PEER REVIEW HISTORY

This paper was submitted to the JECH but declined for publication following peer review. The authors addressed the reviewers' comments and submitted the revised paper to BMJ Open. The paper was subsequently accepted for publication at BMJ Open.

ARTICLE DETAILS

TITLE (PROVISIONAL)	A cross-sectional study of hearing thresholds among 4627 Norwegian train and track maintenance workers
AUTHORS	Lie, Arvie; Skogstad, Marit; Johnsen, Torstein; Engdahl, Bo; Tambs, Kristian

VERSION 1 - REVIEW

REVIEWER	Henrik Kolstad, professor of occupational medicine Aarhus University Hospital, Denmark
REVIEW RETURNED	16-Jul-2014

GENERAL COMMENTS	This cross sectional study observes slightly higher hearing threshold levels (HTL) and prevalence of audiometric notches among older occupationally noise exposed train and track maintenance workers when compared with a reference population not exposed to noise at work. The increased risk of hearing loss following occupational noise exposure is well documented and this study does not provide new insight into this that, in my opinion, is relevant for the readers of a scientific journal of general medicine as BMJ Open, but may be so for a journal of occupational health. The authors state that an extensive noise exposure measurement program has been conducted for this population but no data are provided. It would have been a significant strength if this was the case. Especially, if noise levels were categorized by e.g. job title and calendar year (a job exposure matrix) and subsequently matched with the participants to provide individual exposure estimates. The authors question the relevance of the audiometric notch and this is highly relevant, because it is generally accepted that the notch is pathognomonic for noise induced hearing loss even if the empirical evidence is limited. If they can combine the audiometric data (and they have computerized high quality data back to 1994!) with employment history (this should be available in the personnel files of a state railway company) and good noise dosimetry data, this dataset could be able to shed light on the notch dogma as well as other aspects of the exposure response relation between noise exposure and HTL. Such analyses would be very interesting for the readers of general medical journals as well as journals of occupational medicine.

REVIEWER	Patrick Feeney National Center for Rehabilitative Auditory Research Portland VA Medical Center USA
REVIEW RETURNED	19-Jul-2014

GENERAL COMMENTS	Statistical analysis is not clear in table 2. Additional references are suggested. Results would be strengthened by examining notches at 3, 4 and 6 kHz. Suggestions are made for improving English. This cross-sectional study examines hearing thresholds and audiometric notches in a large sample of train and track maintenance workers and office workers obtained in the Occupational Health Service (OHS) of the Norwegian State Railways. The findings suggest little difference in hearing in these 3 groups until the 35-44 year old age group for both audiometric notches and for NIHL criteria for the worse ear. One criticism is that the study acknowledged the frequency of 3, 4 and 6 kHz in the NIHL criteria, but only examined notched audiograms at 4 kHz. This may have the effect of reducing the prevalence of notches in younger ears (see Gates et al. 2000 Hear Res 141, 220-228). Even the median audiograms in Figure 1 have a notch at 6 kHz for the first 3 age groups. Comparison of hearing losses with other published studies in railway workers would be informative e.g. Henderson & Saunders (1998) Ear and Hear 19, 120-30; Prosser et al. (1988) Br J Audiol 22, 85-91; Kryter (1991) J Acoust Soc Am 90 3180-95. It is not clear from Table 2 how the different statistical tests were used for each analysis. Minor comments/edits Abstract Methods: page 2 last sentence: did you mean worse ear? Conclusion: "…have a slightly greater hearing loss…" Page 4 line 8 chemicals may also affect hearing and so Page 4 paragraph 2 How does this compare to published noise exposures? E.g. Landon, Breysse & Chen (2006) Am J Ind Med 47 p 364 -9. Page 4 line 28 Clarify "20 dB or more for all of 3, 4 and 6 kHz" Does this mean the average at these frequencies or 20 dB or more at each of these frequencies, or something else? Page 4 line 47 Explain acronym OH. Page 4 line 49 exposure using dosimetry… The exposure shows high variability,… Page 5 line 10 audiograms Page 5 line 22/23 Hearing Examination Page 5 line 36 should be dB HL not dB (A) Page 6 table 1. How was the <70 exposure determined? Page 2 Table 2 It's not clear what is being reported in the first section for Train maintenance and Track maintenance workers and why the Internal ref is 0.0. Page 7 line 42 should be 63% according to Table 2. Page 7 line 51 significantly greater hearing loss Page 8 line 2 This could also be due to the lower exposure time in

	years for the younger workers. Similarly the older workers have a greater number of years of exposure. Page 8 Line 11 suggest “The strengths of the present study include:…” Page 8 Line 26 Reword limitation …of limited.. Page 8 Line 43 to 46 I don’t understand the last two sentences. Page 9 line 6 …the validity of predicting noise… Page 9 line 9 …hearing loss based soley on audiograms is … Figure 1 Suggest leading the figure caption with 50th percentile hearing thresholds…suggest changing the scale to 0 – 40 dB so that the individual curves can be seen with greater clarity. Suggest showing figures only, not figures and tables. Figure 2. Suggest leading the figure caption with 90th percentile hearing thresholds…

VERSION 1 – AUTHOR RESPONSE

Reviewer Name Patrick Feeney
Institution and Country National Center for Rehabilitative Auditory Research
Portland VA Medical Center
USA
Please state any competing interests or state ‘None declared’: None declared Comment: Done
Statistical analysis is not clear in table 2. Comment: Done
Additional references are suggested. Comment: Have been considered, but according to my judgments, they are not very relevant (see later comments)

Results would be strengthened by examining notches at 3, 4 and 6 kHz. Comment: Done
Suggestions are made for improving English. Comment: Done

This cross-sectional study examines hearing thresholds and audiometric notches in a large sample of train and track maintenance workers and office workers obtained in the Occupational Health Service (OHS) of the Norwegian State Railways. The findings suggest little difference in hearing in these 3 groups until the 35-44 year old age group for both audiometric notches and for NIHL criteria for the worse ear.

One criticism is that the study acknowledged the frequency of 3, 4 and 6 kHz in the NIHL criteria, but only examined notched audiograms at 4 kHz. This may have the effect of reducing the prevalence of notches in younger ears (see Gates et al. 2000 Hear Res 141, 220-228). Even the median audiograms in Figure 1 have a notch at 6 kHz for the first 3 age groups. Comment: We have used another notch definition in the revised paper (Coles notch) which includes 3,4 and 6 kHz.

Comparison of hearing losses with other published studies in railway workers would be informative e.g. Henderson & Saunders (1998) Ear and Hear 19, 120-30; Prosser et al. (1988) Br J Audiol 22, 85-91; Kryter (1991) J Acoust Soc Am 90 3180-95. Comment: Considered, but the Prosser paper is about hunting and hearing loss, the Henderson paper is a highly selected material from compensation claimants. Kryter uses the term “trainmen” with no more specifications. Out paper is specifically about train and track maintenance workers who have an exposure and hearing different from train drivers and conductors.

It is not clear from Table 2 how the different statistical tests were used for each analysis. Comment: Improved

Minor comments/edits

Abstract
Methods: page 2 last sentence: did you mean worse ear? Comment: No
Conclusion: "…have a slightly greater hearing loss…"
Page 4 line 8 chemicals may also affect hearing and so Page 4 paragraph 2 How does this compare to published noise exposures? E.g. Landon, Breysse & Chen (2006) Am J Ind Med 47 p 364 - 9.Comment: This suggested paper is not relevant since it only deals with noise exposure and has no information on chemical exposure nor hearing.
Page 4 line 28 Clarify "20 dB or more for all of 3, 4 and 6 kHz" Does this mean the average at these frequencies or 20 dB or more at each of these frequencies, or something else? Comment: Done
Page 4 line 47 Explain acronym OH. Comment: Done
Page 4 line 49 exposure using dosimetry… The exposure shows high variability,… Comment: Done
Page 5 line 10 audiograms Comment: Done
Page 5 line 22/23 Hearing Examination Comment: Done
Page 5 line 36 should be dB HL not dB(A) Comment: Done
Page 6 table 1. How was the <70 exposure determined? Comment: None-exposed workers in a control room. Screening assessment.
Page 2 Table 2 It's not clear what is being reported in the first section for Train maintenance and Track maintenance workers and why the Internal ref is 0.0. Comment: Have tried to improve
Page 7 line 42 should be 63% according to Table 2. Comment: Done
Page 7 line 51 significantly greater hearing loss Comment: Done
Page 8 line 2 This could also be due to the lower exposure time in years for the younger workers. Similarly the older workers have a greater number of years of exposure. Comment: Done
Page 8 Line 11 suggest "The strengths of the present study include:…" Comment: Done
Page 8 Line 26 Reword limitation …of limited.. Comment: Done
Page 8 Line 43 to 46 I don't understand the last two sentences. Comment: Tried to clarify
Page 9 line 6 …the validity of predicting noise… Comment: Done
Page 9 line 9 …hearing loss based solely on audiograms is … Comment: Done Figure 1 Suggest leading the figure caption with 50th percentile hearing thresholds…suggest changing the scale to 0 – 40 dB so that the individual curves can be seen with greater clarity. Suggest showing figures only, not figures and tables.
Figure 2. Suggest leading the figure caption with 90th percentile hearing thresholds… Comment: Disagree. A different scale in the two figures is not to prefer.

VERSION 2 – REVIEW

REVIEWER	Patrick Feeney National Center for Rehabilitative Auditory Research, Portland VA Medical Center, USA
REVIEW RETURNED	19-Aug-2014

GENERAL COMMENTS	The use of the Coles notch criteria expands the consideration of notches to 3 and 6 kHz in addition to 4 kHz. This resulted in a new finding that young workers (<44 years) had a statistically greater percent of noise notches in the exposed workers than in controls. This differs with the percent of exposed workers meeting NIHL criteria hearing loss, which is not significant for workers <35 years. This is a new, interesting finding and suggests that the assessment of notches in the worse ear is a more sensitive measure of impending noise damage than the NIHL criteria hearing loss. This should be mentioned in the Results and discussed in the Discussion section and added to the abstract. Also, I suggest that you repeat the Norwegian NIHL criteria for hearing loss in the Table 2 legend for clarity for the reader.