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## Short Communication

# Concerning the relationship between noise on board ship and the onset of hypertension in seafarers

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Establishing a causal relationship between noise level and the onset of high blood pressure is a controversial topic which has been debated for over forty years. This question may seem to some to be secondary, even insignificant, but the considerable number of studies on this issue confirm that is a public health problem that should not be overlooked. Indeed, noise is a ubiquitous nuisance and arterial hypertension a disease that endangers peoples' lives.

In August 2020 a German team [1] (Bolm-Audorff et Al.) published a new meta-analysis on this subject in the International Journal of Environmental Research and Public Health ("Occupational noise and hypertension risk: A systematic review and metaanalysis"). The team selected 180 eligible works from 4,583 papers collected from large databases, ultimately including only 23 in the meta-analysis. To my surprise, one of the 23 articles selected is one that I published in French in 1986, in Archives des maladies Professionnelles [2]. This work involved 455 merchant seamen aged 40 to 55. 164 were engine room personnel and 291 were deck crew. The difference in noise exposure level between these two categories of seafarers was evidenced by the existence of a notch at 4000 Hz, typical of damage due to noise above 85 dB (A) in engine room personnel, while this notch was not found among the deck crew [3]. The hypertensive sailors included in the survey were those who had permanent levels of systolic blood pressure (SBP) greater than 140 mmHg and of Diastolic Blood Pressure (DBP) greater than 90 mmHg, or who were taking antihypertensive medication issued by their attending physician. All blood pressure measurements were taken by the same doctor, using a mercury tensiometer. We calculated a prevalence of 18.90% (12.8–25%) of confirmed hypertension among engine room personnel

against 11.68% (7.92–15.44%) among deck crew ( $p < 0.05$ ). The calculated relative risk was 1.62 (1.03–2.53). No relationship was found between the extent of hearing loss and the existence of hypertension. This risk was independent of other causes of hypertension (obesity, alcoholism, family history). Our paper also indicated that the occurrence of hypertension was linked, on the one hand, to a high level of noise (>85 dB (A)) and, on the other hand, to a long duration of exposure to noise, greater than 20 years. The conclusions of the Bolm-Audorff meta-analysis [1] provide clear evidence for the relationship between exposure to industrial noise above 85 dB (A) and the risk of arterial hypertension. This relative risk is calculated at 1.72 (1.48–2.01). Although some studies [4] do not demonstrate this relationship, including in the maritime environment [5] (that is the reason why it is always a hypothesis), several other recent metaanalyses [6–9] also conclude that there is a positive relationship between noise and hypertension. Fu, et al. [6] found a relative risk at 1.62 (1.40–1.88) and Skogstad [7] at 1.68 (1.10–2.57), equivalent to that which we had calculated. The mechanism mentioned by Maschke [10] is a vasoconstriction effect caused by a central action due to noise, causing an increase in peripheral resistance, as well as an increase in the release of stress hormones (adrenaline, norepinephrine and cortisol).

The resumption of our work, dating back almost 40 years, in this very recent metaanalysis, inspires us a few thoughts:

1. The maritime environment constitutes a model, an *in vivo* laboratory, making it possible to study the reactions of human beings to physical constraints such as noise and vibration, but also psychological (stress,



confinement, isolation, boredom), or again, as we have seen recently with the Covid 19 pandemic, spread of infection in confined living and working environments.

2. Over the past 40 years there has been significant technological progress concerning the reduction of noise levels on board ship (improved insulation of living areas, automation of engines, soundproofed surveillance rooms, diesel-electric propulsion...) and engine room personnel are subjected to less noise that might cause damage to their health such as deafness or, as regards this letter, hypertension. Tu and Jepsen [11] report it all the same ("Measured noise levels are highest in the engine rooms, followed by the levels on deck. This may partly explain the high prevalence of hypertension for seafarers working in these two areas."). On the other hand, Oldenburg [12] does not include noise as the cause of hypertension in sailors. However, the same author has recently shown that engine room personnel remain exposed to harmful noise levels, greater than 85 dB (A) [13].
3. We must also maintain strict medical surveillance among fishermen, many of whose vessels are still very noisy, and should not forget that noise is added to many other risks of hypertension, such as obesity, a sedentary lifestyle and alcoholism.

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