A HOLISTIC RISK MANAGEMENT FRAMEWORK TO ADDRESS THE GLOBAL NOISE-INDUCED HEARING LOSS PANDEMIC

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Abstract

The paper presents a holistic risk management framework based on the core corporate governance principles and best-practice technology for addressing the global NIHL (noise-induced hearing loss) pandemic. While some await the announcement of a pharmaceutical drug therapy for hearing loss treatment and prevention, the challenges of noise control continue. Although preventable, the scenario remains tragic in terms of the statistics provided by the World Health Organisation (WHO). NIHL is among the most critical global health risks in terms of productivity, compensation statistics and noise-related deaths every year. Prevention of hearing loss remains the biggest challenge regardless of the availability of modern technology and best practice hearing conservation programmes (HCPs). An explorative research methodology was used to indicate a framework combining best practice with a diligent (bold) corporate and holistic approach to the NIHL problem. In essence, the paper therefore provides a thorough background to the global NIHL pandemic and presents a holistic risk management framework to address the problem.

Keywords: Risk Management Framework, Corporate Governance, Individual Risk Profile, Noise Control, Noise-induced Hearing Loss, Occupational Safety And Health, Environmental Management, Hearing Conservation, Hearing Coach, Pandemic, Accountability, Prevention And Curative Care

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1 Background to the problem

In a society with modern means of communication, loss of hearing capacity is a handicap. It results in reduced levels of participation in the labour market, a poorer position in the labour market, social isolation and compensation costs. To accurately describe the problem for purposes of descriptive validity and to gain an ontologically objective understanding of the phenomenon, the background to the problem is discussed in three parts.

1.1 A review of the global challenges of occupational health and safety (OHS) and noise control

Environmental managers are confronted with an almost uncontrollable natural and physical reality in terms of noise (ASSE, 2010). The noise hazard should not merely be accepted as a common inevitable fact of life. Productivity is perceived to be associated with a busy and noisy environment, and management must balance the economic pressures of performance with "green and safe" products. Martines (2012) points out that occupational hearing loss has become one of the most critical issues. Noise pollution negatively affects labour productivity. Prolonged exposure to noise can cause incapacitating ill effects, for instance, having a negative impact on performance, safe behaviour, attentiveness, problem solving and memory. Kurmis and Apps (2007) refer to occupationally acquired NIHL as a senseless workplace hazard. Lopes et al. (2012) also state that work-related hearing loss is one of the most common occupational diseases. They highlight its negative effect in terms of quality of life in terms of communication difficulties, concentration, memory difficulties, stress and fatigue.

Noise has also became a leading environmental issue in the WHO European Region (WHO, 2015) and is recognised as an underestimated threat that can cause a range of short and long-term health problems such as sleep disturbances, cardiovascular effects, poorer work and learning performance and irreversible hearing impairment. The negative lifelong effects on productivity, academic achievement (education) and the health of children and youth are of grave concern. Studies have found that noise exposure harms cognitive performance, motivation levels and catecholamine hormone secretion.

According to the National Institute for Occupational Safety and Health (NIOSH) in North America, 30 million workers are exposed to noise levels that could lead to irreversible hearing loss.

1.1.1 Most industries are exposed

WHO (Europe) is currently in the process of developing the WHO Environmental Noise Guidelines for the European Region. The guidelines will assess several environmental noise sources in industries such as aviation, rail, road, wind turbines and personal electronic devices (WHO, 2015).

McBride (2004) reports on NIHL and conservation in mining. The mining of minerals has always been an arduous task and remains "a pick and shovel proposition". Noise has become a generic hazard common to all commodities, but to a greater extent to all operations in mining. The highest noise exposure (from 100 dBs and above) from plant and equipment is associated with loaders, long-wall shearers, chain conveyors, fans and pneumatic percussion tools. The mining sector has different challenges and engineers (e.g. mine ventilation engineers) can make a significant contribution to safety and quality of work-life (QWL). The engineers have more potential to affect safety in the workplace than any other employees (Goetsch, 2005).

According to a European Union (EU), publication about 40% of the population in EU countries is exposed to road traffic noise at levels exceeding 55 db(A). In addition, 20% is exposed to levels exceeding 65 dB(A) during the daytime and more than 30% is exposed to levels exceeding 55 dB(A) at night (WHO, 2015).

Chang and Chang (2009) report on the prevalence and risk factors of noise-induced hearing loss among liquefied petroleum gas (LPG) cylinder infusion workers in Taiwan. Edelson et al. (2009) reported comprehensively on the various predictors of hearing protection utilisation in the construction industry. The military, for example, is desperately seeking a drug that will prevent hearing loss if taken just before noise exposure (or for treatment after exposure). Large numbers of soldiers and marines caught in roadside bombings and fire-fights in Iraq and Afghanistan are coming home with permanent hearing loss and ringing in their ears, which have prompted the military to redouble its efforts to protect troops from noise. Hearing damage is the number one disability in the war on terror, according to the Department of Veterans Affairs (VA), and some experts say the true toll could take decades to become clear. Nearly 70 000 of the more than 1.3 million troops who have served in the two war zones are collecting disability for tinnitus, a potentially debilitating ringing in the ears, and more than 58 000 are on disability for hearing loss, the VA said. The numbers are staggering, and troops return with alarming rates of hearing loss.

The entertainment industry is another concern in terms of loud music at festivals, the use of iPods. Deafening special effects at the movies pose a risk for hearing damage or tinnitus.

1.2 Facts about noise and NIHL

- The ILO (International Labour Organisation) reveals that despite global efforts to address OHS concerns, an estimated two million work-related fatalities and 330 million work-related accidents still occur each year (ILO, 2009:xi).
- It was reported in 2009 that approximately 30 million individuals in the United States were at risk of NIHL (http://www.ncbi.nlm.nih.gov/pubmed/19728686).
- High NIHL compensation costs urge managers to seek other solutions even if the avenue of medicine is starting to provide answers. NIHL has huge human and economic consequences even in small countries such as New Zealand, costing the Accident Compensation Corporation approximately $53 million annually (http://www.noiseandhealth.org/text.asp?2012/14/59/202/99896).
- A study of 2 484 white South African gold miners defined social impairment as an average loss of >25 dB for the audiometric frequencies 0.5, 1 and 2 kHz. At age 58, 21.6% fell into this group. A NIOSH (National Institute of Occupational Safety and Health) analysis of a large sample of audiograms showed that 90% of coal miners and 49% of metal and non-metal miners had a hearing impairment at age 50 (McBride, 2004:292).
- The Mine Health and Safety Council (MHSC) (South Africa) has set high targets for the mining industry of no PLH (percentage loss of hearing) greater than 10% and no machinery emitting noise of higher than 110 dBA. The targets are an attempt to improve the prevention of NIHL in the mining industry and are based on statistics that the majority of South African mineworkers are exposed to high noise levels of 85 to 105 dBA (TWA8h).
- In 2012, the WHO released the following estimates relating to the degree of disabling hearing loss: 360 million people in the world suffer from disabling hearing loss (5.3% of the world's population); 328 million (91%) are adults (183 million males and 145 females); the occurrence of disabling hearing loss in children is greatest in South Asia, the Asia Pacific and sub-Saharan Africa; nearly one-third of people over 65 years are affected by disabling hearing loss; the occurrence of disabling hearing loss in adults over 65 years is greatest in South Asia, the Asia Pacific and Sub-Saharan Africa (WHO, 2012).

1.3 Inadequate management of noise

Exposure to excessively high levels of noise at work is such a complex and prevalent problem that it needs corporate and governmental control. OHS should

therefore consist of a multifunctional team to address complex and multifaceted challenges such as explosives, stress, standards, noise, laws, radiation, product safety and ergonomics, inter alia. The OHS manager must have a team of experts to address the different types of risks. A huge effort should be made to overcome these challenges and to provide workers with a healthy quality of work life. Workers also have to manage communications in extreme noise environments which justifies innovative and modern solutions.

Goetsch (2011) is a leading authority in the OHS field and a major part of his recent publications focuses on the human element. The International Journal of Occupational Safety and Ergonomics (IJOSE), for example, focuses exclusively on the protection of the human in the workplace and new approaches to measuring work-related well-being in a recent publication (refer to IJOSE, 2011).

1.3.1 The need for sophistication

Managing noise and hearing conservation (second-level noise control) is a science on its own, and demands sophisticated management skills (Vinck, 2011). Professional and aggressive management of HCPs is the only way to address NIHL effectively.

For over 35 years, Elliot Berger has been a pioneer and driving force behind hearing loss prevention research, management and training. He established national and international standards (and regulations) and is active in personal hearing protection product development. Berger (an MS Division Scientist for 3M's Occupational Health and Environmental Safety) was presented with the National Hearing Conservation Association (NHCA) Lifetime Achievement Award in St. Petersburg, Florida, in February 2013. Despite all the knowledge available, the most prominent factor remains the lack of prevention, while most of the problem can be reduced by making use of engineering controls such as noise assessments, audiometric monitoring, worker education, hearing protection and record keeping (Nelson, Nelson, Concha-Barrientos & Fingerhut, 2005; Franz, 2002).

1.3.2 Risk perception works against compliance

Inaccurate risk perception works against compliance. A worldwide fatalist belief exists that noise is an acceptable and unavoidable part of the job. A contributing factor is the insidious nature of the disease (referred to as the silent disease) as workers do not physically feel or experience immediate harm.

1.3.3 A search for easier ineffective measures

A few pharmaceutical companies (and venture investors) pursue drug therapy in their search for developing an oral capsule for hearing loss. While venture firms have funnelled billions of dollars into treatments for heart disease and other maladies, hearing loss barely registers. Other examples are drugs that reduce the need for hearing aids, treat tinnitus and acute noise-induced hearing loss, and those that protect auditory hair cells. The problem is exacerbated by different types of hearing loss such as acoustic trauma, otitic blast injuries, conductive hearing loss and sensorineural hearing loss.

1.3.4 The inaccurate perception that all hearing protection devices (HPDs) are equally effective

There is a widespread belief that hearing protection is a simple solution. The notion is that less costly HCPs are as effective in preventing hearing loss as noise engineering control programmes that reduce noise to less harmful levels. In theory this implies that noise control capable of reducing the exposure level by 10 dB is no more effective than an HPD that reduces the noise exposure level by 10 dB. The flaw in this assumption is the high variability in the real-world performance of HPDs.

1.3.5 Dual protection

Another misconception concerns dual protection. The notion exists that workers need to double up (using earplugs and earmuffs) in high noise environments. This principle raises several questions relating to illegally high noise levels demanding dual protection, measuring non-dual (single) protection and vague calculations (e.g. to add five decibels to the highest published noise reduction rating of either hearing protector) (http://ehstoday.com/hearing-protection/balancing-act-new-hearing-conservation-technology).

1.3.6 Hearing conservation is diluted

Kryter (2009) reports on an acoustical model and theory for predicting the effects of environmental noise on people. This is part of an effective HCP which is the only real solution if harmful noise exists. The 2009 edition of "*A guide to developing and maintaining an effective hearing conservation program"* is based largely on the work of Julia Doswell Royster and Larry H. Royster (see Royster, Royster and Berger,1982:22-25; and Royster and Royster, 1985:20–23). They provide an effective framework and support a flexible approach to hearing conservation (custom-designed HCPs), because it is impossible to specify HCP guidelines to cover every situation.

1.3.7 Confusion about standards

SANS10083:2007 (2007) is one of several related standards utilised to address the problem in all industries in terms of the measurement and assessment

of occupational noise for hearing conservation purposes. According to Vinck (2011), these typical grey areas in hearing "protection" are caused by a hiatus in legislation, insufficient universal standards (e.g. individual risk profiles based on ISO1999), inadequacies in the knowledge of hearing and sound (HS) practitioners in areas such as different noise levels, risk misconceptions (most countries set the limit between 82 and 85 dB, while some set it as low as 70 dB) and different periods for exposure levels (PELs), such as 75 dB, maximum of eight hours; 78 dB, maximum of four hours; 81 dB, maximum of two hours; 84 dB, maximum of one hour; 87 dB, maximum of half an hour; and 91 dB, maximum of quarter of an hour.

1.3.8 Individual risk profiles

In the case of noise pollution there is no single approach that fits everyone. A lack of knowledge of each worker's personal risk situation (profile) for individual customised attention and coaching is a common weakness. Pure tone audiometric monitoring is essential, but otoacoustic emission (OAE) techniques show good promise for the future (Vinck, 2011).

2 Problem statement and research method

The previous section provided a background to the problem. The problem statement is therefore defined as understanding and managing the harmful noise and NIHL pandemic. The problem is described by the global challenge, the facts of the NIHL pandemic and the mediocre ineffective management of the challenge. The complexity and scope of the problem indicate the need for a comprehensive corporate and holistic risk management framework to address the global NIHL pandemic.

2.1 Method

An integrated explorative research approach was used. Cooper and Endacott (2007:816) refer to generic qualitative research of which phenomenology, action research and experiential knowledge of the researcher is applicable. Besides the comprehensive literature review of the problem (the previous section) and the suggested solution (the framework), narrative data from different sources of observational research were integrated (Plowright, 2011: 16-135). This included naturalistic observation of behaviour (the utilisation of personal protective equipment) and artefact analysis of other related objects such as best practice hearing conservation technology, text-based artefacts and sound measuring artefacts.

The main objectives were to provide facts about the problem (the NIHL phenomenon) and present a solution in terms of a practical risk management framework based on corporate governance guidelines and best practices used.

3 Solutions to address the problem

3.1 A holistic risk management framework for hearing conservation

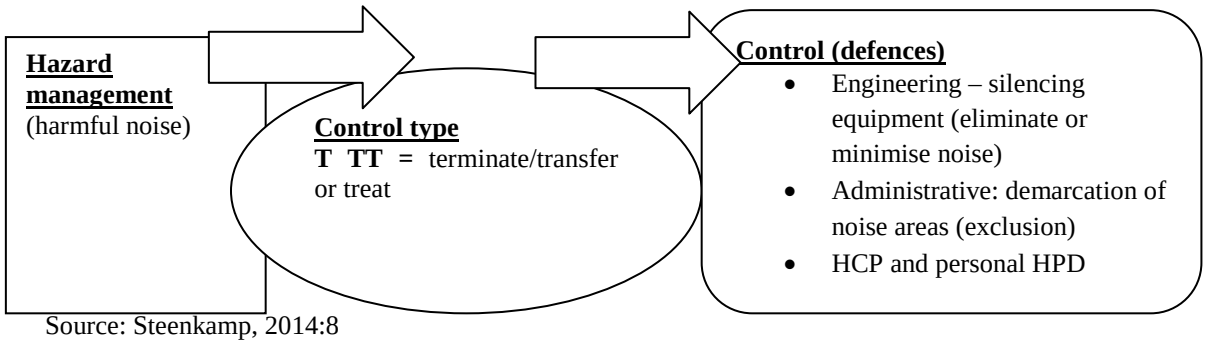
It is clear that the OHS function has become more complex than ever before owing to advances in technology, new legislation, the potential for costly litigation and a proliferation of standards (Goetsch, 2005:628). The following principles for a framework ensure the effective management of the NIHL pandemic:

- Leadership and best practice management – an effective board should head the company to meet its business purpose. Hearing conservation excellence is impossible without visionary and service leadership. Culture precedes action and leaders determine the vision and culture that underpins the personality of the organisation.
- Capability and capacity must be acquired for an appropriate mix of skills, experience and independence to enable board members to discharge their duties, responsibilities and challenges such as noise and NIHL effectively. Slack, Chambers and Johnston (2010:251-252) highlight four primary OHS dimensions of which each are separate sciences on their own, namely ergonomics, working temperature, illumination levels and noise. Earlier publications and conventional views of OHS were geared more towards risk concepts, risk control, risk assessment, risk perception, risk communication and cost-benefit analysis (Fuller & Vassie, 2004) instead of prevention of hazards through technology, improved operations design and improved human behaviour.
- Accountability cannot be delegated, and the board should communicate to the company's shareholders and other stakeholders at regular intervals in a fair and balanced assessment of how the company is achieving its business purpose and meeting its other responsibilities.
- Sustainability of the company should not be compromised by noise and NIHL risks. The board should guide the business to create value and allocate it fairly and sustainably in terms of reinvestments and distributions to stakeholders.
- Integrity of the board implies transparency about all risks and challenges. It must lead the company to conduct its business in a fair and transparent manner that can withstand scrutiny by all stakeholders. The human ear is extremely sensitive to any material such as earplugs, regardless of the modern more comfortable acrylic hypo-allergenic materials used. Management must understand the resistance to wearing HPDs.
- Regulations, laws, high standards or so-called "best practices" do not necessarily work in practice. It becomes clear that OHS managers must succeed in a

highly complex and dynamic internal and external environment.

- Providing best practice HCPs without best-practice education and training makes an HCP only as strong as its weakest link. Unfortunately, follow-up studies indicate that while participants demonstrate a considerable gain in knowledge about noise hazards and hearing loss after training, they frequently show minimal or only short-term changes in hearing-health behaviours. Several dimensions of OHS communication play a role in awareness, knowledge and understanding, in order to improve health and safety in the work environment (Bonehill, 2010:23).
- All categories of defences against noise as illustrated in figure 1 should be utilised.

Figure 1. Defences against noise



Source: Steenkamp, 2014:8

3.2 The design, implementation and sustainability of a best practice HCP

This section is based on the four-dimensional hearing coach HCP model (www.hearingcoach.com). Under the expert guidance of Prof. Dr B. Vinck (Head of Department of Audiology of the University of Pretoria), Hearing Coach International introduced this model as a best practice solution for HCP excellence. It is a well-designed programme, minimising the medical, social and financial risks of noise at work. This model is adopted in many mining operations and other manufacturers worldwide. It is *regarded as a best practice proven method that has been awarded as "Best Practice" by the European Agency for Safety and Health at Work (EU-OSHA).* Hearing Coach International BV is based in Terneuzen, the Netherlands (info@hearingcoach.com, www.hearingcoach.com). The programme is also widely used in the South African mining industries (Pienaar, 2015) as illustrated in figure 2.

Figure 2. The four-dimensional hearing coach HCP model

Source: www.hearingcoach.com

4 Shareholder-stakeholder-government

This part (shareholder-stakeholder-government) of the four-dimension HCP model refers to the previous section (A) a holistic risk management framework for hearing conservation. OSH management excellence is impossible without top management support and good corporate governance.

5 Person at risk

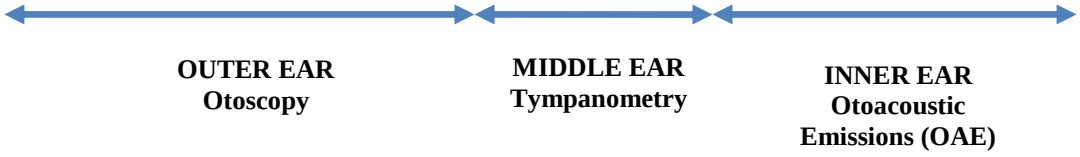
Each individual is managed differently and the point of departure is a personal risk profile based on the ISO 1999 standard. The risk profile should convey a clear picture of each employee based on audiometry, historic data and other information. Employees should be coached, equipped and monitored according to this risk profile. One element in this is a personal dosimeter (or dosebadge) that can be used by the worker to monitor sound exposure for the full shift or any specified portion of the shift. SANS 10083 provides useful guidelines.

The otoacoustic emissions (OAE-gram), quantifies damage to the outer hair cells as a percentage (not in dB), which is ideal for understanding and personal coaching in a professional HCP. OAE provides accurate information on the actual condition of the outer hair cells, for the early detection of damage to the sensory mechanism of the ear. OAEs provide the only direct way of observing changes in the performance of the ear's sensory mechanism. Any change in the condition of the cochlea can be detected as a change in OAE. This method is important since it detects a pattern not noticed in the standard audiogram (Lotter, 2010).

The OAE-gram can be used as (1) a diagnostic tool for determining/examining the level of cochlear damage, the affected frequency range, difficulties in understanding speech and establishing a differential diagnosis. OAEs can also be used as (2) a follow-up tool thanks to their high level of reproducibility, sensitivity and specificity. The technique is highly suitable to follow up the progression of damage over time. This is a major trump card in a *preventive* approach towards NIHL. A shift in the OAE is an alarm signal regarding the effectiveness of the HCP.

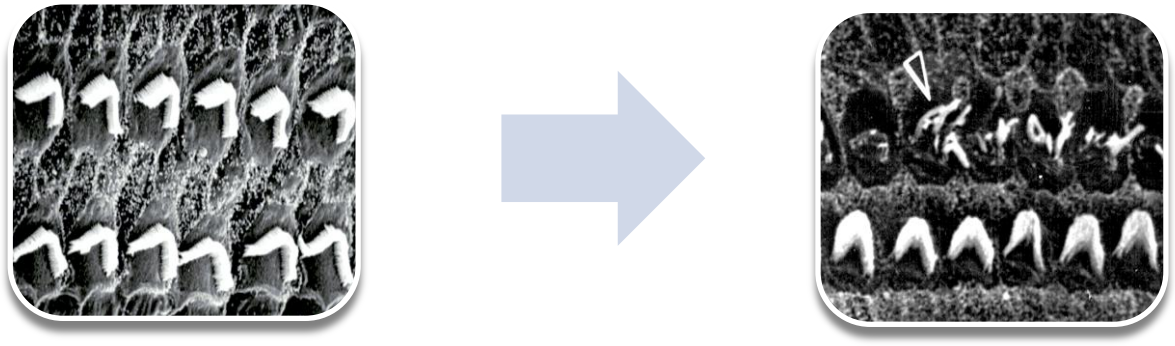
It is important to check that both the outer and middle ear function properly beforehand. For this reason a *preventive hearing examination* is recommended during which the external ear, middle ear and inner ear are all examined, consecutively.

Figure 3. Outer, middle and inner ear



The inner and outer hair cells are located in the cochlea. Exposure to excessive noise levels damages the *outer* hair cells.

Figure 4. Healthy and damaged hair cells



HEALTHY
outer hair cells

DAMAGED
outer hair cells

Source: www.hearingcoach.com

5.1 Three types of measurements needed

Firstly, otoscopy is process of examination by means of a small light (otoscope) that is shone into the outer ear canal. The purpose is to check that the eardrum is intact and healthy and that no wax build-up or foreign object is obstructing the passage to the middle ear. Secondly, a tympanometer is used to examine the middle ear. The middle ear contains the eardrum, ossicles and the stapedius muscle. The proper functioning of these could be impaired by ear infections (a cold or allergies), perforation of the eardrum or calcification of the ossicles. Thirdly, an optoacoustic emissions measurement (OME) is necessary (www.hearingcoach.com). A miniature microphone is placed in the ear canal through which a sound stimulus is sent which makes the outer hair cells contract. If they react it means they are healthy. If they do not react, they have been damaged or have died. The purpose of this examination is to identify damage as early as possible and identify any trouble with ”understanding speech”. Damage to outer hair cells is shown as a percentage, namely the OHC damage index. The higher this percentage, the more outer hair cells that have been damaged and the more difficult it is to follow a conversation. Prevention (one of the four main dimensions of the hearing coach model) is discussed next. It is important to note that ”prevention” is not a step in a sequence, but rather the golden tread.

6 Prevention

Preventing NIHL is a complex problem and therefore needs to be approached from different angles. A multidisciplinary approach requires the deployment of a multidisciplinary team and continuous consultation between the various experts involved. One way to combine all the necessary know-how from the different areas of attention is to house them in a single ”hearing coach”, who is a professionally trained audiologist (or team of audiologists/coaches) (www.hearingcoach.com).

The hearing coach’s core role is to manage prevention of NIHL by means of the following:

- Individual coaching and discussions with each employee using the OHC-scan. The aim is to create positive behaviour towards the dangers of noise and the wearing of hearing protectors at work and during leisure time. Frequent awareness on the risks of music that is too loud and environmental noise must be provided.
- Design, coordinate, implement and evaluate personal HCPs, personal HPDs and determine the personal daily noise (LEP,d) by using dose badges.
- Obtain and sustain the necessary skills to utilise modern technologies such as OAE and quality custom-made HPDs.
- Conduct frequent measurements and conduct preventative hearing screening utilising the OHC damage index.
- Manage the perfect balance between ”prevention” and ”curative care”.
- Manage a professional record-keeping system of each personal risk profile. Historical record keeping and data management are a crucial part of this risk management system. Each year, all of the above parameters are stored in a historical database per person. This includes status reports per individual/department/company and certification.

Manage and promote quality personal HPDs that can be defined as those that are worn consistently, seal in a leak-tight manner, attenuate sound to just below the safe limit (75 dB(A)) at 4 kHz, are checked annually to clean, repair or improve them, give maximum communication functionality, are not only worn at work, are environmentally responsible, and are durable and economically beneficial. Advise management and the workforce on the selection of the most appropriate hearing protection device (HPD). Persons at risk (LEP,d > 75 dB(A)) are equipped with personal HPDs and each HPD is checked for efficiency and effectiveness ”while in the ear of the user” by means of:

- SEAL-check: By building up pressure in the cavity ”eardrum-HPD” air-leaks are checked for with the HPD in place.
- MIRE-check: Measurement of the residual noise (noise behind the hearing protector). The attenuation of the hearing protector is set in such a way that the residual noise stays below the legal noise criteria, on the one hand, and below the human damage threshold of 75 dB(A) at 4 kHz, on the other.

6.1 Second-level noise control through HPDs

HPD selection and use is a vital part of preventing NIHL. A quality HPD is therefore not one size-fits-all, but personalised PPE (personal protective equipment). The inner ear is seldom receptive to any inserted device. Even the most comfortable HPD must be maintained for wearability (ownership). Hard-working conditions and dirt can influence the effectiveness of the HPD. HPDs must be comfortable in many ways (temperature, ventilation, communication, localisation, signal detection, weight and user-friendliness). Other quality dimensions are attractiveness (e.g. colours, names, packaging, etc.), hypoallergenic properties (e.g. acrylic material) and durability (increased wearability, increase ownership and cost-effectiveness). The following factors relate to attenuation:

(1) being physically sized for comfort, with consistent (low variability) tailor-made sizing

(2) elimination of leakages as verified by a seal-test (measured) and fitted either correctly or not at all

(3) being adjusted for the individual's specific circumstances and working zone and minimisation of overprotection to optimise communication (speech discrimination) and the detection of machines and warning signals

(4) adjustable filter mechanisms with both fiddle and tamper-proof calibration (Pienaar, 2015)

6.2 Communication ability while wearing HPDs

This consideration is certainly the most challenging. Studies (e.g. Pienaar, 2015) show that workers fear HPDs might interfere with communication and job performance. To overprotect and isolate workers from reality can be a bigger hazard than noise itself. Discomfort at work can cause more hazards and another dimension of comfort during hearing protection is communication. Communication in the context of HPDs refers to a feeling of "non-isolation" and being able to detect alarm signals and general signals, speech eligibility, orientation, localisation and ventilation. Several custom-made HPDs (such as Variphone) have a filter mechanism to allow for communication and speech discrimination.

The first solution is to make communication possible by means of individual attenuation. Unnecessarily high NRRs (noise-reduction rates) must be eliminated because of the dangers of overprotection. Laboratory tests can provide an excellent indication, but these do not always add up to a real-world test report. HPDs with filter mechanisms can optimise speech eligibility and some of these HPDs can also be measured "from inside the ear" using the insertion gain method (Woxen & Borchgrevink, 1991). This is part of HPD verification where the assumed protection value (APV) is compared with the real protection value (RPV). Certain important warning and communication signals therefore need to be assured and verified through measurement.

7 Curative care

This dimension is necessary because of the lack of effective prevention. Curative care may be necessary due to several reasons as reflected by the reality of NIHL (the section on the background to the problem) and is an unfortunate outcome. Since NIHL is a disability it may be necessary to transfer workers out of noise areas to other jobs and compensation might come into play. Audiologists can assist with curative care in terms of further prevention and hearing aids, but irreversible hearing loss can never be healed or restored (www.hearingcoach.com).

8 Conclusions and recommendations

Although preventable, the scenario of the NIHL phenomenon remains tragic in terms of the statistics given by the WHO. NIHL is one of the most critical global health risks in terms of productivity, compensation statistics and noise-related deaths every year. In essence, the paper therefore provides a thorough background to the global problem and presents a risk management framework to address the problem.

Most OSH managers are challenged by the complexities of noise control and welcomes innovative practical solutions. Any best practice technology is of minimal use without top management support and the suggested risk management framework is therefore based on two very strong dimensions, namely: (1). top management, OSH leadership and governance (a bold, transparent and diligent commitment is vital) and (2) best practice HCP technology based on the four-dimension HCP-model from Hearing Coach International BV. The successful integration and implementation of these dimensions results in the holistic risk management framework for hearing conservation to address the global NIHL pandemic.

It is recommended that the pandemic is addressed at both national and organisational levels. Government and management should "stop whispering to the silent disease". HCPs should be well resourced and managed as projects for successful roll-out and needs dedicated management, such as professionally equipped hearing coaches deployed to maintain and sustain them.

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