

Investigation of Hand-Arm Vibration (HAV) in Railroad Track Workers: Addressing Stakeholder Conflict of Interest †

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Abstract: The use of powered hand tools and equipment that exposes track workers to HAV vibration and other biomechanical hazards in the USA was investigated by a research team, following scientific principles and guidelines including protecting confidentiality of study participants. Musculoskeletal symptoms and neuro-musculoskeletal disorders were linked to workplace physical factors, such as HAV, and were reported in peer-reviewed journals. The methodology and results were subsequently challenged by a team of consultants hired by the Association of American Railroads (AAR), which represents major North American railroad corporations. Such an influence appears to challenge the integrity of occupational health research and impede the conduct of such research.

Keywords: physical hazard; hand-arm vibration; occupational epidemiology research; methods; conflict of interest; ethics; railroad; track workers; maintenance-of-way; epidemiology

1. Introduction

The National Institute of Safety and Health (NIOSH) estimated that more than 1.5–2 million workers in the United States (U.S.) are regularly exposed to hand-arm vibration (HAV) at work [1]. These old estimates did not include railroad maintenance-of-way (MoW) workers, who work on 140,000 miles of rails in the U.S., primarily owned by seven major class-one railroad corporations, represented by the Association of American Railroads (AAR). The job duties of a MoW worker have been often compared to general construction workers, but there are a number of specific and important differences regarding their special tools and work practices. Their work entails the use of heavy old-style hand tools and, more recently, makes use of powered hand tools and automated equipment that exposes workers to HAV. A university-based study team was tasked to collect epidemiological data from the members of the Brotherhood of Maintenance of Way Employees (BMWED) union. The results of the study were published recently in peer-reviewed journals [2–4]. The publications initially prompted an email inquiry to a co-investigator (P.L.) requesting access to our “raw data” because of “the overlap of interest”, in order “to conduct additional analysis” by an “Occupational Epidemiologist” [5], without disclosure of the contractual affiliation of this “researcher” with the AAR and his other interested parties, who were hired by the AAR to reply to the published study results. The BMWED is the owner of the “raw data” and they denied this data request, indicating that the request had also been followed-up by additionally named “disclosed colleagues”, of who all are well known for their robust “expert witness practices” on behalf of the major US railroads [6]. The union’s concern was also based upon a “history of retaliation by railroad employers against employees who report injuries”, a history which we documented in our reply [7]. This was followed up by individual letter(s) to the editors of the journals publishing our research by four named AAR consultants with academic and legal consulting firm affiliations.



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These AAR consultants stated “*several concerning scientific limitations. Taken together, these limitations result in a manuscript that substantially misleads the readership on the associations between workplace factors and musculoskeletal disorders, as well as their conclusions on biomechanical risk for MOW employees*” [8–10]. The authors of these letters acknowledged that they received “partial funding” by the AAR for the preparation of the letters, but, other than methodological arguments, did not provide any compelling or objective data of their own in support of their assertions. The AAR consultants did cite conference proceedings of their AAR railroad-funded tool and equipment research; however, their research has never been published in peer-reviewed journals in order to allow the scientific community to evaluate their methods [11]. In detailed replies, the arguments of the AAR consults were addressed and a conflict of interest (CoI) of these authors was raised [7,11,12]. The challenge for occupational health research is to avoid or control any CoI by the funding sources or other influences.

2. Original Study Results

Briefly, the details of the methods, materials and key findings of our MoW study were reported in the three peer-reviewed journals based on a comprehensive questionnaire addressing work practices, work factors and the health of approximately 34,580 current BMWED members and 3975 retirees. Survey responses were received between 1 August 2016 and 28 February 2017. The survey was answered by 4816 members and retirees in full or in part, amounting to approximately a 12% response rate. The survey questions on vibration exposure and symptoms were based on validated instruments, primarily the collaborative European VIBRISKS project [13]. Musculoskeletal symptoms and disorders were reported by the MoW survey respondents [2–4].

MoW workers frequently reported typical hand-transmitted vibration-related symptoms, and appeared to be at risk for neuro-musculoskeletal disorders of the upper extremity. Compared to all U.S. employed men aged 18–74 years, active BMWED men were more likely to have been told by a doctor or a health professional that they have carpal tunnel syndrome (CTS) (7.9% vs. 3.6%) [2]. Daily or weekly symptoms during the past year, consistent with vibration-related disease (fingers going white (blanching) when exposed to cold ($n = 143$, 3.7%)), and having experienced white fingers where the whiteness was clearly demarcated (showed clear limits or boundaries) ($n = 77$, 2.0%). In addition, 8.0% ($n = 314$) reported difficulty picking up very small objects, such as screws or buttons, or opening tight jars [4]. In addition, workers reported biomechanical, WBV and HAV exposures, and associations between those exposures and health outcomes.

Compared with U.S. employed men, adjusted for age, race and region, active male MOW workers were more likely to report “repeated lifting, pushing, pulling, or bending” at work (74.6% vs. 46.9%), and not enough staff (88.1% vs. 65.2%). They were less likely to report management priority on workplace health and safety (59.37% vs. 94.8%), ability to make job decisions on their own (68.4% vs. 87.7%), and supervisor support (60.3% vs. 90.8%) (all comparisons, $p < 0.001$) [2].

Associations were found between the use of high-vibration vehicles and neck pain (aPR = 1.47, 95% confidence interval (CI): 1.07–2.03) and knee pain (aPR = 1.38, 95% CI: 1.04–1.82) for more than 1.9 years (vs. 0 year) of full-time equivalent use, but not back pain. Back pain radiating below the knee (sciatica indicator) was associated with high-vibration vehicle use greater than 0.4 and less than 1.9 years (aPR = 1.58, 95% CI: 1.15–2.18) [3].

Powered hand tools were ranked according to each tool’s listed average segmental vibration emissions and self-reported average use. In the analyses of specific tool-related work exposures and shoulder, elbow and hand/wrist symptoms, the ranked frequency of tool use, as reported by the MoW worker survey participants, was calculated (adjusted for age, region, race/ethnicity, smoking, second job vehicle vibration, spare time vehicle vibration) and listed in two detailed tables of the article. The average duration of full time equivalent exposure values ranged from 5.04 y of vibration exposure (impact wrench) to 0.06 y of vibration exposure (scabbler). It is noteworthy that 50% of users of nine of the

ten highest ranked tools in the tables indicated that they “always” or “often” used that tool. A significantly increased risk in pain was seen after 10 y (x fraction of a day) use of various powered hand tools, ranging from 32% (asphalt tamper, $n = 336$) to 71% (nut splitter, $n = 176$) increased risk [4]. A literature review and analysis of HAV emissions of MoW hand tools was conducted using published resources by independent, governmental and commercial/manufacturer sources [4]. Of all of the powered hand tools used by this track worker trade, 88% of the selected tools exceeded a 5 m/s^2 emission level and were above vibration emission magnitudes of common tools of other comparable industries.

3. Summary and Conclusions

Scientific publications about identified workplace hazards that require employer attention may have legal consequences under the US Federal Employers Liability Act (FELA), as a “notice to employers”, i.e., the US railroad corporations, showing “negligence and proximate cause”. In our replies to the Letter(s)-to-the-Editor by the AAR consultants, we emphasized that we followed guidance from our respective Institutional Review Boards (IRBs) and an international and independent scientific advisory panel regarding assuring participant confidentiality and protection from reprisals, and the methodology, design of the survey instrument, and data acquisition and analysis. Potential study limitations, including the use of workers’ self-report of symptoms and workplace exposures, and a low survey response rate, were acknowledged, and the methods for statistical adjustments were described in the replies to the letters [7,11,12].

Corporate influence on public and occupational health research, challenges to research study reports and publication of biased science has a long history in the United States [14–16]. Such influence is designed to challenge the credibility of occupational health research. We fully support the idea that scientific integrity is based on the principle that research is conducted as objectively as possible. Public health and occupational health rely on the integrity, objectivity and validity of data, as well as disclosing all possible CoIs of the authors. Physician-industry or -Union collaboration may trigger the “imputation of motive” and a raised “doubt” or “concern” is meant to be an assault on science [14–16]. Occupational safety and health research needs to recognize and manage these possible CoIs when investigating workplace conditions, and investigators should “design and carry out their activities on a sound scientific basis with full professional independence and follow the ethical principles relevant to health and medical research work” [17]. CoIs can be controlled by adhering to a professional “Code of Ethics”, such as that outlined by the American College of Occupational and Environmental Medicine (ACOEM) or the Code of Ethics of the International Commission on Occupational Health (ICOH). The primary responsibility should be the health and safety of the individual in the workplace and the environment [18]. A cooperative study by the stakeholders could occur if the AAR and the railroad companies accept the BMWED invitation for a joint study. Researchers from NIOSH have offered technical assistance for any further follow-up intervention studies. Such a study could include a review of anonymous medical claim and disability data specific to recognized HAV related medical conditions. Such studies could also include evaluations of interventions involving ergonomically designed hand tools and equipment with improved vibration attenuation technology.

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Institutional Review Board Statement: The study [2–4] was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of the Cook County Hospital (Chicago, Illinois) and the State University of New York-Downstate Medical Center (Brooklyn, New York). To ensure that the identity of all survey participants would be legally protected from discovery, a Certificate of Confidentiality was issued by the National Institutes of Health (NIH), USA.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study [2–4].

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article. Cited study data of the referenced publications is under the ownership of the BMWED.

Conflicts of Interest: Johannung has been evaluating and treating railroad workers and represented some in Federal Employers Liability Act (FELA) disability claims. Landsbergis is a consultant to the Center for Social Epidemiology, Marina Del Rey, CA, on issues related to work organization. The BMWED funded the MoW study and facilitated access to the union’s membership for informed consent and survey administration, but had no role in the analyses, or interpretation of data; in the writing of the manuscripts; or in the decision to publish the results.

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