and to coat and strengthen the surfaces of stones when they are carved,
shaped, ground, or polished. Stone workers use numerous types of epoxy adhesives, and the containers are not labeled. Stone workers generally call them "AB glue" without knowing their components. The mixing and application of epoxy adhesives are usually performed using simple equipment without ventilation. Solvents could be inhaled and affect the workers' health. However, personal protective respiratory and hearing equipment are seldom used among these stone workers. Please see page 9, line 1-3 and page 9, line 9-12. We have re-organized the METHODS and used appropriate subheading in the RESULTS.

10) Results
Again, this section is very hard to read. There is no use of subheadings. It is very difficult to follow the ideas. This section has to be re-organised. I encourage the authors to use subheadings.
Response: Thank you for your comments. We have largely revised the RESULTS and used subheadings. Please see page 17, line 11 to page 20, line 12.
Hearing loss in workers exposed to epoxy adhesives and noise: a cross-sectional study

Hsiao-Yu Yang, Ruei-Hao Shie and Pau-Chung Chen

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