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NOISE: AN UBIQUITOUS POLLUTANT

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Noise is one of the most ubiquitous* environmental pollutants. It permeates all aspects of life - urban and rural, domestic and social, educational and occupational. Long thought to be a problem only to the military and heavy industry, it is now recognised as an almost universal issue. It may interrupt communication and thought, as well as disrupting audition. Prolonged exposure damages hearing and has adverse physiological consequences leading to auditory and non-auditory problems.

Some of these effects have been reported since ancient times. For example, the disruption of speech reception by waterfalls, deafness in gunners on 18th century naval vessels and hearing loss in ancient metal workers. Two important sources of damaging sound today are military noise and entertainment, as in discos or concerts and individually from listening to MP3 players. There is evidence of increased frequency of hypertension, psychiatric disturbance, interference with cognition and sleep disruption with excessive noise exposure. Occupational hearing loss increased exponentially with the industrial revolution; damaging military noise started with the invention of gunpowder and has become ever more intense. Global urbanisation and population growth have compounded to make social noise a major problem. The negative impact of excessive sound on sleep, speech, schooling and everyday life is well documented and is growing. In addition, it may precipitate tinnitus. There are particular problems in schools, both from external sounds and poorly designed classrooms where the acoustics are frequently appalling (extremely poor). Oral communication becomes difficult and thinking may be disrupted.

**Ubiquitous: Ever present; everywhere*

Noise: An Ubiquitous Pollutant

The 'Developed' World and the 'Developing' World

In the developed world, excessive occupational sound exposure is diminishing. New manufacturing techniques such as welding or glueing are replacing riveting in shipyards and aircraft factories, making the workplace quieter. Greater efficiencies and automation are also reducing the total number of workers exposed and the sound levels which they experience. The developed world workforce expects a safe work site and has accepted occupational safety is a required priority. This is not the situation in much of the developing world where, in spite of some excellent programmes, equipment may not be silenced, hours of exposure are less monitored and hearing protection is rarely used. In addition, occupational sound levels are lower in the post industrial occupations than in manufacturing. Farm mechanisation is a global problem, machinery is loud, varied and work hours are not controlled.

The urban 'soundscape' is ever louder, in Toronto as well as in Karachi, in Sao Paulo as well as in Rome. Many cities have noise bye laws, however, few are implemented. Traffic noise is difficult to control and is a greater problem in developing world cities than in most of the developed world. More traffic, older and poorly silenced vehicles, amplified music in outdoor bazaars, all producing a cacophony of sound, making speech communication difficult. This is largely due to diesel trucks and motorcycles. The hearing of the 'Baby Boomers'** is worse by about 10 years than that of the preceding generation at the same age; i.e., 50 year olds today have hearing like 60X year olds of the last generation.

***Baby Boomers – The baby boom generation is a term which portrays a generation born during the middle part of the 20th Century*

Hearing Conservation Programmes

However, there is also cause for cautious optimism. Hearing conservation programmes have multiplied in industry and are effective. Their demonstrable (provable) benefits to occupational safety and the work environment encourage their adoption. Maximum sound level specifications are also more and more frequently required when machinery is ordered. Issues with classroom acoustics have become fairly widely recognised in the USA, Canada and several European countries, with helpful developments occurring. City noise is being addressed by an innovative programme in India (see Chadha, Djelantik and Agarwal in the next Issue of CEHH) and is being studied with interest in South East Asia. The World Health Organization has had workshops and has published recommendations regarding urban noise. Machinery of all types is becoming quieter. The more fuel efficient, modern jet engines are also less noisy. It is being recognised by manufacturers that noise is an unwanted by-product, not a needed indicator of power. Sadly, so much of this is offset by the increasing exposure to and intensity of recreational sound. The greater efficiency of the now ubiquitous MP3 players makes them more hazardous than the personal radios and CD players that preceded them.

Cellular Basis of Hearing Loss

The cellular basis of hearing loss from intense sound exposure is becoming clearer. Work is advancing rapidly on medication to prevent the damage produced by extreme noise exposure, such as in military noise. It seems to work in animal models; hopefully, it will translate to man.

When I started working in this area almost 50 years ago, I thought that by the year 2000 there would be no more industrial hearing loss in the industrialised nations. Well, I was wrong, but the amount is reducing. There is still much to be done. The focus has shifted from industrial to community noise and this requires continuing effort. ❑

THE RISK OF HEARING LOSS IN YOUNG ADULTS

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In the past few years, the number of publications on the risk of acquired hearing loss among children and young adults has increased substantially both in the scientific literature as well as in the popular press.

The headlines tend to be fear-provoking:

- 'TURN IT DOWN! MP3 fans told'
- 'Sounding a warning on earbuds!'
- 'People risk hearing losses at younger ages, experts warn.'

Although sensationalised by the media, scientific evidence of increased risks to hearing faced by youth is not yet available.

Music Exposure amongst Children and Young Adults

The increased media attention may be a consequence of the introduction of MP3 players and a 2006 lawsuit which alleged that such devices pose a risk to users' hearing. This issue has brought widespread scrutiny to the question of potential risks to young people's hearing. Teenagers, more than any other age group, expose themselves to loud sound levels during their leisure time. Recreational exposure sources include toys, arcade games, and music (from concerts, discos, car stereos, and Walkman*-style and other personal media players). Modern audio equipment can produce peak sound pressure levels of 130-140 dB which are harmful to human ears. Recent studies have examined teenagers' noise exposures, their attitudes and behaviours towards noise and music, and the consequences of those exposures to their hearing.[1, 2, 3, 4, 5, 6] However, researchers have reported mixed results. Some studies found no effects of recreational music exposure and hearing loss. A study conducted in Brazil assessed the hearing thresholds of 957 young adults between the ages of 14 and 26 years and their exposure to amplified electronic music.[7] The main source of exposure was through personal media players, which was reported by 65% of the participants. However, no significant differences in audiometric thresholds were found between the exposed and the non-exposed. A study of 10,000 people conducted in Germany

**Walkman: Walkman is Sony's audio cassette player brand, now used to market its portable audio and video players. The original Walkman introduced a change in music listening habits (Wikepedia)*

reported that in the 18-to-25-year-old group unexposed to occupational noise, only a minimal difference in thresholds (not statistically significant) was seen between people who regularly go to discotheques (discos) and those who have never been there.[8] Similar findings were reported for Walkman users.[9] On the other hand, tinnitus and temporary threshold shifts have been reported by teenagers after attending music concerts or disco clubs, as well as by those who were/are heavy users of personal audio devices.[3] An interdisciplinary longitudinal investigation of the hearing status and noise exposure of teenagers conducted in Argentina found that the participants' hearing thresholds worsened during the four-year period of the study.[5] Authors also indicated that attending discos seemed more harmful than the use of media players; and that while the habit of attending music concerts had increased during the study, it did not increase as much as visits to disco clubs.

Other Potential Sources of Noise Exposure

Although music exposure seems to be the most studied source of excessive sound exposure to children and youth in several countries, there are also other potential sources of hazardous noise exposure. Dangerous sound pressure levels produced by some toys have been documented, and several countries have adopted sound level labels to alert consumers of the risk. Data from Sweden have shown the presence of the audiometric high frequency 'noise notch' in groups as young as ten years old.[10, 11]

Noise Exposure and Work Situations

Noise exposures at work are also an issue, and may even be the most significant source of hearing risk among youth. Although urbanisation has reduced the number of children working on farms worldwide, young people continue to be employed in this economic sector, as well as in other industries with noise risks. The proportion of young adults or children working, as well as their work conditions and legal protections, varies from country to country.

The Noise-damaged Ear and Later Hearing Loss

Recent basic science investigations on the long-term effects of noise exposure highlight another reason for concern regarding noise exposure among youth. Historically, hearing loss prevention researchers have assumed that noise damage ceases after the termination of noise exposure, with further deterioration in hearing threshold levels resulting only through the ageing process. This assumption, however, may be incorrect. Animal experiments have described noise-induced degeneration in the brain as a result of cochlear damage.[12, 13] Human and animal studies suggest that the noise-damaged ear does not age at the same rate as the non-damaged ear. Evidence indicates that while hearing impairment at the most noise-affected frequencies of 3000-6000 Hz tends to slow, hearing loss at the neighboring frequencies of 8000 Hz and 2000 Hz appears to accelerate.[14, 15, 16] Therefore, early noise exposure, even if resulting in negligible hearing loss, can potentially increase susceptibility to further hearing loss in later years.

Discotheque

Hearing in Young Adults in the USA

The hearing status of young US adults was examined over the past 20 years by comparing yearly prevalence of hearing loss in the baseline audiograms of 2526 individuals, ages 17 to 25, beginning employment between 1985 and 2004.[17] The prevalence of high frequency hearing loss decreased over the twenty-year period, while the prevalence of audiometric 'notches' remained constant. Their results suggest that, despite concern about widespread recreational noise exposures, the prevalence of hearing loss among a group of young US adults has not significantly increased over the past two decades. However, in view of the basic science research described above, it is possible that the effects of youth exposures will only be detected after a longer period of time. Further research is necessary to reveal and clarify any effects.

Hearing Protection

In the meanwhile, efforts to prevent noise exposure and hearing loss among youth are needed. In 2006, the Cochrane Review published a review of interventions to promote the wearing of hearing protection.[18] Only two studies met their rigorous criteria for inclusion in the report; and, of these, the one successful intervention was a four-year school-based hearing loss prevention programme for students working on their parents' farms (N=753). The intervention group was twice as likely as the control group (which received only minimal intervention) to wear some kind of hearing protection. This evidence suggests that long term school-based programmes can effectively increase the use of hearing protection among students and sheds some light on approaches that ought to be considered for increasing awareness of the value of hearing and means of preventing disorders.

New products and organisations have been created with the goal of reducing hearing risks (hearing loss and tinnitus) due to music exposure. For example, output limiting headphones are now available for some personal media players. Another approach towards reducing the risk of hearing loss is to establish regulations. Some are in place in countries like Switzerland, Italy, Austria, Finland and Sweden, with specific recommendations for exposure limits when it comes to musical activities or noise in the entertainment industry. But enacting new regulations can take a while. In the meantime, professional organisations in the USA and elsewhere have been taking steps to examine and share information on best practices in hearing loss prevention in schools.

Surveillance and Research

Surveillance of children and young adults' hearing seems necessary for a clearer understanding of the hearing risks facing them, as well as controlling their exposures to excessive sound pressure levels. Further research and public health interventions, such as exposure assessment and control, education, and audiometric testing targeted to children and youth are recommended by most of the investigators in this field.

The Risk of Hearing Loss in Young Adults

Disclaimer

The findings and conclusions in this article are those of the author and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

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PREVENTING NOISE INDUCED HEARING LOSS IN FUTURE GENERATIONS

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Take a moment to consider the listening behaviour of those around you every day. You can often hear a thumping car stereo before you see the car coming down the street. Riding public transport, you hear the music coming from the headphones of your fellow riders. If you attend concerts and clubs, your ears may ring for days afterwards. If you have children, the noise from their video game battles can be heard in every corner of the house.

These types of listening behaviour have become increasingly common in recent years. Yet have we really thought about the impact it may have on our hearing? At the Hearing Foundation of Canada, we have become concerned that this amounts to a huge, unregulated, although unintentional experiment that exposes the general population – especially young people – to the risk of noise-induced hearing loss.

Sound Sense

Several years ago, reacting to alarm bells set off by Canadian and international researchers, the Hearing Foundation became increasingly concerned about this issue and its impact on the future of our young people. As a result, the Hearing Foundation designed, with the help of the Ontario Trillium Foundation – an award winning and unique preventative education programme called *Sound Sense/Oui à l'ouïe.*

Students learn just how loudly they listen to their MP3 players

Preventing Noise Induced Hearing Loss

Sound Sense is a hearing health programme designed to teach elementary school students about the dangers of noise-induced hearing loss. This programme, available in English and French, complements the Healthy/Active Living module within most provincial elementary school curricula. *Sound Sense* focuses on the value that young people place on music as a way to engage them in a discussion about their hearing. For students who are at the start of the active, noisy teenage years, music becomes increasingly important – because how they listen to music will likely play a key role in preventing noise-induced hearing loss.

The *Sound Sense* Programme

The Sound Sense Programme is delivered by trained facilitators, including audiologists and people with existing hearing loss. The classroom presentation includes:

- Interactive discussions that make students aware of how their hearing connects them to others and the world around them
- A partially animated DVD that shows how hearing works and the fundamentals of noise-induced hearing loss
- Testing of students listening levels using a sound meter and MP3 player
- Discussions on ways to practice safe listening
- Take-home materials for students (earplugs, stickers) and parents (information sheets)
- Materials for teachers that include posters, a backpack for programme materials, and fact sheets on improving classroom acoustics.

Spike is the engaging host on the Sound Sense programme DVD

By establishing *Sound Sense*, the Hearing Foundation is building on a growing body of international research that is indentifying hearing loss at younger ages and that is showing the value of preventative education. For example, the Royal National Institute of Deaf People, in the United Kingdom, highlights a Norwegian study where the incidence of some form of hearing loss among 18 year-olds increased from 15% to 35%, within the space of 10 years. This was strongly linked to an increase in leisure noise exposure. Within seven years of beginning a comprehensive public information campaign, however, these levels dropped by more than half, to 15%. Early results from a scientific outcome study by Vancouver researchers are showing that *Sound Sense* may have a similar impact on Canadian students.

In the past several years, the *Sound Sense* message has been delivered to more than 3,000 elementary schools across Canada. As part of its long-term strategy to deliver the message of noise-induced hearing loss, the Hearing Foundation is now in the early stages of piloting a complementary programme to engage high school students. These students are in their prime listening years and are exploring lively social activities and playing their music loudly.

The Hearing Foundation: High School Students, Medical Researchers and Musicians

In the fall (autumn) of 2008, the Hearing Foundation brought together high school students (including many with hearing loss), medical researchers, musicians and songwriters for Canada's first 'Youth Listening Summit'. In two days of discussions, research briefings and other activities, this diverse group designed the basics of what will become an interactive presentation for Canadian High School students. Using a mix of live presentations by working musicians and using social media such as Facebook[a] and Twitter,[b] the programme will engage high school students on their own terms in a discussion on listening behaviour and hearing loss.

This programme will be piloted in three high schools in Ontario, Canada, by mid-2009 and, then, evaluated to determine how best we can use this model to involve students across the country.

While the elementary school *Sound Sense* programme and its emerging high school counterpart are on the front lines of addressing what we believe is a growing public health challenge, much more needs to be done. The Hearing Foundation of Canada is only one of many non-profit organisations across the world that are trying to highlight the challenge of noise-induced hearing loss, with the purpose of alerting and advising governments, health care providers, researchers and the public.

[a]Facebook - Facebook is a social networking website that is operated and privately owned by Facebook Inc (Wikipedia)

[b]Twitter - Twitter is a free social networking and micro-blogging service that enables its users to send and read messages known as tweets. Tweets are text-based posts of up to 140 characters displayed on the author's profile page and delivered to the author's subscribers who are known as followers Wikipedia)

For more information on the Foundation's work, please visit www.hearingfoundation.ca

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CARDIOVASCULAR RISK DUE TO COMMUNITY NOISE STRESS

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Introduction

Sound penetrates our life everywhere. It is an essential component of our social life. We need it for communication, orientation and as a warning signal. However, 'unwanted' sound must be considered as 'acoustical rubbish'. The auditory system is continuously analysing acoustic information, which is filtered and interpreted by different cortical and sub-cortical brain structures. Sound becomes noise when it disturbs activities, when it is perceived as a nuisance, or when it causes ill-health.

Adverse effects of noise that have been studied with respect to community noise are:

- *Annoyance*
- *Sleep disturbance*
- *Cognitive impairment (in children)*
- *Hearing impairment*
- *Mental health*
- *Cardiovascular diseases (including hypertension and ischaemic heart diseases).*

As far as environmental noises are concerned (including noise from road, rail and air traffic), hearing impairment is not a problem in most instances, because ambient noise levels[a] are below the ear damaging criteria. This paper focuses on the non-auditory effects of transportation noise on the cardiovascular system.

Noise Effects' Hypothesis

The hypothesis that long-term exposure to environmental noise affects cardiovascular health is based on the general stress theory. Noise is an unspecific psychosocial stressor that activates the autonomous nervous system and the endocrine system, including the hypothalamo-sympathetic-adrenal medullary system (SAM axis) and the hypothalamic-pituitary-adrenal cortical system (HPA axis). According to the general stress model, repeated temporal changes in biological responses can result in permanent metabolic changes of the organism leading to chronic diseases in the long run. The arousal of the sympathetic and endocrine system is associated with changes in physiological functions and the metabolism of the organism, including blood pressure, cardiac output, blood lipids, carbohydrates, electrolytes, blood clotting and other biological (endogenous) risk factors. Increased allostatic load[b] and chronic dysregulation[c] of risk factors promotes the development of cardiovascular diseases, including hypertension, arteriosclerosis and myocardial infarction in the long run. Noise affects the organism either directly through synaptic nervous interactions, or indirectly through the emotional and the cognitive perception of sound and the increased effort of coping with the noise. It should be noted that the 'direct' pathway is relevant even at low sound levels, particularly during sleep, when the organism is at its nadir[d] of arousal.

[a] Ambient noise level – The sound pressure level at a given location
[b] Allostatic load – The physiological costs of chronic exposure to the neural and neuro-endocrine stress response
[c] Dysregulation - poor emotional response/mood swings
[d] Nadir – lowest point

Transportation noise can affect health (1)

Photo: BMU/H.-G.Oed / Wolfgang Babisch

Cardiovascular Risk due to Community Noise Stress

Evidence of the Association

The evidence and the causation regarding the long-term health effects of subjects exposed to moderate environmental noise levels over a long time is based on the results of:

- Short-term experiments carried out on humans, showing acute physiological and biochemical responses in subjects exposed to moderate levels of noise over a short time (for example, heart rate, blood pressure, vasoconstriction, stress hormones, ECG, blood lipids). Noise-induced instantaneous autonomic responses did not only occur in waking hours but also in sleeping subjects, even when no EEG awakening is present. They did not adapt on a long-term basis although a clear subjective habituation occurs after a few nights. Repeated arousal from sleep was associated with a sustained increase in daytime blood pressure.

- Long-term experiments carried out on animals, showing manifest disorders in species exposed to high levels of noise over a long time, including high blood pressure, thickening of vascular walls, increases in connective tissue in the myocardium ('ageing') and mortality.

- Long-term effects of occupational noise exposure on humans, showing high blood pressure and ischaemic heart diseases in workers exposed to high noise levels over a long time.

Quantifying the Risk

Most epidemiological noise studies in the environmental field were carried out with respect to road and air traffic noise. The studies suggest a higher risk of cardiovascular diseases, including high blood pressure and ischaemic heart diseases in subjects persistently exposed to higher levels of noise at the workplace or transportation noise outside their dwellings. Numerical meta-analyses were carried out assessing exposure-response relationships in quantitative terms. Such curves can be used for a quantitative risk assessment and burden of disease calculations in public health. If the distribution of exposure in a population and the exposure-response relation are known, the so-called population 'attributable risk percentage' or 'impact fraction' can be estimated. This is an estimate of the proportion of the entire population that develops a disease due to the exposure. An example is given for Germany: It is estimated that 2.9 percent of the total cases of myocardial infarction is attributable to the traffic noise exposure in the country. According to the 'European Noise Directive', noise maps are currently established all over Europe. The maps can be used for quantitative risk assessments and for the assessment of the environmental noise burden of disease of European citizens due to noise. Expert groups have concluded that average road traffic noise levels at the front of houses exceeding 65 dB(A) during daytime and 55 dB(A) during the night were considered to be harmful to cardiovascular health. Adverse health effects due to aircraft noise were found at even lower average noise levels, which may have to do with the fact that people do not have access to a quiet side (or place) when the noise comes from above.

Transportation noise can affect health (2)

Photo: UBA / Wolfgang Babisch

Quality Targets for Environmental Noise

Summarising the results of social surveys and epidemiological studies regarding the effects of community noise on cardiovascular health and subjective well-being, the following quality targets can be formulated as recommendations:

- To avoid a health hazard due to environmental noise exposure the average noise levels during day/night outdoors of the dwellings should not exceed 65/55 dB(A).

- To avoid serious annoyance, the respective average noise levels should not exceed 55/45 dB(A).

These numbers may change due to the results of new studies. It was estimated that more than 30% of the European population were exposed to day/night-noise immission levels of 55/45 dB(A) and more than 10% to 65/55 dB(A).

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NOISE ANNOYANCE: A REVIEW OF RESEARCH CONDUCTED AT HEALTH CANADA'S ACOUSTIC DIVISION

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1. Background

The objectives of Health Canada's Acoustics Division include assisting in the reduction of noise-induced hearing loss and non-auditory health effects of noise. In order to meet these objectives, the Acoustics Division is involved in several research activities that include, but are not limited to, generating information on the health effects of noise that can be used by both the public and regulatory authorities for risk management. Recent research activities have included Canada-wide surveys on noise-induced annoyance and disturbance of daily activities. This paper provides a summary of the research done to date by the Acoustics Division on noise and annoyance.

2. Long-term High Annoyance as a Health Effect of Noise

Canadian federal, provincial and territorial governments have adopted the definitions of 'health', as put forth by the World Health Organization (WHO).[1]

These definitions are: ***'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'*** and, ***'the extent to which an individual or a group is able, on the one hand, to realise aspirations and to satisfy needs, and on the other, to change or cope with the environment'.***

Health Canada's regard for 'high annoyance' towards community noise as a measure of health impact, is not only consistent with these definitions of 'health', but also recognises that there is a reasonable causal relationship that exists between the percentage highly annoyed* by noise (%HAn) among an average community and long term, average sound levels. Not only is high annoyance indicative of an inability to cope with intruding noise, but there is some support that long-term high annoyance may be associated with the expression of other diagnosed or perceived health impacts.[3,4,5]

A recent WHO study on housing and health status, described the Large Analysis and Review of European Housing and Health Status (LARES), and showed that being highly annoyed towards traffic and general neighbourhood noise (i.e., neighbouring apartments, staircase and noise within the apartment) increased the relative risk for the prevalence of a variety of illnesses, as diagnosed by a physician.[3] As discussed below, the latest national survey commissioned by Health Canada also showed that self-reported high annoyance towards road traffic noise was more likely to be perceived as having a greater negative impact on one's health, compared to lower magnitudes of annoyance.[5]

**The term 'highly annoyed' was operationalised in the research done by Schultz[2] as reflecting the response to a social survey question on noise annoyance, with a response in the top 27% to 29% on an anchored numerical scale or, in the top two categories, on an adjectival, five point verbal scale.*

Interestingly, in that study there was no relationship between high annoyance and self-reported health status. One possible interpretation of this observation is that high annoyance may be expressed before other health effects are manifested.

The notion that high annoyance may be associated with other illnesses has been recently discussed in more detail in a review paper by Michaud et al.[6] This review explored whether a change in percentage highly annoyed with project noise could be used as a health effect for environmental assessment purposes. In particular, consideration was given to this endpoint as a basis for noise mitigation (reduction) recommendations.

The International Organization for Standardization (ISO) technical specification (ISO/TS 15666) includes two standardised questions for assessing noise annoyance in socio-acoustic research.[7,8] This facilitates comparisons between studies and circumvents ambiguity (uncertain conclusions) that might exist in deciphering variations in annoyance questions. The two ISO questions have been among those used in the national surveys commissioned by Health Canada as a way of understanding how Canadians view community noise.

3. National Surveys on Noise Annoyance in Canada

In the Spring of 2002, the acoustics division commissioned the first national survey specifically designed to develop a 'baseline' understanding of how annoyed Canadians were by environmental noise, in general,

and to identify the sources that were declared to be the most annoying.[9] This randomised telephone survey was conducted on a representative sample of 2,565 Canadians, 15 years of age and older. The results indicated that 8% of Canadians (~ 1.8 million) reported being highly annoyed by environmental noise in general and that road traffic noise was the source identified as being the most annoying. However, depending on how the data were grouped, neighbourhood noise could also be considered as one of the most annoying (combination of) noise sources. In order to better characterise the degree of annoyance towards road traffic noise, the acoustics division commissioned a second survey in the fall (autumn) of 2002 using the two ISO/TS 15666 recommended questions. This survey followed the same methodology as the previous survey. It was revealed that 6.7% of Canadians declared to be very (or extremely), i.e., highly annoyed by traffic noise when they were asked to respond on a five-point adjectival scale. This increased to 9.1% when highly annoyed was defined as responses on a numerical value of 7 and above on the 11-point numerical scale, where 0 was defined as 'not at all annoyed' and 10 was defined as 'extremely annoyed'. The national margin of error associated with the results of the study was plus or minus 1.9 percentage points, 19 times out of 20. The publication by Michaud et al[9] also includes a discussion of these results. Three years later, a third national survey was commissioned using the same methodology as the first two surveys.

The third national survey took place in autumn of 2005 and included questions designed to verify the road traffic noise annoyance results of the previous survey, assess interference with daily activities due to noise, subject concerns about noise and self-reported distance to a major road. The primary results showed that:

1. The %HAn towards road traffic noise was unchanged from three years earlier (i.e., 6.7%).

2. There was a significant relationship between self-reported distance to a heavily travelled major road** and the magnitude of annoyance and disturbance of a variety of daily activities attributed to road traffic noise.

3. The magnitude of annoyance was statistically related to the degree to which noise interfered with daily activities, including sleep disturbance.

4. As mentioned above, those who were highly annoyed by road traffic noise perceived their high annoyance to have a greater negative impact on their health compared to those who self-reported lower magnitudes of annoyance.

Other variables that had an influence on road traffic noise annoyance were sex, age, education level, community size and province. These results are discussed in more detail by Michaud et al.[5]

4. Concluding Remarks

Environmental noise is ubiquitous and the most common community response to it is annoyance. Health Canada specifically considers long-term high annoyance from noise to be a health effect. In support of this position, the Acoustics Division has recently published a review paper that provides a rationale for using a change in the %HAn[6] as one of the ways to assess noise impacts in environmental assessments. A recent complementary paper discusses how this approach can be used as a basis for deriving noise criteria for wind turbine projects.[10]

The nation-wide surveillance research conducted to date in Canada indicates that nearly two million Canadians are highly annoyed by environmental noise, most of them, by far, due to road traffic noise. There is also evidence from this research that shows Canadians perceive their annoyance towards road traffic noise to have a negative impact on their health. This provides further justification to developing noise mitigation strategies aimed specifically at reducing the increase in %HAn among Canadian populations exposed to noise.

***** A heavily travelled major road was defined as one with 4 or more lanes or one with a posted speed limit of 80 km/hour or greater. Self-reported distances were 30 metres or less, between 30 metres and 500 metres and greater than 500 metres.***

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BRAZIL'S NATIONAL IMMUNISATION CAMPAIGN FOR THE ELIMINATION OF RUBELLA

The Ministry of Health in Brazil conducted the largest immunisation campaign against rubella in the world. In the last five months, more than 67.2 million people were immunised - 95.79% of the targeted population. On 3 March, 2009, the final report was handed to WHO (World Health Organization) and PAHO (Pan American Health Organization). This is an historic moment for the country and Brazil enters now a second stage when the country will be monitored by WHO.

Data from the Ministry of Health demonstrates that 34.8 million women were immunised (98.4% coverage) and 32.4 million men (93.1%), ages 20-39, with selected States including the ages 12 to 20. The Ministry of Health predicts that by the middle of 2009, Brazil may be rubella-free and may have eliminated the Congenital Rubella Syndrome.

The campaign in Brazil is part of the commitment made by the countries of the Americas during the 44th Board of Directors' meeting of the Pan American Health Organization - to eliminate rubella and Congenital Rubella Syndrome by 2010. The estimate is that for each dollar invested in the strategy for immunisation, US$ 12.00 are saved in the treatment of children with Congenital Rubella Syndrome. In 2006, there was an increase in the number of confirmed cases of rubella, in two States in Brazil. The dissemination of the virus also happened in 2007, when 20 States were affected, totalling 8,683 cases.

Health Minister, José Gomes Temporao immunises the Brazilian swimming champion, César Augusto Cielo Filho. The T-shirt used by both says: 'To vacinado' meaning: 'I am immunised' and below the information about the Campaign against Rubella.

César Augusto Cielo Filho is a Brazilian freestyle swimmer who on August 16, 2008, won the gold medal in the 50 metre freestyle at the Beijing Olympics.

Photo: Ministry of Health, Brazil

The campaign against rubella demanded the preparation of a 'mega' structure. To reach the goal, the Ministry of Health of Brazil trained professionals in all 5,564 municipalities in the country. The numbers of the Campaign for the Elimination of Rubella are impressive: 67.2 million people immunised; 84 million vaccine doses; 90 million syringes and needles; 220 thousand people mobilised (health workers and volunteers); 10 Brazilian Air Force airplanes; 41 thousand cars and 600 boats.

The vaccine against rubella was taken to places with high people flow - to guarantee the highest possible vaccine coverage: parades, stadiums, rodeos, parks, beaches, train stations, shopping centres, music shows, soccer stadiums and many other places. A website was available that measured daily the numbers of the campaign in the different areas of this large country. The campaign received support from celebrities and popular television stars to help sensitise the population.

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Source: Ministry of Health, Brazil
Website: www.saude.gov.br

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BOOK REVIEW: AUDIOLOGY IN THE USA

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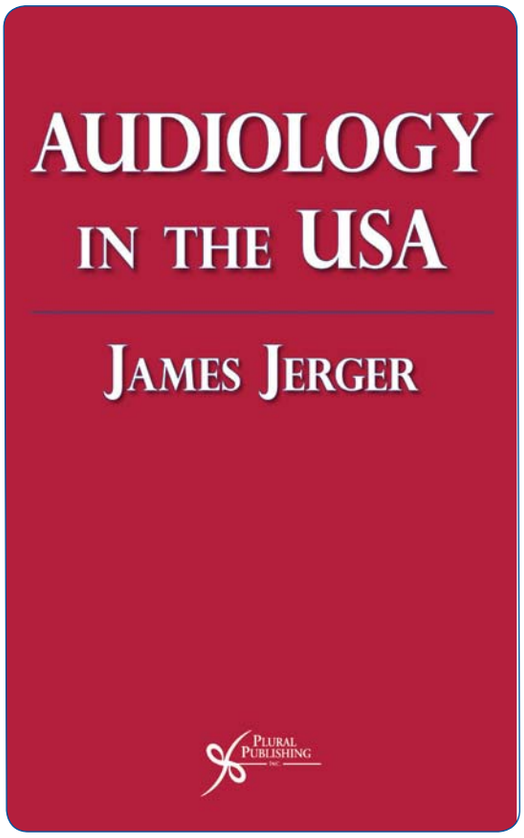

In this book, the world renowned audiologist, James Jerger, recorded a very interesting, brief historical review of the professional growth of audiology in the United States since the beginning of the last century. This book has 15 chapters in three sections:

1. The Early Years.
2. Six Divergent Paths.
3. Professional Growth.

First Section: The Early Years

The first section on ***'The Early Years'*** reviews the early efforts in the development of commercial audiometers and the establishment of calibration standards for these audiometers. Jerger has also elaborated on the development of the military rehabilitation programme which was developed in 1943 and was the first audiology rehabilitation programme. The Veterans' Administration (VA) programme which was developed after the end of World War II, is now the largest employer of audiologists in the United States.

Second Section: Six Divergent Paths

In section two, ***'Six Divergent Paths'***, Jerger discusses the divergence of the audiology profession into six distinct but interacting paths in the past half century. These were concerned with audiological diagnosis, rehabilitation, paediatric audiology, auditory processing disorders, tinnitus evaluation and therapy and hearing conservation. Jerger stated; 'The history of any profession is intimately related to four factors:

1. Its interaction with related professions.
2. The educational institutions and policies that influence the training of its members.
3. The professional organisations that provide a home for its members.
4. The source of research support for its scientific base.'

Third Section: Professional Growth

Section three; ***'Professional Growth'*** is devoted to providing a historical review of these four issues. In this section, Jerger explained the necessity of developing an AuD degree which would foster an atmosphere of co-equality between the audiologist and colleagues in the medical professions. However, some otolaryngologists argue that the AuD will increase the cost of employing audiologists and result in over-qualified audiologists. Jerger mentioned the development of the famous American Speech-Language-Hearing Association (ASHA), then, the American Academy of Audiology (AAA), which broke away from the ASHA in order to fulfill the need of the audiologists to have their unique professional home. Other organisations were formed recognising special interests, e.g., the Academy of Rehabilitative Audiology (ARA) and the American Auditory Society (AAS).

Comment

In the last chapter of the book, Jerger came to a very interesting conclusion about the important lessons we can take from the historical review of the growth of our audiology profession. He said that fragmentation of audiology and development of specialisation is inevitable. Though there will be always be grim talk of disloyalty and the need to preserve unity, fragmentation will go on, in spite of prophets of doom and disaster. These new specialties and organisations should work together for the common good rather than competing with each other over their interests and influence.

General speaking, I found the book very interesting as it provides an insight into the exerted efforts for development of contemporary audiological diagnostic and rehabilitative tools. I was very pleased with the large number of personal pictures of renowned audiologists published in the book, which gave it a very warm human touch.

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Gael Hannan presenting Sound Sense to northern Canadian students in Yellowknife, North West Territories, Canada

Photo: The Hearing Foundation of Canada

COMMUNITY EAR & HEARING HEALTH

Aim

- To promote ear and hearing health in developing countries

Objectives

- To facilitate continuing education for all levels of health worker, particularly in developing countries
- To provide a forum for the exchange of ideas, experience and information in order to encourage improvements in the delivery of ear and hearing health care and rehabilitation.

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