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*Canadian*
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## Journal Canadian Hearing Report

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# Based on Bandpass Filters and a Compound Deep Denoising Autoencoder, Speech Enhancement for Hearing Impaired

By Joseph Millan*

## INTRODUCTION

Speech is the most basic form of human communication. The voice signal is usually mixed with other signals transferring energy at the same time, which might be noise or even separate speech signals, in most noisy settings. As a result, improving speech quality and decreasing speech intelligibility is critical. Speech Enhancement (SE) techniques have been used in high-tech communications systems such as mobile communication and speech recognition, as well as hearing aids. The fundamental goal of SE algorithms is to enhance various elements of speech perception that are distorted by additive background noise. SE algorithms are used in Hearing Aids (HA) to clean the noisy signal before amplification by decreasing background noise, which is extremely difficult for hearing-impaired people to communicate in situations with varied levels and types of noise. Reduced background noise causes speech distortion, which lowers speech intelligibility in loud situations in many cases. It is a subjective performance evaluation metric since quality reflects the individual tastes of listeners. Because it provides the percentage of words that can be properly identified by listeners, intelligibility is an objective metric. The significant difficulty in creating an efficient SE algorithm for hearing aids based on these two criteria is to improve overall speech quality and intelligibility by reducing noise without generating detectable signal distortion. Many ideas and methods to SE have been developed and suggested throughout the years. In the correlation domain, spectral subtraction methods were suggested, and subsequently he presented the spectral subtraction methodology in current hearing aids for real-time speech augmentation. When speech pauses, the method employs a vocal activity detector to estimate the noise spectrum, which is then subtracted from the noisy speech to determine the clean speech. This method typically results in a different form of noise in each frame at random frequency positions.

This sort of noise is known as musical noise, and it can be more distressing than the original distortions, not only to the human ear but also to SE systems. Using a directional microphone, scientists employed the Wiener filter approach based on previous SNR estimate to improve voice quality. The all-pole spectrum of the voice signal, on the other hand, might have abnormally strong peaks, resulting in a substantial drop in speech quality. The log-magnitude-based Minimum Mean Square Error (MMSE) method was proposed in. The method finds the coefficient by minimising the log-magnitude spectra's mean square error (MSE). Meanwhile, deep neural network (DNN) methods have attracted a lot of interest and promise in the field of SE. For speech denoising, for example, scientists employed a DNN model. When confronted with noisy speech inputs, the model predicts clean speech spectra without the need for RBM pre-training or complicated recurrent structures. To increase the quality of voice, scientists presented a regression model of the denoising autoencoder (DAE). Based on the log-power spectra (LPS) characteristic, the model translates a noisy input to a clean signal. In the training step, the researchers employed several forms of noise to acquire an exceptional capacity to generalise to unknown noise settings.

Deep neural networks have been successfully used to improve speech. An individual neural network with a fixed number of hidden layers, on the other hand, causes strong interference for large variations in speech patterns and noisy environments, which can result in a slow learning process, poor generalisation in an unknown signal-to-noise ratio in new inputs, and some residual noise in the enhanced output.

## AGE RELATED FACTORS IN HEARING

Aging populations are a worldwide concern, not a problem restricted to a single country. As a result, rather than being treated as an individual concern, the health problems of the elderly should be handled at the national level of public health. Due to their diminished capacity to speak, the elderly over the age of

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65 typically have various challenges in listening situations, resulting in less social relationships and a lower quality of life. At the same time, the elderly may experience difficulties with situational awareness in everyday situations such as hearing a fire alarm, hearing a car horn in traffic, seeing incoming items on the street, and falling things. These age-related problems are frequently associated with age-related hearing loss (ARHL, also known as presbycusis), one of the three major chronic geriatric illnesses and a secondary cause of social, functional, and psychological decline.

Both the peripheral and central auditory systems eventually lose function as people age. As a result, the elderly frequently exhibit poor performance in their orienting sense to various sound sources and find it difficult to hear speech in the midst of background noise, contributing to the aforementioned difficulties. Scientists hypothesised that older people with ageing auditory systems performed much worse in sound localization tasks than younger adults. Even when the researchers took into account the ageing effect in the peripheral auditory system (i.e., hearing thresholds in the high-frequency range), the elderly performed the sound localization task with less accuracy and/or precision. This might explain why, despite peripheral auditory system degeneration being regulated and/or compensated for utilising acoustical characteristics (i.e., stimuli frequency), ageing has a detrimental impact on and deteriorates the central auditory system. Aging continues to have a detrimental impact on cognitive abilities. When the older population struggles to locate and interpret incoming noises, they devote more cognitive resources to doing so, which leads to increased tiredness. Listening effort (or mental effort) for the listeners is described as cognitive heavy labour.

There are a few key fundamental cognitive processing processes (i.e., memory, comprehension, attention, and speed of processing). Aging has a big impact on these processes. As a result, not only do elderly people do worse on tasks involving memory, understanding, and attention, but they also have slower speed processing identification. Pichora-Fuller and Singh found that when the elderly were exposed to demanding listening situations (i.e., many sound sources to focus on in the background) and/or hard intrinsic features of ageing, cognitive processing increased substantially. According to a study conducted by a researcher, when the elderly were placed in the same listening contexts as young listeners, such as a church and a senior welfare centre, they exerted more listening effort than young listeners. That is, if older individuals strive to overcome their challenges by attempting to improve their auditory performance in challenging listening contexts, their cognitive resources will be depleted, and they will be more likely to avoid listening situations. As a result, the burdened physical and/or cognitive listening for the old should be taken into account based on scientific evidence.

Despite recent study efforts focusing on greater and/or enhanced performance for the elderly, their cognitive burden represented as listening effort could not be taken into account. We think that the findings of this study will provide a valuable chance to better understand the elderly's listening characteristics and needed effort. In order to achieve this aim, researchers looked at the impact of age, changing directionality, different types of stimuli, and the presence of background noise on listening effort. When considering the relationship between ageing and listening effort, factors related to challenging listening environments such as various directionality, particularly on the opposite (diagonal) side, differences between stimuli in terms of meaning and/or contextual cue, and presence of background noise were found to be negatively related to listening effort in simulated real-listening situations.

# Monitoring of Ototoxicity in Children after Platinum Chemotherapy

By Joseph Millan*

## INTRODUCTION

Despite their toxicity, the alkylating platinum chemotherapeutics cisplatin and carboplatin remain the backbone of therapy for a variety of children and adolescent malignancies. Medulloblastoma, osteosarcoma, hepatoblastoma, neuroblastoma, and germ cell tumours are the most frequent paediatric malignancies treated with cisplatin. Although only a tiny percentage of children and adolescents are affected by these life-threatening illnesses each year, the impact on children and their families is considerable. Platinum chemotherapeutics, as well as other treatments that induce free radicals, such as radiation, can have a variety of systemic and neurological adverse effects.

Ototoxicity is the most common side effect of Cisplatin treatment in youngsters. In paediatric patients, the prevalence of cisplatin-induced ototoxicity, as assessed by conventional audiometry to 8 kHz, is around 60%-70%. Carboplatin is much less ototoxic, yet high-dose therapy can cause hearing loss. When both medicines are used together, ototoxicity rises to 80-90 percent. Age less than 5 years, cisplatin cumulative dose and dose intensity, prior or concurrent cranial radiation, and concomitant treatment with other ototoxins such as myeloablative carboplatin, aminoglycosides, and loop diuretics are all individual risk factors for developing hearing loss from cisplatin therapy.

## MECHANISMS OF PLATINUM OTOTOXICITY

The degradation of the cochlear hair cells and supporting cells induced by cisplatin and carboplatin causes hearing loss. Platinum first damages hair cells at the base of the cochlea, where high-frequency sounds are encoded, and outer hair cells are destroyed before inner hair cells. Clinically, this is characterised by a loss of hearing sensitivity that begins in the high-frequency range and worsens with time, progressing to lower frequencies. Cisplatin ototoxicity causes hearing loss that is generally bilateral, high-frequency, steeply sloped, and symmetrical. Caregivers and medical professionals may not notice ototoxic high-frequency hearing loss. Hearing aid technology can help minimise the negative implications of acoustic information loss, but it is not a substitute for normal hearing.

## GENETICS OF PLATINUM OTOTOXICITY

Individuals with a hereditary susceptibility to cisplatin ototoxicity may be identified and screened for hearing loss. Pharmacogenomic research on genetic polymorphisms in methyltransferases, catechol-o-methyltransferase gene cisplatin transporters, glutathione-S-transferases (GSTs), and megalin (LRP2) has shown mixed findings, owing to the diversity of patient groups and treatment regimens. In three separate paediatric cohorts, genetic variations in TPMT were substantially linked to cisplatin ototoxicity, and it is therefore advised that all children undergoing cisplatin therapy have genetic variants in TPMT tested, ideally before starting medication. Despite the strong predictive value of TPMT (92%) for cisplatin-associated ototoxic hearing loss, only around 25% of children with cisplatin-associated ototoxic hearing loss have a genetic variation in TPMT. ACYPT2 has a variation that is highly linked to ototoxicity, according to a recent genomewide association analysis. Pharmacogenomics is a fast evolving science. Audiologists should keep an eye out for new research on the use of pharmacogenomic markers for ototoxicity.

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# The Impact of Unmeasured Time Hours on the Assessment of Occupational Noise Exposure in the Korean Shipbuilding Process

By Joseph Millan*

## INTRODUCTION

Occupational noise exposure is one of the leading causes of hearing loss in a wide range of industries and workplaces, with approximately 16% of manufacturing workers suffering from hearing loss with serious consequences such as irritation, sleep disorders, daytime sleepiness, metabolic syndrome, hypertension, and cardiovascular disease as a result of acute or chronic noise exposure. Occupational noise is one of the most dangerous workplace risk factors in Korea, having consistently exceeded the Occupational Exposure Limit (OEL) throughout quantitative exposure evaluations in a wide range of sectors and locations (1).

To avoid occupational hearing loss, a complete assessment should be carried out to quantitatively describe all levels of cumulative noise exposure over the course of a full shift of fixed duties, therefore defining task-based exposure profiles for individual employees. Personal noise exposure is often calculated as a daily hour time-weighted average (8 h-TWA) value utilising a cumulative noise metre within a radius of 30 cm from the worker's ears over 6 hours and then compared to the set OEL of 85 dBA in Korea. The majority of research found that collecting exposure monitoring samples across a complete shift of working hours each day gives the most reliable noise exposure estimate. The Occupational Safety and Health Administration (OSHA) in the United States recommended that noise exposure assessments be conducted to gather complete shift monitoring samples for at least 7 hours per day, with any break time shorter than 1 hour being considered unmeasured. However, in light of the real-world work environment in Korea, the Ministry of Employment and Labor (MoEL) set the length of noise exposure monitoring samples at more than 6 hours per day. When analysing the US OSHA's Integrated Management Information System (IMIS) database, which includes all industries in the North American Industry Classification System (NAICS), including shipbuilding and repair, and comparing the results of quantitative exposure measurements, a previous study found that annual levels of occupational noise exposure were significantly decreasing. Instead of using similar exposure groups (SEGs) classified based on detailed qualitative information on the magnitude and frequency of noise exposure in the shipbuilding industry, occupational exposure assessment in Korea has focused on the analysis of a small number of monitoring samples collected for only a few workers representing each occupation (job title) or department. Because precise quantitative information on exposure profiles and related factors can be gathered largely during exposure monitoring events in real-world workplaces, this technique has been employed. Recent studies have used computational fluid dynamics (CFD) programmes to show the patterns and characteristics of underwater radiated noise from small ships and ducts, and case studies have also suggested a new engineering approach to effectively reduce noise exposure levels in the workplace using a noise simulation (2). However, no previous study has been conducted to assess occupational noise exposures for a large group of workers engaged in shipbuilding processes in the shipyard industry, using qualitative exposure information on work-related characteristics, and to evaluate the effect of unmeasured time hours for lunch break and instrument preparation, when including or excluding break hours, on average levels. As a result, the goal of this study is to characterise occupational noise exposure levels during the break period (sampling preparation and lunch break hour) among a large number of manufacturing workers in the shipbuilding industry, identify several work-related characteristics that affect noise exposure levels when including or excluding the break periods during the exposure monitoring, and statistize the results (3). As a result, we were able to determine the most appropriate technique to noise exposure assessment while taking into account the work-related features, patterns, and other aspects of daily exposure measurements among individual employees in the Korean shipbuilding sector. Workers at a big shipbuilding business in Korea were found to be exposed to significant levels of occupational noise during break hours, particularly those working in the heating, grinding, and power operations in various painting-related departments, according to this study. Furthermore, when conducting noise exposure evaluations in accordance with the KOSHA guidance, we discovered evidence those excluding break periods is inadequate, resulting in underestimation of occupational noise exposure levels. We propose that the

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most reliable schedule of daily noise exposure measurement should include the break time and must be assessed continuously for at least six consecutive hours following the commencement of the job duties, based on the findings of the exposure assessment using the US OSHA technique. As a result, more research is needed to determine the most comprehensive exposure assessment approach and daily monitoring schedule that can be used to other workers with varied job duties in other sectors in the future.

## REFERENCES


1. Nelson DI, Nelson RY, Concha-Barrientos M, Fingerhut M. The global burden of occupational noise-induced hearing loss. American journal of industrial medicine. 2005; 48(6):446-458.
2. Lee JH. Occupational diseases of noise exposed workers. Hanyang Medical Reviews. 2010; 30(4):326-332.
3. Basner M, et al. Auditory and non-auditory effects of noise on health. The lancet. 2014; 383(9925):1325-1332.