

Abstract

The prevalence of tinnitus and hearing impairments among adolescents seems to increase as a consequence of exposure to loud noise. Several studies have highlighted the negative auditory effects of exposure to loud music at concerts and discotheques, environments in which young people today spend considerable periods of time. The appreciation of loud music clearly involves health-risks. Previous research suggests that patterns of health risk behaviours differ in relation to socio-economic status. The purpose of this thesis is to gain a better insight into adolescents' and young adults' attitudes and health-risk behaviours regarding exposure to loud music.

Four empirical studies were conducted. Permanent tinnitus and noise sensitivity were not found to be significantly related to socio-economic status, although significant age-related differences in the prevalence of experienced tinnitus and noise sensitivity were found, which might indicate that the problem increases with age. Of 1285 subjects a larger number (30%) reported the use of hearing protection when attending concerts. Our finding that adolescents' attitudes and behaviours regarding the use of hearing protection differed between levels of socio-economic status and age is of considerable interest. Adolescents from low socio-economic backgrounds express more positive attitudes towards noise and report less use of hearing protection, in comparison to those with high SES. These differences in attitudes and behaviour may indicate future socio-economic differences in ear health.

Comparisons between Swedish and American young adults revealed that attitudes towards noise differed significantly due to gender and country. Men had more positive attitudes towards noise than women, and men from the USA had the most positive attitudes. Least positive were the women from Sweden. In Sweden the use of hearing protection at concerts was substantially higher than in the USA, a result that can be explained by cultural and attitudinal differences between the countries. Young people's experiences, attitudes and beliefs concerning risk-taking in musical settings have been investigated in a qualitative study. In a theoretical framework, we suggest that background variables, such as gender, culture and social status may have an impact on the individual's self-image, risk consideration, social norms and ideals. These variables, together with attitudes and experience of risk-behaviour, are considered as important factors in the understanding of health-risk behaviour.

Key words: Adolescents, Tinnitus, Noise sensitivity, Socio-economic status, Attitudes, Use of hearing protection, Risk behaviour, Risk-consideration, Self-image, Norms and Ideals.

Preface

This thesis consists of a summary and four studies, which are referred to by Roman numerals below:

- I. Olsen-Widén, S.E., & Erlandsson, S.I. (2004). Self -Reported Tinnitus and Noise Sensitivity among Adolescents in Sweden. *Noise & Health 7: 25, 29-40.*
- II. Olsen-Widén, S.E., Erlandsson, S.I. (2004). The Influence of Socio-Economic Status on Adolescent Attitude to Social Noise and Hearing Protection. *Noise & Health 7: 25, 59-70.*
- III. Widén, S.E., Holmes, A.E. , & Erlandsson, S.I. (2006). Reported Hearing Protection Use in Young Adults from Sweden and the USA: Effects of Attitude and Gender. *International Journal of Audiology 45: 273-280.*
- IV. Widén, S.E., & Erlandsson, S.I. (2006). Risk perception in musical settings – a qualitative study. (Submitted to: *The International Journal of Qualitative Studies on Health and Well-being*).

Acknowledgements

First of all I want to express my deepest gratitude to my supervisor, assoc. Prof. Soly Erlandsson at the Department of Social and Behavioural Studies, University West, for her invaluable guidance and support, and for sharing her considerable expertise. In addition, I want to express my sincere gratitude to my examiner and supervisor Prof. Erland Hjelmqvist at the Department of Psychology, Göteborg University, for believing in my research and for giving me the opportunity to do research as a PhD student in the first place. Furthermore, I would like to thank Prof. Alice Holmes at the Department of Communicative Disorders, University of Florida, for her important role in this project. My thanks also go to Prof. Sven G. Carlsson at the Department of Psychology, Göteborg University, for providing me with useful comments during my PhD studies. I also want to thank Prof. Björn Lyxsell for reading through my PhD dissertation and for me helpful suggestions for improvements to the manuscript.

I am also very grateful to the University West, The Stinger Foundation and The Solstickan foundation for providing me with financial support during my years as a doctoral student.

Further, I want to express my gratitude and appreciation to the library staff at University West for being so helpful and service minded in assisting me in accessing relevant literature for my research. It is always a pleasant and positive experience visiting the library! I also want to thank Alastair Henry for reviewing, and for providing suggestions for linguistic improvements to all of my articles and to this manuscript. I would also like to thank all the school principals, class teachers, and my colleague Ingemar Johansson, for assisting with the data collection. In addition, I especially want to thank my colleagues Margareta Bohlin and Gunne Grankvist from the Psychology and Organisational Studies programme at University West for all the amusing and interesting discussions we have enjoyed, as well as for being good friends who never miss an opportunity to have a good laugh.

Last, but by no means least, I would like to thank my wife and my very best friend Jill for all of her encouragement and support and, most of all, for believing in me through these years of hard work. You are the music in my life!

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Study I. Self -Reported Tinnitus and Noise Sensitivity among Adolescents in Sweden.

Study II. The Influence of Socio-Economic Status on Adolescent Attitude to Social Noise and Hearing Protection.

Study III. Reported Hearing Protection Use in Young Adults from Sweden and the USA: Effects of Attitude and Gender.

Study IV. Risk perception in musical settings – a qualitative study.

Introduction

Adolescents' progression to adulthood varies from one period of time to another, and from one culture to another. The context in which adolescents are brought up influences their decisions, behaviours and lifestyles. Adolescence is a time when young people continue to develop the social and intellectual skills that will prepare them for adult roles and responsibilities. During this period in life, the individual reaches physical and sexual maturity, develops more sophisticated reasoning ability, and begins to look to their future by developing lifestyle expectations and setting educational and occupational goals that will shape their adult lives (Harris, Duncan & Boisjoly, 2002). The biological, cognitive and psychosocial changes during adolescence, provide many developmental opportunities for adolescents to participate in behaviours that have important implications, not only for the adoption of healthy lifestyles, but also in relation to health risk behaviours (Millstein, Peterson & Nightingale, 1993). Loud, popular music is often associated with the word "teenager", as is for example, the wearing of "rebellious clothing". Wearing certain clothes, or listening to popular music is of course, a natural part of being a young person, going from childhood to adulthood and engaging in the process of finding one's own identity. However, some of the activities associated with today's youth culture may involve a degree of risk-taking behaviour, such as smoking, drug misuse, addiction, sexual risk-taking and participation in criminal activities. Risk-taking behaviour in adolescence may be one of the factors contributing to health problems later in life.

The prevalence of tinnitus and hearing impairments among young people seems to increase as a consequence of exposure to loud noise, or music played at loud volumes. A number of studies have recently been published on the auditory effects of music exposure at discotheques and rock concerts (e.g. Serra et al., 2005; Biassoni et al., 2005). The results indicate that concert- and discotheque-goers are routinely exposed to sound levels above 100 dBA (Clark, 1992). To be affected by even a moderate hearing impairment may have serious consequences for the individual's social life and can even result in a functional disability. Clearly, there are some health risks associated with the appreciation of loud sounds, or the enjoyment of being in environments where loud music is played. It is important to emphasise that music itself should be considered as something positive affecting peoples' perceived quality of life and providing opportunities for relaxation. The problem is not music per se; the problem is loud *volume*. The use of hearing protection when listening to music is not the best

solution to the problem of noise related tinnitus, noise sensitivity and hearing impairments. The best solution is to lower the volume. However, on some occasions (e.g. at a concert) the individual is not able to control the sound environment by lowering the volume, so instead the use of earplugs may be a health preventive strategy.

In this thesis the individual's attitude towards social noise (e.g. loud music on concert and discotheques) is considered to be an important factor when judging noise related health risks. Furthermore, social differences, both in attitudes towards noise and in health preventive behaviours, i.e. the use of hearing protection in musical settings, have been identified. We believe that, in the long run, these differences may cause similar inequalities in actual health. Are young people aware of the risks associated with listening to loud music, and is this regarded as a health-risk behaviour? Are temporary hearing symptoms, such as buzzing ears after noisy activities, perceived differently, and might these cause individuals to act in different ways? These are some of the issues that will be discussed in this thesis.

Aims of the thesis

Participating in activities where loud music is played and its negative auditory effects have been investigated in several studies (Ising et al., 1997; Sadhra et al., 2002; Serra, et al., 2005; Biassoni et al., 2005). The general purpose of this thesis is to gain a greater insight into adolescents' and young adults' health-risk behaviours regarding exposure to loud music, and in addition, to developing a theoretical understanding of risk-taking behaviour. The focus of this thesis is upon adolescents' and young adults' experiences of hearing problems, their attitudes towards noise, and the prevalence of health preventive behaviour, such as the use of hearing protection, when exposed to loud music. In addition, the young people's own beliefs and perceptions about risks connected to musical settings have also been investigated. These aspects were investigated in four empirical studies, each of which had its own specific aim.

Few studies regarding exposure to loud noise and the prevalence of noise sensitivity and tinnitus among Swedish adolescents have been reported. Only a few no studies have focused on young people and the use of hearing protection in noisy environments and musical settings. Therefore, the aim of **Study I** was, first, to explore the prevalence of tinnitus and noise sensitivity among young people in Sweden, and secondly, to describe their habits regarding noise exposure and the use of hearing protection.

Attitudes have been identified as an important variable in the understanding of health-risk behaviours (Ajzen, 1991). Another important variable regarding health-risk behaviour is the individual's social background (Pietilä, Hentinen & Myhrman, 1995). The aim of **Study II** was thus to discover whether adolescents' attitudes towards noise differed due to age and socio-economic status (SES). Additionally, the study investigated the influence of assumed health preventive variables, such as permanent tinnitus, noise sensitivity, socio-economic status and attitude towards noise, on the use of hearing protection at discotheques and pop concerts.

Mead's (1934) theory of the development of self-consciousness places an emphasis on the interaction between the individual and society. According to Foucault (1972) discourse in society has power over individuals, since it governs people's thinking and behaviour. Binde (2002) argues that individuals' understanding about risks and actions that involve risk-taking

is based upon knowledge, which is shaped by culturally specific norms, ideals and values. Cultural differences in knowledge, norms and ideals can in this way, be linked theoretically to attitudes and behaviour. There are no published studies on cultural differences in attitudes towards noise and the use of hearing protection. In the light of the two first studies, the aim of **Study III** was to compare attitudes towards noise held by young men and women in Sweden and in the United States of America. This was done with the aim of investigating whether assumed cultural differences between the two countries in use of hearing protection at concerts could be explained by underlying attitude differences towards noise.

Even though in the previous three studies, we found that adolescents in Sweden commonly used earplugs, a great number of adolescents did not use any hearing protection when visiting musical settings. Research (e.g. Chung et al., 2005; Behar et al., 2004; Sadhra, et al., 2002) has found that participating in activities where loud music is played presents a risk to hearing. However, little is known about the extent to which young people who participate in these activities are aware of the health-risks they are exposed to. The purpose of **Study IV** was therefore to gain a better understanding of the underlying variables on risk-taking regarding exposure to loud music in musical settings by means of Grounded theory (Glaser & Strauss, 1967) and, additionally, to investigate whether exposure to loud music is perceived as a risk by the participants themselves.

The concepts of risk-taking and risks

Adolescents seek to develop their own identity, opinions and values (Miller, 1989). For adolescents given the freedom to experiment, as they are allowed in our culture, this period in life also entails taking certain risks. Risk-taking behaviour can be any behaviour that has a significant degree of uncertainty about the losses associated with its outcome. The losses may refer to any possible undesirable consequences. The benefits of risk-taking behaviour are often regarded as positive reinforcers to the behaviour in question. The motivating circumstances that serve to maintain or initiate a risk-behaviour are often regarded in theoretical models, as when the subjective or perceived benefits of behaviour over-ride the costs (Burns & Wilde, 1995). The concept of risk behaviour can comprise all behaviours affecting wellbeing, health, and the individuals' life course in general (Jessor, 1998). Risk behaviours can be considered as risk factors for personally, socially or developmentally undesirable outcomes.

Risk-taking may be considered from either an individual (internal) or a cultural (external) point of view, or indeed both. The internal point of view deals with personality factors relevant to risk-taking behaviour. Pinkerton and Abramson (1992) have classified the range of the personality dimensions considered to be relevant for risk-taking behaviour into three main groups in their decision-making model. The first is "drive or motivation", which deals with venturesomeness and impulsiveness. Secondly, there are "integral personality traits" such as Eysenck's three dimensions of personality, which are introversion-extraversion, psychoticism and neuroticism. Finally there are, "other kinds of reference", such as object relations and general personality characteristics.

The theory of broad and narrow socialisation (Arnett, 1992) represents the external point of view. According to this theory, risk taking can be understood in terms of socialisation. In his theory Arnett identifies the dimensions crucial to socialisation and which play an important role for risk-taking behaviour, especially among adolescents. These dimensions are; family, peers, school, neighbourhood, community, the legal system, the media, and the cultural belief system. In cultures characterised by broad socialisation, individualism and independence are promoted, and there are relatively few restrictions regarding different dimensions of socialisation. This allows individuals to express their personal characteristics by, for example, engaging in risk-taking behaviours. In contrast, cultures characterised by narrow socialisation reinforce obedience and conformity to the

social and normative standards of the community. Restrictions or punishment may follow deviations from these norms. Consequently, risk-taking behaviours are more rare in such cultures (Arnett, 1992). Personal lifestyle, family structure and social inequalities are other external factors contributing to risky behaviour and differences in health outcomes, especially among adolescents (Rice, 1996; Pietilä, Hentinen & Myhrman, 1995; McArdle et al., 2002).

According to George Herbert Mead (1934), social psychology has primarily dealt with social experience from an individual perspective. However, Mead's theory of the development of self-consciousness places an emphasis on the interaction between the individual and the society. According to Mead, we achieve self-awareness when we learn to distinguish the "me" from the "I", where the "I" is the unsocialised infant and the "me" is the social self. The development of self-consciousness is a process in which the individual starts to perceive herself as other people see her. A concept central in this theory is the "generalised other", which refers to the general values and moral rules involved in the culture in which a child is developing. Mead's theoretical perspective clearly has some similarities with Anthony Giddens' (1991) view of self-identity. Giddens argues that self-identity is shaped by, and yet also shapes, the institutions in modern society. In his social-constructivist perspective, the self is not passive and is not completely determined by external factors. Individuals actively contribute to, and directly promote, social influences that may have global implications and consequences. In modern society, self-identity becomes a reflexively organised endeavour, where the reflexive project of the self, takes place in a choice-rich context filtered through abstract systems. Because of the openness of social life today, at least in western cultures, lifestyle choices are increasingly crucial in the constitution of self-identity and in daily activity. Reflexively organised life planning, which normally presumes risk consideration identified by expert knowledge, becomes a key task for the structuring of self-identity.

Individuals' understanding about risks and those actions that can be regarded as involving risk, are based upon available knowledge, which in turn is shaped by norms, ideals and values existing in specific societies (Binde, 2002). Since knowledge is dynamic, it is not possible to view the concept of risk as something that remains stable over time. According to Binde (2002) the individual's understanding about risks is formed in two ways. One way is to learn from one's own experiences. The other way to learn about risks in our society is through discourse, via what we read in newspapers, or hear on the radio or see on television. Foucault (1972) argues that discourse in society has power over individuals, since it governs people's thinking and behaviour.

Within cultural theory it is suggested that all risks are social constructions that mirror a specific society. This involves both individuals' risk perceptions, as well as the research community's produced knowledge about risks (Boholm & Ferriera, 2002). However, perceiving risks as merely social constructions implies a denial of the distinction between "actual" and "perceived" risks. In contrast to cultural theory, which claim that risks are social constructions, risks can be regarded as actual or objectively existing risks, independently of the individual's awareness of, or attention to them. This point of view can be characterised as a realistic position. Over time, a number of situations and activities have had a negative impact on people's health and lives, although the negative impact on people's health or on the environment has been identified at a much later point of time (Boholm & Ferriera, 2002). The problem with the concept of risk is that risks exist both as an objective reality independently of people's awareness of them, whilst at the same time, risks also exist as a social construction. That is to say that, when people become aware of something being risky, then the risk is created as a social construction, which may or may not impact upon people's attitudes and behaviour. Hence, social discourse in society is an important factor for people's recognition of health-risks. Are noise and loud music perceived as risks, and is exposure to loud music in musical settings experienced as health risk behaviour by people in general?

Noise and music as a health risk

Noise has become a widespread environmental problem. Environmental noise is the source of disturbance that has been identified as affecting the largest number of people in Sweden. Noise is not perceived as an immediate threat to human life, but, nonetheless, it still plays an important role for our health (Berglund, Lindvall & Schwela, 2000). Noise affects people in different ways depending on the type, volume and frequency of the noise, the time of day when it occurs, and its duration. Environmental noise is a major factor contributing to people's displeasure (Carter, 1996). Some examples of such displeasure are the disturbance of sleep and rest, stress, difficulties in the ability to hear other speakers in a conversation, difficulties in paying attention, difficulties in learning, and of course, hearing impairments. From a physical viewpoint, there is no difference between sound and noise. However, from a psychological point of view, sound is a sensory perception, and noise, music, speech etc can represent the complex patterns of sound waves. Noise can be defined simply, as undesired or unwanted sound (Berglund et al., 2000).

In Sweden, the guideline for occupational noise is 85 dBA. This means that a worker can remain in such a noise environment without wearing hearing protection for 8 hours a day, 5 days a week, during an entire working life without developing a hearing impairment. However, this is a statistical recommendation, which means that approximately 10% of the workers exposed to this noise will in fact develop a hearing impairment in any event (SOU, 1993:65). As a means of assessing levels of occupational noise, the "equal energy principle" is used. This principle refers to the effect of a combination of noise events related to the combined sound energy of those events. The sum of total energy over a particular time period gives a level equivalent to the average sound energy over that period. This is sometimes referred to as LAeq, T, and should be used when measuring continuous sounds e.g. road traffic noise, or in some cases, industrial noises (Berglund et al., 2000). To estimate the risk of hearing loss in a noisy environment, the equivalent continuous noise level (Leq) is used measured in dBA. It is defined as the constant noise level that would provide an equal amount of sound energy over the measured period. Thus it can be understood as a measure of the amount of acoustic energy entering the ear, during a certain period of time (Behar, MacDonald, Lee, Cui & Kunov, 2004). A noise level of 85 dBA or its equivalent level for an 8 hour period is considered to be as dangerous to the hearing as 3 dB or louder noise level (88 dBA) with a duration of just half the time (4 hours) (SOSFS, 1996:7).

Music is another source of environmental noise that is encountered during leisure time. Modern techniques can produce sound peaks at 130-140 dB at pop/rock concerts as well as at discotheques and from car stereos. Some researchers argue that music in musical settings can be harmful at 5 dB louder sound levels than is the case for occupational noise. If the energy principle is used for music at 5 dB louder tolerance level, and the exposure time is limited to one hour a day or five hours a week, this provides a value of 99 dBA (90dBA for 8 hours, 93 for 4 hours and so on). Therefore, music levels below 100dBA at e.g. concerts and discotheques, would imply a low risk of developing hearing impairments and tinnitus, provided that the noise exposure lasts for less than 5 hours a week, and as long as any other exposure to noise does not exceed 85 dBA (SOSFS, 1996:7).

Hearing protection regulations must be observed in occupational noise environments. However, in leisure time activities, such as attending concerts or discotheques, no such regulations exist, despite often considerably greater sound levels. Young people are frequently exposed to loud music during leisure time, especially when attending discos, live concerts or listening to personal music players (Ising, Babish, Haneer & Kruppa, 1997; Gunderson, Moline & Catalano, 1997). Discotheques and pubs have had a long-standing association with playing pre-recorded and amplified music for entertainment. The risk of developing hearing loss from amplified music is, of course, dependent on the duration of exposure and the sound intensity. In addition, the individual's genetic vulnerability is another important factor related to the risk of developing hearing impairments (Sadhra, Jackson, Ryder & Brown, 2002). Recent studies have found that the average sound level for amplified music at discotheques ranged between 104.3 and 112.4 dBA, which increases the risk of hearing loss and hearing symptoms, such as temporary or permanent tinnitus (Serra et al., 2005).

Bogoch, House and Kudla (2005) investigated perceptions about loud music as a risk and additionally the use of hearing protection at rock concerts. They found, in a sample of 272 individuals, that 34.3% thought it was somewhat likely and that 39.8% thought it was very likely, that noise levels at concerts could damage their hearing. In spite of this, 80.2% reported that they never wore earplugs at concerts. Concern about tinnitus, other hearing disturbances and the development of hearing loss were significantly associated with the participants' use of hearing protection. Additionally, the Level for Readiness for Behavioural Change Instrument, devised by Prochaska, was found to contribute significantly to the explanation of the use of hearing protection at concerts. Bogoch et al., (2005) point out that whilst many types of hearing protection designed for industrial use are available, few have been developed for listening to loud music. These devices typically provide more attenuation

for high frequencies than is the case for low frequencies, which can result in a distortion of the perceived spectrum of the sound. Additionally, such types of hearing protection have a tendency to produce an occlusion effect, i.e. an enhancement of low frequencies, as a result of the ear canals being blocked. Consequently, there may be an effect when wearing inexpensive hearing protection on the listener's perception of musical quality, which is undesirable when listening to music.

Noise induced hearing loss is often believed to be preventable. However, it is not uncommon for audiologists to meet patients who continuously listen to loud music even though they have tinnitus or noise-induced hearing losses (Florintine et al., 1998). To gain insight into the behavioural characteristics of individuals who listen excessively to loud music, Florintine, et al. developed the Northeastern Excessive Music Listening Survey, which is derived from the widely used screening instrument for alcohol addiction, the Michigan Alcoholism Screening Test (MAST, Seltser, 1971). The study included 90 subjects, and the result indicated that 8 individuals (9%) scored within the range that would suggest maladaptive music-listening behaviour similar to that exhibited by substance abusers, e.g. continuing the behaviour even though negative health outcomes are experienced. Although, maladaptive music listening is not as serious as some other addictions, such as drug use, it might lead to damaged hearing, and may be one explanation as to why some individuals expose themselves to loud music levels without wearing hearing protection. However, the reasons behind excessive music listening were not investigated in Florintine et al. (1998) study.

Noise exposure and aspects of health

Non-auditory effects of noise are not as well established as auditory effects. Nonetheless, noise, like any other stressor, provokes a series of physiological, psychological, and behavioural changes (Evans & Cohen, 1987). Exposure to noise may even cause several kinds of reflex responses, especially when the noise is of an unfamiliar or unwanted character. These responses partly reflect primitive defence responses of the body and may also develop after exposure to other stimuli. If the exposure is temporary, the physiological system usually returns to a normal state within a short period of time. A sudden change in the acoustic surroundings may activate several physiological systems leading to arousal changes, such as an increase in heart rate, increase in blood pressure, vascular constrictions, and may even

initiate alarm reactions (Andrén, 1982). Community noise interferes with a number of human activities, e.g. recreation, sleep, communication, and concentration. The risk of health effects must be considered from the perspective that noise, as a stressor, may operate through physiological responses modified in complex ways by individual psychological processes (Berglund & Lindvall, 1995). Some studies (e.g. Crook & Langdon, 1974) point to the relationship between exposure to noise and certain physical and mental problems, such as headache, distress, and insomnia. Furthermore, research suggests that a person's self-report of symptoms of ill health can be related to their quality of sleep. Noise sensitivity is also related to problems with sleep as well as to impaired health (Niveson, 1992). Chronic noise-induced interference with sleep may result in deleterious health effects, since it interferes with the functions of sleep, such as brain restoration and respite for the cardiovascular system (Carter, 1998). Gómez-Jacinto and Moral-Toranzo, (1999) found that urban traffic noise has a negative effect on people's self-reported health and this remains the case even when the objective noise conditions are improved. Additionally, people's negative evaluation of a noise, rather than its objective value, is crucial to reported negative effects on a person's health. Annoyance caused by noise can, for example, be related to attitudes, coping capacity, and individual sensitivity (Rehm et al., 1985).

There is an indication of increased blood pressure as a consequence of noise from airports or road traffic in adults (Babisch et al., 1998). This is considered to be a risk for cardiovascular or heart disease. The results confirm previous findings by Cohen, Evans, Krantz & Stokols, (1980). However, noise leading to increased blood pressure also seems to concern children. In a study on children aged 3-7 years, researchers found that blood pressure was significantly higher among children living in noisy environments compared to those living in quieter environments (Regecova & Kellerova, 1995). Other research regarding airport noise and stress among school children has indicated that children who lived near an airport had significantly higher blood pressure and higher levels of adrenaline and noradrenaline in their urine compared to children living in a quiet area (Evans et al., 1998).

Findings of noise-induced temporary changes in the cardiovascular system have led to investigations of possible long term effects associated with noise exposure, such as stress-related cardiovascular disorders (Passchier-Vermeer, 2000). Other studies have focused on the effects of noise exposure on the hormone and immune systems, and the effects of occupational or environmental noise on reproduction and development. The American Academy of Pediatrics has issued a statement warning against the risks of high frequency hearing impairment in babies of mothers exposed to high levels of occupational noise during

pregnancy. The babies' hearing impairments were considered to be consequences of their mothers' stress caused by exposure to noise during pregnancy (American Academy of Pediatrics, 1997).

A study in New York has shown that school children who were exposed to noise from airports had more difficulties in learning how to read, compared to those who were raised in quieter environments (Lang, 1997). Since the reading test in Lang's study was conducted under quiet conditions, the results indicate that permanent noise exposure can have long term effects on reading ability. The study also showed that children raised in noisy areas had more difficulties in understanding speech, which in turn can lead to consequences for their reading ability. Evans & Maxwell (1997) discuss the possibility that noise exposure can have a negative impact on reading comprehension, since children exposed to noise seem to discriminate or dismiss auditory stimuli including speech, as an attempt to adjust to a noisy environment. Another possible interpretation of the study is that the results may be explained by socio-economic differences between the two areas. Environmental risks are not randomly distributed in the population. For example, a study by Evans and Marcynyszyn (2004) found that crowding, environmental noise, and housing quality were assessed in a sample of 216 low- and middle-income elementary school children aged 8 to 10 years. Among the children from low-income families, the mean noise level (Leq dBA) was found to be 64.94, whereas in the middle income families the noise level was 61.45. Neuroendocrine indices of chronic stress increased with cumulative environmental risk exposure for the low-income children. However, this was not found for the middle-income children. Middle-income children also faced lower levels of environmental risk exposure compared to low-income children.

Studies have indicated that exposure to high levels of occupational noise can be associated with the development of neurosis and irritability, and that exposure to high levels of environmental noise can be associated with mental illness (Evans, 1982; Cohen et al., 1986). However, a review of the literature suggests that noise should not be considered to be a direct cause of mental illness; rather its impact might be such as to accelerate and intensify the development of latent mental disorders (Berglund & Lindvall, 1995). The relationship between noise annoyance, noise sensitivity, and mental health is complex and, as yet, has not been fully differentiated.

Noise and hearing

When the ear is exposed to loud sounds, temporary or permanent hearing impairments may arise. Temporary hearing impairments can occur at an equivalent level of 75 dBA after several hours of exposure to noise. Permanent hearing impairments develop either through many years of noise exposure, such as occupational noise in industry, or through loud levels of noise (more than 140 dB at peak) for short periods of time (SOSFS, 1996:7), which is also referred to as *acoustic trauma*. In acoustic trauma the elastic inner ear compartments are stretched beyond their limits and are physically damaged by the impact of the noise peak. In contrast to acoustic trauma, chronic exposure to noise levels between 90 and 140 dB results in metabolic cochlear damage, called *noise-induced hearing loss*, also referred to as NIHL (Clark, 1992). The extent to which NIHL progresses depends on the intensity and duration of noise exposure, as well as individual differences in susceptibility. Hearing impairment is typically defined as an increase in the threshold of hearing, which is defined as the quietest sound that can be detected. A permanent noise induced hearing loss (NIHL) occurs predominantly in the higher frequency range of 3 000- 6 000 Hz, with the largest effect at 4 000 Hz. But with increasing equivalent levels, and increasing exposure time, NIHL can occur even at frequencies as low as 2 000 Hz. NIHL is audiometrically characterised by more deteriorated hearing loss in the higher frequencies, and grows deeper when the damage gets worse (Berglund, et, al., 2000). An acute NIHL may also be either permanent (permanent threshold shift, PTS) or temporary (temporary threshold shift, TTS). TTS may occur when a person enters a very noisy area with sound levels between 90 to 140 dB (Clark, 1992). However, the person's hearing may recover some time after returning to a quiet environment. This phenomenon can be measured as a reversible or temporary shift in audiometric thresholds (Berglund & Lindvall, 1995). Repeated TTS over the course of a few weeks to a few years can lead to accumulated cellular damage, causing a permanent threshold shift (PTS) (Clark, 1992). According to Lutz et al. (1973) temporary threshold shifts alone can not predict the magnitude of permanent threshold shifts, although they are regarded as early indicators of permanent damage.

World-wide, NIHL is the most prevalent irreversible occupational hazard and it is estimated globally that, approximately 120 million people have disabling hearing difficulties due to noise exposure (Berglund et al., 2000). In addition to occupational noise, environmental noise can also increase the risk factors for the development of hearing impairments. But, hearing impairments may also be caused by certain diseases e.g.

otosclerosis, industrial chemicals, ototoxic drugs, blows to the head, accidents and hereditary factors. Furthermore, hearing deterioration is associated with the ageing process itself (presbycusis). Other reasons for hearing threshold differences mentioned in the literature, are gender-related differences in lifestyles. For example, a higher degree of acoustic hazard is found among men (Davis, 1983; Kryter, 1985). Socio-economic status has also been found to be associated with hearing problems e.g. ear infections (Power, 1992) as well as noise induced threshold shift (NITS) in children and adolescents (Niskar, Kieszak, Holmes, Esteban, Rubin & Brody, 2001). NITS are caused by exposure to hazardous sounds, which can damage the inner ear's hair cells. NITS are defined as the hearing threshold level shift attributable to noise alone. The first audiometric sign of NITS is usually a threshold loss at 3, 4, or 6 kHz (Berglund & Lindvall, 1995). Sadhra et al. (2002) investigated noise exposure and TTS among 14 employees working in University entertainment venues. The results from their study revealed that the mean personal exposure levels for security and bar staff exceeded 90 dBA. The maximum peak pressure reading for security staff was 124 dB. TTS values were moderate, but they were found to be significant at both low and high frequencies and for both ears. Additionally, permanent hearing loss was found for more than 30 dB at either low or high frequencies. Music teachers are another occupational group, who are exposed to loud levels of noise. Behar et al. (2004) assessed the risk of hearing loss for 18 school music teachers during the course of activities, by using dosimeters. The equivalent continuous noise level (Leq) of each teacher was recorded during classes and for the entire day with an eight-hour exposure. The Leq measure exceeded the 85-dBA limit for occupational noise for 78% of the teachers, which increases the risk for NIHL.

Hearing impairments can be accompanied by tinnitus. Tinnitus is often defined as a conscious sensation of a distinct sound or of different sounds without the presence of any external source of sound. It may be located in one or both ears (unilaterally/bilaterally) or experienced in the head (McFadden, 1982). Information regarding the prevalence of tinnitus varies. According to Davis (1995) approximately 45% of the general population has experienced tinnitus at least once in their lives. A majority of those people can be expected to experience a sound of very short duration, or habituate to the sound without any further complications. Coles, for instance, has reported (1984) that the experience of a sensation of tinnitus "at some time" was present in 35% of all adults while spontaneous tinnitus lasting over five minutes was present in 15% of all adults. He suggested a prevalence rate of tinnitus in the general population of approximately 18%. Axelsson and Ringdahl (1989) found in a prevalence study among adults in Västra Götaland in Sweden, that 10 – 15% of them had

tinnitus, while about 2% of the population have a more serious form of tinnitus which affects their experienced quality of life. Researchers within the field of audiology claim that the prevalence of tinnitus may increase as a consequence of environmental factors, such as community noise or loud music. Exposure to loud sounds increases the risk of sustaining physiological damage to the auditory organ, which in turn can lead to tinnitus (Kroener-Herwig, Biesinger, Gerhards, Goebel & Hiller, 2000). A recent study among 9693 young adults found that 61% had experienced tinnitus after attending concerts and 43% after visiting clubs. Only 14% of the respondents used earplugs (Chung, Des Roches, Meunier & Eavey, 2005). However, there are also reports in the literature pointing to tinnitus onset following traumatic experiences. Erlandsson (1998) found, based on clinical observations, cases where either the onset of tinnitus or an acceleration of symptoms had occurred during a time of bereavement. The bereavement was accompanied by feelings of guilt as a result of a complicated early relationship with the deceased. Other examples of psychologically significant events coinciding with tinnitus onset are incidences where important bonds with a loved object are either lost or threatened (Erlandsson, 2000a).

Many adults with normal hearing report the experience of tinnitus and, likewise, there is an incidence of non-distressing tinnitus experiences among children with normal hearing. Nodar (1972) appears to be one of the first researchers to gather information about the prevalence of tinnitus in children of school age. He found in a sample of 2 000 eleven to eighteen year-old children with normal hearing, a prevalence of tinnitus of 13.3%. Mills et al. (1986) questioned 93 five to sixteen year-old children with normal hearing about tinnitus prevalence. Out of these, 29% reported tinnitus, while 10% claimed that they were bothered by their tinnitus. Martin and Snahall (1994) noted that 50% of the cases in their population of children with tinnitus had normal hearing. They also observed that intermittent tinnitus was usually associated with hearing loss and constant tinnitus with normal hearing. Other research suggests that the incidence of tinnitus is more common in children with hearing impairments than in children with normal hearing. Stouffer et al. (1991) found that approximately 25% of hearing-impaired children reported tinnitus, and the incidence rate of tinnitus in children with normal hearing children was 6 to 13%. Little is known about the severity of tinnitus in childhood and adolescence. In adults the correlation between perceived tinnitus severity and hearing function is low. However, correlations between tinnitus severity and psychological factors, for example depression, problems with concentration and irritability, seem to be rather strong (Collet et al., 1990; Erlandsson, Hallberg & Axelsson, 1992; Gerber et al., 1985). In a study including 185 adult tinnitus patients, 75% had depressive or anxiety

disorders according to the criteria of the Diagnostic and Statistical Manual of mental disorders (DSM IV; Holgers, Zöger, Svedlund & Erlandsson, 1999). In another study by Zöger, Svedlund and Holgers (2001) the prevalence of life time depression among 82 tinnitus patients without severe socially disabling hearing loss, was found to be 62% in men, and 63% in women. This is a higher percentage than what would be expected in the normal population (43%) according to DSM-III-R.

Few Swedish studies that have investigated the prevalence of tinnitus in children and adolescents have been conducted. Children, unlike adults, seldom complain spontaneously of having tinnitus and, for this reason, tinnitus in children has not received adequate consideration (Bagueley & Mc Ferran, 1999). The discrepancy between the often high incidence of tinnitus and low rate of spontaneous complaints in children may be explained by the fact that children more often complain of tinnitus being intermittent, rather than continuous, and that they consider tinnitus to be a normal event (Savastano, 2002). A second explanation for this discrepancy lies in the fact that children may not distinguish between the presence of tinnitus and its medical significance. In some cases, even if the child has had tinnitus permanently over a long time, she or he may not feel that this is something to worry about. Yet another explanation could be that children are more easily distracted by their external environment than adults are, and thereby they pay less attention to internal sounds (Viani, 1989). Erlandsson & Olsen (2001) found in a pilot study of 309 Swedish children and adolescents, aged 10-16 years, that approximately 20% reported the experience of buzzing sounds in the ears that lasted longer than a day at some time in their lives. According to another Swedish study that comprised 316 adolescents (13-19 years of age), 15% reported daily problems with tinnitus (Hellqvist, 2002). The prevalence of tinnitus in a sample of 964 children (7 years of age) was found to be 12% (Holgers, 2003). The results also indicated that there was no correlation between tinnitus and other hearing parameters (e.g. pure tone average) and no significant gender differences. Measuring the prevalence of tinnitus in very young children by the use of a single question, as in the study by Holgers, is not an easy task since the answer that the child provides will be dependent on the way in which the question is formulated. It can be concluded, thus, that information regarding the prevalence of tinnitus in the young population varies, and that most studies are based on relatively small samples. Questions asked about tinnitus also seem to differ in reported studies. This fact points to the need to conduct national epidemiological studies, with an agreement both as to the definition of tinnitus and as to how questions regarding tinnitus should be formulated. This needs to be

done in order to establish the prevalence rate of tinnitus in the young Swedish population with any degree of certainty.

Although tinnitus can be a symptom of an illness that can be managed and treated, as for example in the case of conditions like acoustic neuronoma or otosclerosis, the most common underlying cause of tinnitus is associated with relatively small changes in the cochlea (Vernon & Möller, 1995). According to clinical studies, clients suffering from tinnitus are at a high risk of developing serious mental disturbances (Hiller & Goebel, 1998). Individuals who suffer from or are annoyed by tinnitus, seem to experience increased stress in their lives. Holgers, Erlandsson and Barrenäs (2000) found that the occurrence of tinnitus was related to poor health in general, which might affect the capacity to cope with stressful situations. The influence of severe tinnitus on working capacity was related to general health and physical immobility. The life situations and gender roles of women differ from those of men and this also affects the divergent ways in which women and men manage their problems with tinnitus (Erlandsson, 2000b). Erlandsson and Holgers (2001) described the use of the Nottingham Health Profile (NHP), a health-related quality of life instrument, in a clinical sample of patients complaining of tinnitus. Patterns of health-related quality of life seemed in their study to be gender-related. Although gender was not a predictive factor in the regression model, four dimensions of the NHP, Mobility, Pain, Sleep, and Energy had a higher severity rate among the females. Erlandsson and Hallberg (2000) reported that the most significant contribution to the variance of quality of life in a sample of patients with tinnitus, came from psychological variables. Quality of life was reduced in patients who complained of impaired concentration, depression and emotional problems in relationships with family and friends. It seems that increased stress in relation to the individual's experience of annoying tinnitus is associated with her or his perception of others' attitudes towards the problem (Erlandsson, Hallberg & Axelsson, 1992). The questions used in the study by Erlandsson and Hallberg were aimed at mirroring how individuals with hearing loss and tinnitus perceived that family members and significant others react. Misunderstandings and feelings of worthlessness in contact with others can lead to threats to the self-image, a rather common experience in patients complaining of hearing impairment and tinnitus according to Hallberg and Carlsson (1991).

Noise sensitivity

Another consequence of noise is annoyance. According to Guski (1997), annoyance caused by noise can be defined as displeasure caused by exposure to noise that affects health or wellbeing. Annoyance is thus the result of unwanted, interfering or disturbing sounds. Reactions of annoyance to noise are often associated with the reported interference of noise in everyday activities (Taylor, 1984) and dependent on the context in which the noise is heard (Hall, Taylor, Birnie, 1985).

An important factor contributing to individual differences in noise perception is noise sensitivity (Stansfeld, 1992). Noise sensitivity is a stable personality trait covering attitudes and reactions towards a wide range of environmental sounds and sound sources (Ellermeier, Eigenstetter & Zimmer, 2001). Noise sensitivity can be defined as the internal state (physiological or psychological) that increases the level of reactivity to noise in general (Job, 1999). Stansfeld (1992) identifies and differentiates between two separate, but related, concepts of noise sensitivity. First, there is *sensitivity to annoyance* by noise, which identifies individuals as being “high-sensitive” when they express more annoyance than others to a particular level of noise, and “low-sensitive” when they express lower levels of annoyance than others. Secondly, there is *general susceptibility to noise*, which is associated with annoyance, but implies susceptibility to a wide range of noises. Anderson (1971; quoted in Stansfeld, 1992) uses a definition which distinguishes sensitivity from annoyance. Noise sensitivity consists, according to Anderson, of underlying attitudes towards noise in general, whereas annoyance is constituted by attitudes towards a specified noise or noise environment. Research has shown that current mood also has an effect on individuals’ judgements of annoyance and on individuals’ preference for sound. The individual’s current mood seems to interact with noise sensitivity. This indicates that both individual noise sensitivity and mood are important factors for human auditory perception (Västfjäll, 2002).

Noise sensitivity can, according to Stansfeld (1992), be understood from two different angles. First, noise and sound are important to people who are sensitive to sound. Such individuals tend to pay attention to sounds and differentiate between sounds more frequently than others do. Furthermore, they tend to perceive sounds as more threatening and they experience reduction in control compared to people who are not sensitive. Secondly, people sensitive to noise react more negatively to unexpected sounds than those who are non-sensitive, which implies that it takes a longer time for them to habituate to a sound. Consequently, people who are sensitive to noise experience more threats from sounds, and

have a general tendency to be more irritated, irrespective of the sound exposure. Stansfeld (1992) assumes that these circumstances can explain the relationship between noise sensitivity and mental health. Accordingly, it may explain why noise sensitivity can be understood as a factor of vulnerability in mental health (Stansfeld, 1992). Results from a prospective study of traffic noise in the UK support this hypothesis. The authors found a strong association between noise sensitivity and psychiatric symptoms, but no association between noise level at baseline and later development of psychiatric disorders (Stansfeld, Gallacher, Babisch & Shipley, 1996).

In addition to noise sensitivity, personality traits, such as introversion and extroversion, have proven to be associated with noise levels preferences. Extroverts have been found to choose more intense levels of noise than introverts do. Introverts were also found to experience greater arousal from the same intensity of noise than extroverts (Green, 1984). It is possible that introverts are more sensitive to noise than extroverts are.

Environmental noise exposure is merely one of the factors that contributes to noise annoyance, although it is undoubtedly an important one. The degree of annoyance experienced by an individual can differ considerably from what could be expected from the exposure-response relationship as a result of other, non-acoustic, factors. These factors are, for example, anxiety, fear of the noise source and feelings that the noise could be avoided. These, so called effect-modifying factors, have been identified in multivariate analyses (Passchier-Vermeer, 2000).

Socio-economic status, health, and risk-taking

Throughout history, socio-economic status (SES) has been linked to health. Individuals higher in the social hierarchy typically have better health than those in the lower range. SES differences are found for rates of mortality and morbidity for almost every single disease and condition (Antonovsky, 1967; Anderson & Armstead, 1995). This seems to be the case regardless of whether SES is measured as a factor of education, income, or occupation (Chen, Boyce & Matthews, 2002; Backlund, Sorlie & Johnson, 1996; Ecob & Davey Smith, 1999). Even though the impact on health of SES has been recognised for decades, the reasons for the existence of this fundamental association remains largely obscure (Adler, Boyce, Chesney, Cohen, Folkman, Kahn & Syme, 1994). Most explanations regarding the association between SES and health have focused on factors such as poverty, inadequate living conditions, and malnutrition, which would predict a threshold effect for SES. Above a certain level of SES, where nutrition and housing are of less importance, all individuals ought to display similar levels of good health (Chen, Boyce & Matthews, 2002). However, this is not the case. Epidemiological studies reveal that SES is linked to health outcomes in a monotonic fashion (Backlund et al., 1996). This means that each decrease in SES level is associated with an increasing prevalence of disease. Not only do poor people suffer from poorer health than people who are economically better off, but individuals at each SES level also enjoy better health than individuals immediately below them on the scale. This finding is problematic and challenging to researchers trying to find plausible explanations to account for the SES effects (Chen et al., 2002).

Because SES is a powerful risk factor, a search for other etiologic factors in disease are often regarded as circumspect unless, that is, the influence of SES is controlled. This has resulted in SES being almost universally relegated to the status of a control variable, and thus SES has not been systematically studied as an important etiologic factor in its own right (Adler et al., 1994). Other researchers have noted that SES is generally included with as much regularity but with as little thought as gender (Marmot, Kogevinas & Elston, 1987). In addition, most research on SES and health has focused on middle-aged adults. Far less is known about the impact of SES on health during childhood and adolescence. In addition, the relationship between SES and health may change with age, since SES seems to have a stronger effect during certain stages of life, than it has during others (Chen et al., 2002).

Contrary to research studies that have included both children and adults, studies that have focused on adolescents have found little support for the association between SES and health outcomes (West, Macintyre, Annandale & Hunt, 1990; Macintyre & West, 1991; Rahkonen, Arber & Lahelma, 1995). Such findings indicate that adolescence, as opposed to other stages of life, could be characterised as a period when SES has little or no impact on health outcomes. The period of adolescence is an important stage of life when the adolescent goes through biological, psychological and social changes. During this stage of life, parental influence on the adolescent decreases, whereas the adolescent's own requirements of autonomy increase. The adolescent also tries to find his or her own life-style, habits and behaviour (Sernhede, 1995). These life styles, habits and behaviours may, in a longer perspective, have consequences for the individual's future health (Cotterell, 1996).

Even if there are no simple correlations between SES and health outcomes in adolescents, SES differences can be linked to health risk behaviours, causing poor health later on in life (Pietilä, Hentinen & Myhrman, 1995). In relation to health risk behaviours, socio-economic differences in adolescence can, from this perspective, be regarded as an interesting and important predictor to SES-related health outcomes in adulthood. Tuinstra et al. (1998) call this assumption; "the hypotheses of latent differences", due to the fact that there are little or no differences in health itself during adolescence. However, health related behaviour or health risk behaviour might be different depending on SES during this period of life (Tuinstra, Groothoff, Van den Heuvel & Post, 1998). West (1997) has proposed an explanation for the reason why SES seems to have less effect on health among adolescents. West suggests that adolescents aged between 12 –19 experience a time of *relative equality* with regard to SES and health. West concludes that regardless of SES background, adolescents experience fewer health differences than at any other period of their lives. The explanation that West provides for this is "a process of equalisation" in which, he claims that certain characteristics that can be associated with the adolescence, e.g. school, peers, youth culture etc, are shared with others, and that these characteristics tend to break down structures associated with social class, e.g. family and neighbourhood. However, the situation seems to be different when it comes to health risk behaviours, where lifestyle or individual behaviour in adolescence can be viewed as an important variable in the understanding of the connection between SES and health later on in life (Stronks, Van de Mheen, Looman & Mackenbach, 1996). Studies on socio-economic factors in adults show that individuals with low SES engage in more health risk behaviours, than individuals with high SES (Stronks et al., 1996). Several studies in many different countries have confirmed this. People with lower SES have, in general, a higher

behavioural risk profile (Cavelaars et al., 1997). However, the findings regarding SES and health risk behaviours among adolescents are not always consistent.

Evans and Kantrowitz (2002) have conducted a survey of the relationship between SES and environmental risk exposure, e.g. noise, air pollution, and water pollution. Exposure to ambient noise levels was found to be associated with SES. Low-income residents were nearly twice as likely (9.1%) to report that neighbourhood noise is bothersome in comparison to high income families (5.9%) (Sherman, 1994). Furthermore, a nation-wide survey of U.S. metropolitan areas found a strong adverse correlation ($r = -0.61$) between household income and average levels of sound exposure during a 24 hour period. Households with a low income (below 10 000 U.S. dollars per annum) had average sound exposure levels of more than 10 dBA higher than households with a higher annual income (above 20 000 U.S. dollars per annum). Evans and Kantrowitz (2002) discuss the hypothesis that SES is associated with environmental quality and, in turn, that environmental quality affects health. However, this is not equivalent to the conclusion that SES effects on health are caused by differential exposure to environmental quality, but the linkage between SES and health is, to some degree mediated through environmental quality (Evans & Kantrowitz, 2002).

Another useful explanation for the ability to understand the association between SES and health, besides health risk behaviour and environmental factors, is that cognitive-emotional factors may play an important role in the explanation of why low SES could mean a risk of poorer health (Adler et al., 1994). Individuals with low SES might have a social background where a greater proportion of negative feelings and attitudes are shared with others in the immediate surrounding. Gallo and Matthews (2003) have, in an extensive survey of the literature, found support for the hypothesis that the association between SES and health, at least to a certain degree, can be mediated through cognitive-emotional factors. These factors, the authors claim, might play an important role when it comes to access to “reserve capacity” to handle different situations. Furthermore, they go on to suggest that cognitive-emotional factors are potentially important variables in the understanding of the complexity of SES and health (Gallo & Matthews, 2003).

Looking at the overall picture, it may be concluded that SES produces a complicated mixture of impacts on individuals' health (Marks, Murray, Evans & Willig, 2000). Some research suggests that the social consequences of people's differing circumstances in terms of stress, self-esteem, and social relations, may be some of the most important influences on health (Wilkinson, 1992). Other research suggests that the association between SES and health is a consequence of class-related differences in social support and personal control

(Carroll et al., 1996). Adler et al. (1994) suggests that depression, hostility, stress and social ordering could be responsible for the SES-health association and that individual control over life circumstances might be a higher order variable.

For a more complete account, it is necessary to consider differing experiences and behaviours in the life-spans of individuals with differing levels of SES. It might be necessary to contextualize individual developmental history within the family, social and ecological systems to be able to understand why SES has an impact on health (Marks et al., 2000). Bronfenbrenner (1981) describes four structural ecological systems in which human development can be understood. These are the micro-, meso-, exo-, and macro systems. The central idea is that these systems are interrelated, e.g. the family (micro system) is affected by organisational structures such as politics (exo system), or that a young person may be affected by peers and contemporary youth culture. One key point in Bronfenbrenner's theory is that it is the perceived environment, and not the "objective" environment that affects human behaviour and experience. Any explanation of the relationship between SES and health must therefore consider psychosocial systems and structural inequalities across a broad range of life opportunities and outcomes. Davey Smith et al. (1994) argue that an accumulation and clustering of adverse physical, material, social and psychological effects can explain the impact of SES on health. On its own, any individual factor can only explain the impact on health to a limited extent. However, the combination and interaction of many kinds of ecosystem disadvantages are likely to be sufficiently sizeable as to generate poor health in lower SES groups.

A potentially important factor that can affect adolescents' health is the influence of youth culture. Youth culture can be defined as the sum of the ways of living of adolescents; it refers to the body of norms, values, and practices recognised and shared by members of the adolescent society as appropriate guides to actions (Rice, 1996). In any study of adolescents, it is necessary to consider the central aspects of youth culture. It is however, more correct to talk in terms of *youth cultures*, since several youth cultures coexist concurrently. Common to all youth cultures is the fact that they are all central to the creation of identity (Lalander & Johansson, 2002). In contemporary society, adolescents create their own world by using material artefacts such as clothing and music styles. These "symbols" are used to distinguish themselves from others (Rice, 1996). The French sociologist Pierre Bourdieu, argued in his work *La Distinction* (1992) that individuals from different social classes use symbols such as language, clothes, music, art, food etc, to be able to create similarity to those with whom they identify. Conversely, young people also want to create a distinction from those whom they do

not wish to be connected with. These conceptions about similarity and distinction have been split into two schools of thought within current youth research. Thus, an ability to understand the use of symbols within youth culture, gender and class, are important aspects in the analysis of similarity and distinction (Lalander & Johansson, 2002).

In the literature on youth culture, two general lines of argumentation can be distinguished. Some researchers (e.g. Finkelkraut, 1995; Mestrovic, 1991) argue that youth culture is nothing other than commercialised leisure activities, without any psychological or existential meaning. This perspective, however, is often lacking in support from empirical studies. Other researchers have challenged this view by taking on a more empirical approach. Central to this approach is the effect of youth culture on socialisation and psychological well being. Young people's participation in youth culture might be interpreted as a form of coping behaviour. Youth culture can in this perspective constitute a binding element in the collaborative consciousness of adolescents (Arnett, 1991). Popular music is conceived as particularly beneficial to the regulation of aggression, anxiety, and negative moods. In a similar manner, Sernhede (1995) stresses the positive effects of youth culture in seeking one's own lifestyle and identity as a part of the process of going from childhood to adulthood. Empirical research suggests that youth culture in general and music in particular, moderate anxiety and provide opportunities to express suppressed problems (Kurdek, 1987; Lyle & Hoffman, 1972; Mark, 1988). On the other hand, participating in activities typical to youth culture might also be associated with health risk behaviours. The debut of tinnitus and hearing loss in adolescents is often associated with visits to concerts and discotheques, where they have been exposed to extreme levels of loud sound. High levels of sound due to different kinds of music activities such as pop concerts and discotheques may cause problems such as the temporary reduction in hearing and tinnitus (Axelsson & Prasher, 1999).

Theoretical perspectives on risk-taking

Biological, cognitive and psychosocial theoretical perspectives can be taken into account when investigating adolescents' risk-taking behaviour. In the following section a brief overview will be presented of some of the theories and concepts that can be used to explain adolescents' engagement in health risk behaviours and the transformation of health-risk behaviours into health-oriented behaviours. The first is "Sensation seeking" (Zuckermann, 1971), the second is the concept of "Locus of control" (Rotter, 1966). The third theoretical perspective is the "Health Belief Model" (Rosenstock, 1966; 1974), and the fourth is the "Theory of Planned Behaviour" (Ajzen, 1991). The fifth theory presented here is Problem Behaviour Theory (Jessor & Jessor, 1977). Finally I consider "Self Categorisation Theory" (Turner, Hogg, Oakes, Reicher & Wetherall, 1987). A short summary of each of the six theories is presented below.

Sensation-Seeking

Sensation seeking has been identified as a human trait defined by the seeking of varied, novel, complex and intense sensations and experiences, and the willingness to take physical, social, legal and financial risks for the sake of such an experience (Zuckerman, 1994). The theory of sensation seeking (Zuckerman, 1971) identifies a neuro-biological basis for individuals' participation in risk-taking behaviours. Individual differences in optimal levels of arousal and stimulation, manifested as character dimensions or traits, are regulated by neuroregulators such as catecholamines, dopamine and norepinephrine (Zuckerman, 1994). There are differences between sensation seekers and sensation avoiders, not only in genetic and biological characteristics, but also in their habits, preferences, emotional, cognitive style and personality (Zuckermann & Kuhlman, 2000). The theory of sensation seeking can explain risk-taking behaviours in the sense that high sensation seekers need more stimulation to maintain an optimal level of arousal, while low sensation seekers manage themselves better in less stimulating settings.

The theory of sensation seeking includes four general dimensions. The dimension "Thrill and adventure seeking" deals with the desire to engage in risky physical activities or sports providing heightened sensations. The second dimension "Experience seeking", deals

with the individuals desire to seek new experiences through the mind and senses and through an unconventional life-style. Thirdly, the dimension of “Disinhibition” deals with the seeking of sensation through contact with other people, such as partying, social drinking, sex etc. The fourth dimension deals with “Boredom susceptibility”, which is characterised as an aversion for unchanging or non-stimulating environments or persons (Zuckerman, 1990). Sensation seeking has been related to engagement in many different risk-taking behaviours, including for example potentially risky experiments, sports, vocations, criminal activities, sexual behaviour, smoking, heavy drinking, drug use and abuse, reckless driving, driving under the influence of alcohol, and gambling. These findings have been verified several times, in various international studies (Zuckerman & Kuhlman, 2000). One interesting study conducted by Arnett (1992) found that the enjoyment of rock or heavy metal music was associated with higher levels of sensation seeking generally in comparison with preferences for pop music or mainstream rock music. Explanations for the association between high sensation seeking and risk-taking have been proposed by Horvath and Zuckerman (1993). One tentative reason may be that high sensation seekers value the rewards of the risk-taking more than the low sensation seekers. Sensation seekers are attracted to risky actions since such activities provide them the desired experience of arousal and that the sensation of arousal may outweigh the probability of negative outcomes deriving from such risky actions. Horvath and Zuckerman suggest that one factor that can mediate the association between sensation seekers and risky behaviours are the twin concepts of *risk appraisal* or *risk evaluation*. Risk appraisal can be defined as a cognitive trait specific to particular aspects of risky behaviour. Risk appraisal or risk evaluation is likely to be influenced by factors such as the nature of the negative consequences, the ability to make a free choice, individual/collective perspectives, the probability that a disaster will occur, the degree of uncertainty, and available knowledge (Horvath & Zuckerman, 1993). High sensation seekers have been found to be higher in risk-taking than in risk evaluation, whilst low sensation seekers are found to be higher in risk evaluation than in risk-taking (Rosenbloom, 2003). Another study by Hansen and Breivig (2001) investigated the relationship between sensation seeking and two different aspects of risk-taking behaviour among 360 Norwegian adolescents. Their results indicated a strong association between sensation seeking and risk behaviour. Risk behaviour was defined as both positive risk behaviour, such as climbing, kayaking and rafting etc., and as negative risk behaviour e.g. crime, shoplifting, drug use etc. Negative risk behaviour correlated negatively with support from both school and parents and was also found to be associated with low socio-economic background.

Locus of Control

Health-related locus of control (HLC) is recognised as an important construct for the understanding and the prediction of health-oriented behaviours. The concept of health locus of control is originally derived from Rotter's (1966) social learning theory. Locus of control means either to take responsibility for your own actions (internal locus of control) or to locate the responsibility to other people (external locus of control). Locus of control has been identified as an important variable for the understanding of risk-taking behaviour. Kohler (1996) found a positive correlation between sensation-seeking and external locus of control. Individuals who had an external locus of control also scored higher on sensation seeking. In another similar study, Crisp and Barber (1995) analysed the relationship between risk perception, sexual risk-taking, and locus of control among young drug users between 14 to 21 years of age. Their results revealed that individuals with an internal locus of control knew that they were taking risks in the decisions they made, whilst those individuals with an external locus of control showed a greater tendency to believe that they were invulnerable to such risks. It seems reasonable to conclude that identifying oneself as invulnerable and having an external locus of control may increase risk-taking behaviour.

Health Belief Model

The Health Belief Model (HBM) has received sustained empirical support and is widely used when it comes to explaining health risk behaviour, or predicting health behaviour (Rutter & Quine, 2002). The HBM in its original form takes into consideration four different aspects. These are perceived susceptibility to poor health, perceived severity of disease or poor health, perceived benefits from modifying unhealthy behaviour, and, finally, perceived barriers to modifying the behaviour. The degree to which a health behaviour is perceived as beneficial or not, is a result of the individual's comprehension of the benefits that a health-orientated behaviour could bring, weighted against the cost of, or barriers to, action with respect to the actual behaviour. Rosenstock (1974) argues that the level of readiness provides the energy or force to act and the perceptions of benefits, minus barriers, provides a preferred path of action. However, the combination of these could reach considerable levels of intensity, without resulting in overt action, unless some instigating event occurs to set the process in motion or triggers action in an individual who is, psychologically, ready to act. Rosenstock argues that, in addition to the variables already described, a factor that serves as a cue or a

trigger to appropriate action is necessary, such as falling ill due to poor health or having an accident (Rosenstock, 1966). Based on HBM, it would be expected that persons experiencing, for example, tinnitus or noise sensitivity would use ear protection to a higher extent than persons without this particular experience would.

Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) is expanded from the Theory of Reasoned Action (TRA: Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980). It has been used to explain a number of different behaviours, including those, for example related to health and changing health behaviour. Both TRA and TPB have attracted considerable attention, especially among social psychologists interested in identifying beliefs underpinning health behaviours that may be amenable to change (Rutter & Quine, 2002). TPB provides a theoretical account of the way in which attitudes, subjective norms, and behavioural intentions combine to predict behaviour. The individual's intention to perform the actual behaviour is related to three separate theoretical constructs; the individual's attitudes regarding a specific behaviour, subjective norms, and perceived behavioural control. The individual's attitude towards a specific behaviour or a phenomenon implies an overarching valuation of the behaviour or the phenomenon. The attitude can be either positive or negative. The subjective norm includes the individual's own perception of how other people perceive the intended behaviour (injunctive social norm). Perceived behavioural control is underpinned by "control beliefs" regarding perceptions of obstacles, impediments, skills, resources, and opportunities that may inhibit or facilitate performance of the behaviour in question (Rutter & Quine, 2002). Ajzen (1991) uses perceived behavioural control both for internal and external constraints. However, it certainly seems possible that these constraints may not be the same and therefore would not form one construct (Terry, 1993; Terry & O'Leary, 1995). Internal constraints seem closer to perceptions of self-efficacy (Bandura, 1977) and to the health perceived costs of the behaviour, which may affect the formation of intentions. External constraints, on the other hand, are more likely to reflect factors that may prevent a person from translating their intention into action. A criticism of social cognition models which has been particularly applied to the TPB is that they are unable to explain behaviour which may be under affective control, since they do not adequately take into account factors in decision making (Bish, Sutton & Golombok, 2000). Based on the TPB, the focus of this thesis is primarily on the

individual's attitudes towards noise and how this might be related to the behaviour, such as the use of hearing protection.

Problem Behaviour Theory

Problem Behaviour Theory was developed by Richard Jessor and Shirley Jessor (1977). Problem behaviour theory approaches risk-taking from the combination of a developmental perspective and a person-environment perspective. The theory's social-psychological approach focuses on the explanation of adolescent's involvement in behaviours that are defined as a social problem and as undesirable according to the norms of society. According to Jessor, Donovan, and Costa (1991) risk behaviour results from the sum of two opposing sets of risk and protective factors, which together have an impact on the individual's behaviour as being either as deviant or normative. Jessor et al. (1991) identify three systems, namely the personality system, the perceived environment system, and the behaviour system. These three systems have an impact on the individual's perception of a psychosocial risk, which will result in the degree of proneness to engage in any given risk behaviour. Each of the three systems is organised around structures of variables representing instigations to engage in and controls against participating in problem behaviour. For instance, the personality system consists of variables such as alienation, self-perception, self-esteem, internal-external locus of control, values and attitudes, and the importance placed on e.g. school achievement. The perceived environmental system includes variables such as parental controls, friend controls, and parents versus friends' influence on the individual. The behaviour system deals with different sorts of problem behaviours, such as heavy drinking, drug use or other kinds of socially deviant behaviours. Within each system it is the balance between instigation toward involvement and controls against involvement in problem behaviour that determine the proneness for the problem behaviour. Additionally, it is the balance of instigations and controls across the three systems that in the final analysis determine the overall level of psychosocial proneness for involvement in the given problem behaviour (Jessor & Jessor, 1977).

Self Categorisation Theory

The Self-Categorisation Theory (SCT) can be used to combine health risk behaviour, ecological theory, and youth culture, in that it provides an explanation of how the social context may affect an individual's behaviour. The theory suggests that all social groups have their specific norms. However, the theoretical perspective puts an emphasis on voluntary participation in collective behaviour, which assists in the identity formation of the group (Turner, Hogg, Oakes, Reicher & Wetherall, 1987). Referent informational influence, whereby individuals perceive something or someone as normative, and tend to conform to the stereotypical attributes of their primary or salient social group, is a process central to the theory. The SCT process is comprised of three stages. First, individuals define themselves as members of a particular social group or category. Secondly, individuals observe or form stereotypical norms of that group. Finally, in the third stage, the individuals assign these norms to themselves and their behaviour becomes normative for the group (Turner & Oakes, 1989). One major point of this theory is that people actively participate in creating and activating the social norms of the group to which they belong (Schofield, Pattison, Hill & Borland, 2003).

The interpretation of social influence in SCT stands in contrast to the subjective norm as articulated in TPB, which measures the individual's own perception of how other people perceive their intended behaviour. It is possible that social norms are better conceptualised as shared expectations about the behaviour, attitudes, and beliefs of significant referents or group members. According to SCT, social groups are products of cognitive classification, e.g. that people tend to categorise themselves as similar to the members of one social group as opposed, to members of other, dissimilar, groups (Turner & Oakes, 1986). The influence of the peer group norm on the individual's behaviour is moderated by the strength of the identification with their peer group. Therefore, the group norm may be expected to influence behaviour-related cognition and behaviour itself among individuals who strongly identify with their social group. On the other hand, the group norm would be expected to have less impact on an individual's intentions and behaviour among those who are weak identifiers with the group norm (Turner & Oakes, 1986). This theoretical perspective is interesting since it is often argued those adolescents' behaviour, and in particular their risk behaviour, is influenced by group pressure. It may also give an explanation as to why some adolescents participate in health risk behaviour.

Summary of the introduction

Individuals' perceptions of risks and those actions that can be regarded as involving risk-taking, are based upon available knowledge, values, norms and ideals that exist in specific societies. Research has identified noise as one important stressor contributing to physiological as well as psychological health problems. Auditory effects of noise are well established within the field of audiology. Studies indicate that auditory problems may increase among adolescents due to exposure to loud amplified music. Health risks and health risk-taking may be considered from both a cultural and an individual perspective. From a social-psychology perspective, individuals' perceptions about risks may be influenced by discourse on health risks in any given society. Psychological perspectives on risk-taking behaviour have been identified as important to the explanation of adolescent health risk behaviour in areas such as sexual risk-taking, drug abuse or participation in risky physical activities. In previous research inequalities in health have been linked to higher participation in health risk behaviours. Additionally, lower levels of socio-economic status have been found to be associated with higher degrees of participation in health risk behaviours. Differences in ear health have also been found to be associated with lower levels of socio-economic status.

Psychological theories such as the Theory of Planned Behaviour or the Health Belief Model can be used to explain adolescent risk-taking behaviour. The Theory of Planned Behaviour links attitudes, subjective norms and behavioural intentions to health risk behaviour and behavioural change. The Health Belief Model highlights the importance of a "trigger", e.g. the experience of negative health outcomes, in order to achieve a behavioural change from health risk behaviours to a health preventive behaviours. So far, no empirical studies have been undertaken where noise-induced auditory health problems are linked to psychological perspectives on health-related risk taking and health-oriented behaviour. In this thesis, exposure to loud music is regarded as an example of a health risk behaviour. Little is known about the presence of health preventive behaviours, such as the use of hearing protection in musical settings and the variables that enhance this behaviour. Why, for example, do some young people use hearing protection when being exposed to loud levels of music, while others do not?

Summary of the Empirical Studies

Aims of the studies

The focus of this thesis concerns noise and loud music as a matter of risk perception and the psychological aspects of young people's perceptions and habits in noisy environments. The aim of **Study I** was to explore the prevalence of tinnitus and noise sensitivity among young people in Sweden and, in addition, to describe their habits regarding noise exposure and the use of hearing protection. The purpose of **Study II** was to discover whether adolescents' attitudes towards noise differed due to age and socio-economic status (SES). Additionally, the study investigated factors that could explain the use of hearing protection at discotheques and pop concerts. **Study III** adopted a cross-cultural perspective and was aimed at comparing attitudes towards noise held by young people in Sweden and in the US. Additionally, the study investigated factors that could explain the use of hearing protection at concerts. In **Study IV** the purpose was to explore and understand risk-taking regarding exposure to loud music at e.g. concerts and, additionally, to investigate whether exposure to loud music is perceived as a risk.

Methods

In this thesis both quantitative and qualitative methods are used. The nature of the research problem directs the research method, and different research approaches (both qualitative and quantitative) are regarded to be necessary to achieve a comprehensive understanding of the research field. Quantitative research involves the measurement of variables and the statistical analysis of the data. The measurements and statistical analyses used in this thesis will be discussed in more detail in the sections covering *measurements* and *analysis of data* below. Qualitative approaches include research that produces results without statistical procedures or other means of quantification (Strauss & Corbin, 1998). Qualitative methods produce detailed information on different qualities of a specific phenomenon being studied. It is possible to combine qualitative methods to support quantitative research or indeed the other way around. For instance, qualitative methods can provide hypotheses and ideas that can be investigated, verified or falsified by quantitative approaches in future research. In addition, more comprehensive explanations of quantitative research findings can be investigated and

enhanced through qualitative research (Bryman, 2002). In this thesis the combination of quantitative and qualitative research methods has resulted in a hypothesised model of risk-perception.

The qualitative method of grounded theory (Glaser & Strauss, 1967) is directed towards the exploration of a phenomena and the development of new theoretical perspectives (Strauss, 1987). Grounded theory is based on the premise that theory at various levels of generality is indispensable for achieving a deeper knowledge of social phenomena. According to grounded theory, a theory should be developed in an intimate relationship with data, with researchers fully aware of themselves as instruments for developing that grounded theory (Strauss, 1987). My interest within the field of social psychology provides me with a social-constructivist perspective, which may influence my theoretical understanding for the investigated phenomena of risk-taking, and additionally affect the interpretation of the results. Theoretical saturation is an essential criterion in grounded theory and is achieved in the interview process when the researcher's subjective experience is that nothing new can be added to a category. However, reality is complex and constantly changing, which implies that the data, to some degree, changes over time. This indicates that a complete saturation will never occur, and the theoretical understanding for a phenomenon therefore should be changed too.

Samples

Study I and II in this thesis are based on a single sample of 1547 young individuals aged between 13 and 19. The sample was drawn from schools in Göteborg and Vänersborg. The number of subjects who answered the questionnaire was 1324, indicating an external dropout rate of 14.4%. Thirty-nine questionnaires (2.5%) were incompletely filled in and were regarded as internal dropouts. The response rate was thus 83.1%. In total, 1285 subjects were included in the study. Out of this sample, 665 (51.8%) were girls and 620 (48.2%) were boys. Additionally, 47% of the subjects were from Göteborg, and 53% were from Vänersborg. One explanation for the dropout rate is that one upper secondary school in Göteborg did not have class teachers who could distribute the questionnaires to their classes. The students in the school were not divided into separate classes. This fact was the single most important reason for the number of dropouts in this particular school. Since the response rate could be calculated by comparing the number of respondents and the number of students on a study program basis, only study programs from this school with a dropout rate of lower than 20% were included in the study. This criterion was set to minimise the risk for bias in the responses

due to e.g. social factors. Questionnaires from study programs from this school that had a dropout rate higher than 20% were not included in the study and regarded as dropouts.

The sample consisted of young people from families with different socio-economic status. About 34% of the adolescents came from homes with low socio-economic status, and 38% were from families with medium socio-economic status. The remaining 28% came from families with high socio-economic status. The sample was divided into two groups with respect to age. The first group consisted of secondary school students of 13 to 15 years of age (46.1%) and the second group of upper secondary school students of 16 to 19 years of age (53.9%). This group included both students from theoretical (54.3%) and vocational programs (45.7%).

The study population in **Study III** amounted to 481 individuals of between 17 to 21 years of age. Of these, 230 were recruited from an upper secondary school in Borås, Sweden and 251 were students at a community college in Gainesville, Florida, USA. The response rate was 430/481 (89.4%). The external dropout rate (non-returned questionnaires) was 51 (10.6%) questionnaires in the Swedish sample. In the Florida sample 48 (9.8%) questionnaires were not included due to the individuals being older than 21. Furthermore, 5 (1.3%) respondents did not correctly complete questions from the Youth Attitude to Noise Scale (YANS). However, the assessments were correctly completed with regard to all of the other questions, and were therefore included in all other analyses. Thus in total 382 questionnaires were analysed and formed the study group, 179 (46.9%) from Sweden and 203 (53.1%) from the USA. The gender distribution in the Swedish sample was 57 (31.8%) men and 122 (68.3%) women and in the American sample the gender distribution was found to be 90 (44.3%) men and 113 (55.7%) women.

In qualitative research theoretical sampling is essential to obtain informants who can have relevant and important views of the phenomenon studied (Strauss & Corbin, 1998). **Study IV** consisted of 16 adolescents and young adults between 17 and 28 years of age, 9 women and 7 men, who had attended musical events such as concerts and discotheques. Eight individuals were musicians (classical or jazz musicians) or students at the School of Music and Musicology at the University of Göteborg, Sweden, and 8 were non-musicians. The informants were selected from both Göteborg and Vänersborg. To increase the chances of getting informants with different socio-economic backgrounds, adolescents from both theoretical and vocational upper-secondary programs were selected. Four individuals in the sample came from families with low SES, 7 from families with medium SES, and 3 from homes with high SES. Two of the informants couldn't be classified regarding SES.

Procedures

In Study I and II a questionnaire was distributed among eight different schools in Vänersborg and Göteborg. In Göteborg, five upper secondary schools and one secondary school were selected. In Vänersborg one secondary school and one upper secondary were selected. The educational programs (theoretical and vocational) corresponded well between the upper secondaries in Vänersborg and Göteborg. The principals of the schools were informed about the study and they subsequently gave their permission for the study to be conducted. A short letter of information about the study and its purpose was sent to the teachers involved, who were asked to distribute the questionnaire to their students at a convenient time. The participants were informed about that participation in the study was voluntary and that data should be treated statistically and confidentially. The completed questionnaires were collected and put in an envelope, which was picked up by one of the researchers at a pre-arranged time. In the case of the secondary school students, a letter to the pupils' parents was sent home, in which they were asked to give their permission for their child to take part in the study. Only the parents of three children did not want their child to participate in the study. The time it took to answer the questionnaire was approximately 20 minutes.

In Study III the questionnaire was distributed to students at a school in Borås Sweden, and at the University of Gainesville, Florida USA. Both cities have approximately 100,000 inhabitants. The school principals and college deans were informed and gave their approval for the study. A short informational letter was given to the class teachers involved, who in turn administered the questionnaire to the participating students. The students were informed about that participation in the study was voluntary and that the data should be treated statistically and confidentially. The completed questionnaires were put in an envelope, which was collected by a researcher at a prearranged time. The time needed to complete the questionnaire was approximately 20 minutes.

In Study IV two trial interviews were conducted prior to the study to test the interview themes. A short letter with information about the purpose of the study was sent out to the students at the School of Music and Musicology at the University of Göteborg. The students were asked to contact the interviewer by mail if they were interested in being interviewed. The group of informants that were non-musicians was informed about the purpose of the study during a class session. The investigator told them to write their e-mail addresses on a list if they were interested in being interviewed. Participation in the study was voluntary. The interviewer contacted the students later on and arranged a time for each individual interview.

Before the interviews, the participants were asked about giving their permission for tape-recording the interviews and were also at the same time informed about how the data should be presented and insured confidentiality. The interviewees were informed about the purpose of the study and that participation in the study was voluntary. Additionally, they were told that they could end the interview at any time, if there was a need to do so. The interviews were conducted either at the School of Music and Musicology, the Department of Psychology, or at University West, depending on the informant's preference. The in-depth interviews varied from between 40 minutes to 75 minutes in duration. After fourteen interviews, no new central themes emerged. Two further interviews were conducted and then the interview procedure was terminated.

Measurements

Study I, Study II and **Study III** were quantitative studies with data collected by questionnaires and analysed statistically. In **Study IV** data were collected through qualitative in-depth interviews and analysed using a Grounded Theory approach (Glaser & Strauss, 1967). The measurements used in **Study I** and **Study II** are presented in Table 1.

Table 1. Measurements carried out in Study I and II, and number of items included.

Measurements	<i>Number of Items/questions</i>
1 Demographic questions	9
2 Hollinghead Four Factor Index of Social Status	4
3 Youth Attitude to Noise Scale (second version of YANS)	18
4 Hearing Symptom Description (HSD)	9
5 Adolescents Habits and use of Hearing protection (AHH)	15

The demographic questions (1) concerned information such as gender, age, school, and, choice of educational program. Socio-economic status (2) was measured using the *Hollinghead Four Factor Index of Social Status* (Hollinghead, 1975; Swedish version, Broberg, 1992). The instrument measured both parents' education and employment and the information was used to establish the socio-economic status (SES) of the family and thus used to classify the SES of the child.

Adolescents' attitudes towards noise (3) were measured using "YANS" (Olsen & Erlandsson, 2004, see appendix I for development of the instrument). The internal consistency of the instrument was analysed by means of Cronbach's alpha and was found to be reasonably high ($\alpha = .80$). A five-degree Likert scale from "totally disagree" coded as 1, to "totally agree", coded as 5 was used. The higher score on the scale, the more positive the attitude gets. A positive attitude to noise referred to an attitude where noise was seen as something "unproblematic", whereas a negative attitude referred to the individual's perception of noise as something "bad" and exposure to noise as something to be avoided. An exploratory factor analysis with an oblique rotation based on the sample of 1285 Swedish adolescents indicated a four-factor solution with 18 items ($\alpha = .80$). The factors derived were 1) "attitudes towards noise associated with aspects of youth culture", 2) "attitudes towards common noises in the surroundings", 3) "attitudes towards the ability to influence the sound environment", and 4) "attitudes towards noise and concentration" (see appendix I for further information).

The *HSD* (4) concerned questions of hearing-related character, such as, experienced tinnitus, ear infections, noise sensitivity, the experience of pain in the ear and temporary tinnitus related to different activities like pop concerts and discotheques (Erlandsson & Olsen, 2004a, see appendix II). Additionally, two different ways of reasoning were given as alternatives to a question regarding the experience of ear symptoms (peeps or buzzing) in relation to noise exposure. The first alternative was: "the buzzing might disappear in a while" and the second was: "Imagine, if the buzzing does not disappear and I have to put up with it for the rest of my life." Further, a question was asked concerning worry before attending noisy activities because of previous experience of hearing problems.

Adolescents' habits and use of hearing protection (5) were measured using *AHH* (Erlandsson & Olsen, 2004b, see appendix II). The instrument concerned adolescents' habits regarding noisy activities. Questions were asked concerning how often the subjects were involved in different activities with potentially risky levels of noise. Additionally, questions about the use of hearing protection in such situations were also included (see appendix II). The measurements used in **Study III** are presented in Table 2.

Table 2 Measurements carried out in Study III, and number of items included.

<i>Measurements</i>	<i>Number of questions/Items</i>
1) Demographic questions	4
2) Hearing Symptom Description (HSD)	9
3) Youth Attitude to Noise Scale (third version of YANS)	19

The demographic questions dealt with the participants' age, gender, choice of educational program and country. The Hearing symptom description was the same questionnaire as used in Study I and Study II and described above (Erlandsson & Olsen, 2004a, see appendix II).

A modified version of YANS (third version, see appendix I) was used in Study III, with one additional item (item 19). This item was added in order to enhance the reliability of Factor Four. In this study, Cronbach's alpha for the entire scale was $\alpha = .82$. In the American sample and the Swedish sample the values of Cronbach's alpha were found to be $\alpha = .80$, and $\alpha = .83$ respectively.

Additionally, two further questions focused on the frequency of concert-attendance measured on a four-degree scale, ranging from "never" to "several times a week or daily". The participants could indicate whether or not earplugs were used (yes or no) when attending concerts.

In **Study IV** data were collected via in-depth interviews. The open-ended interview focused on young peoples' beliefs, attitudes and experiences of music and music-levels at concerts, discotheques, pubs and clubs. The interview was based on three main themes, "music experience," "hearing and hearing protection", and "music and health risks". The recorded interviews were transcribed verbatim and consecutively analysed in accordance with the principles of grounded theory.

Rigour in research is commonly evaluated through reliability and validity assessment strategies. Relevance is determined by the accuracy of research findings as perceived by those who are knowledgeable about the phenomena being studied. As suggested in the qualitative research approach reliability was achieved in the present study, when similar relationships between phenomena frequently emerged in the interviews. In general, qualitative researchers, emphasises and evaluate the trustworthiness or credibility of the findings (Glaser & Strauss, 1967). Credibility is used to describe the validity of the qualitative study. High correspondence between a theoretical concept and its indicators, as reflected in quotations

from the interviews is regarded as evidence of good validity. Comparative analyses between theoretical concepts, categories and interview quotations were therefore continuously conducted in order to increase the validity of the study. The coding and classification of the interviews was checked by a second judge, a reliability and validity assessment in qualitative research known as co-judging. The substantive codes were compared with the co-judgers substantive codes and were found to be approximately the same. When the substantive codes were sorted to build up categories grounded in the data, these categories were discussed with the co-judger and in a few cases modified to achieve a better fit to the data.

Analysis of data

In Study I descriptive data was analysed by the use of frequency tables and the Chi square test. The alpha level was set to 0.05 for all statistical tests. In **Study II** a factorial ANOVA were used to analyse the effect of age and socio-economic status with respect to attitudes towards noise. In **Study II and Study III** multiple logistic regression analysis was used to analyse relationships between the dichotomous dependent variable (use of hearing protection) and a set of independent variables. Multiple logistic regression is similar to multiple regression analysis and, as in the case of multiple regression analysis, its strength lies in its ability to model several independent variables at the same time (Hosmer & Lemeshow, 2000). However, the logistic regression is different from multiple regression analysis in the method of estimating coefficients. Instead of minimising the squared deviations, logistic regression maximises the likelihood that an event will occur (Hair, Anderson, Tatham & Black, 1998). What distinguishes a logistic regression model from a linear or multiple regression model is that the outcome variable is binary or dichotomous (Hosmer & Lemeshow, 2000). The outcome variable is the probability of having one or another outcome based on a non-linear function of the best linear combination of predictors (independent variables). The multiple logistic regression model is given by the equation;

$$\ln_{(\text{odds})} = \alpha + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_k x_k$$

where $\ln_{(\text{odds})}$ is the natural logarithm for the odds, that is, the probability that an individual is reported to be in one group or the other. α is the intercept which represents the value of the

outcome variable when the values of all coefficients is equal to zero. β is the vector of coefficients of x , which is the explanatory variable(s) (Tabachnic & Fidell, 1996).

The results of the logistic regression are presented as odd ratios (OR) and their 95% confidence intervals (CI). When a categorical variable is used as an explanatory variable, one of the categories of the variable is used as a reference group (indicator coding) and receives the value of 1.00. The $-2LL$ ($-2 \log$ likelihood) is a value for the fit of the model, whilst the chi-square test for the reduction in the log likelihood value provides one measure of improvement due to the introduction of the independent variables. In addition to the chi-square test there are several different R^2 like measures, such as Nagelkerke R^2 , which provides an overall model fit, as it is done by the coefficient of determination in multiple regression (Hair, Anderson, Tatham & Black, 1998). In **Study III** a 2×2 factorial MANOVA (Multivariate Analysis of Variance) also was used to analyse relationships between gender and country with respect to the entire YANS (Youth attitude towards Noise Scale) and the four factors of YANS. MANOVA is the multivariate extension of univariate techniques for assessing the differences between group means. The use of separate univariate ANOVAs or t -tests can create a problem when trying to control the overall, or experiment-wide, error rate (Hair et al., 1998). As an example, if we evaluate a series of five dependent variables using separate ANOVAs, each time using .05 as the significance level, it would, given no real differences in the dependent variables, be expected that a significant effect on any given dependent variable would be observed 5 percent of the time. However, across our five separate tests, the probability of a Type 1 error will increase to somewhere between 5 percent, if all dependent variables are perfectly correlated, and 23 percent ($1-.95^5$), if all dependent variables are uncorrelated. Hence a series of separate (univariate) statistical tests leaves us without control of our effective overall or experiment-wide Type 1 error rate. To maintain control over the experiment-wide error rate and, in addition, if there is at least some degree of intercorrelation among the dependent variables, then MANOVA is the appropriate procedure to use (Hair et al., 1998).

The method used in **Study IV** was Grounded Theory (Glaser & Strauss, 1967). The purpose of Grounded Theory is to investigate a phenomenon through interviews, and thereby build up a theoretical understanding based upon the data obtained. The method is used to generate concepts, hypotheses, and theories grounded in the empirical data. Grounded theory is an appropriate method when there is a need to explore a new research area, where theories are lacking, and additionally to bring a new perspective to a familiar field (Stern, 1980). An important aspect of the method is that data generation and data analysis proceed

simultaneously. The interviews were tape-recorded and transcribed verbatim. They were read line by line, and the text was broken down into discrete parts and substantive codes (open coding), using concrete words describing the individuals' beliefs, attitudes and experiences regarding exposure to music. The open codes were sorted, interrelated and grouped to construct categories and sub categories, a process known as axial coding. The next step was selective coding, whereby the categories were analysed with the aim of identifying a core category. The core category includes all parts of the analysis, and offers an explanation to the purpose of the study (Strauss & Corbin, 1998). A core category is identified when patterns in the data are related to the same category. In each phase of the analysis, relationships between the categories were hypothesised and tested in the data. According to Glaser and Strauss (1967) the data should be summarised in as few categories as possible, explaining as much as possible of the area investigated. In the final step of the process of analysis selective sampling of relevant literature was made to find support and a theoretical understanding for the emerging result.

Results and interpretations

Study I.

The aim of **Study I** was to explore the prevalence of tinnitus and noise sensitivity among young people in Sweden and, in addition, to describe their habits regarding noise exposure and the use of hearing protection. The sample consisted of 1285 secondary school- and upper secondary school students (13-19 years of age) in Göteborg and Vänersborg. The results showed that the self reported prevalence of permanent tinnitus was 8.7% in the total group. Noise sensitivity was reported by 17.1% of the subjects. Significant age related differences were found with respect to prevalence rates of experienced tinnitus and noise sensitivity. Older adolescents reported such symptoms to a greater extent than younger ones.

Permanent tinnitus was not significantly related to socio-economic status. However, significant differences were found between levels of socio-economic status with regard to ways of reasoning when temporary peeps or buzzing in the ears occurred after noise exposure. Worrying thoughts were more prevalent among subjects with high SES as, compared to subjects with middle or low socio-economic status. Subjects with low socio-economic status tended however, in general to react with repression to the symptoms. This result might

indicate socio-economic differences in the ways in which adolescents perceive health risks and act upon early signs of temporary or permanently damaged hearing. Gender differences regarding worrying thoughts were also found. Significantly more girls than boys reacted with worry. Age differences, however, did not prove to be significant.

Another finding was that subjects who reported hearing related symptoms, e.g. tinnitus and noise sensitivity, protected their hearing to a higher extent compared to those who did not report such symptoms. Additionally, subjects who reported hearing-related symptoms expressed worry before attending activities that included exposure to loud sounds, e.g. concerts or discotheques, to a greater extent, than individuals who did not report such symptoms. It seems likely that subjects who have experienced tinnitus and noise sensitivity become more focused on sounds in general and more aware of the importance to protect their hearing than subjects who have not had this experience. The results are also congruent with the implications of the Health Belief Model (HBM, Rosenstock, 1974). According to this model, one important factor in changing behaviour, is whether or not the individual is mentally prepared to accomplish the behaviour and whether or not the behaviour can be regarded as favourable. To be able to accomplish the desirable health behaviour there is often a need for an additional factor. Such a factor can be regarded as a releaser or a "trigger", leading to a desire to change the behaviour (Rosenstock, 1974). In the case of hearing-related symptoms, the "trigger" can be either tinnitus or noise sensitivity. Possibly, the combination of hearing symptoms and worry prior to noise exposure at the prospect of being harmed by loud sounds can lead to the more frequent use of hearing protection. To react with worry can, under the current circumstances, be seen as an adaptive way to behave, since a certain degree of concern and worry is necessary in order for the individual to change her or his behaviour.

Study II.

The aim of **Study II** was to discover whether adolescents' attitudes towards noise differed due to age and socio-economic status (SES). Additionally, the study investigated factors explaining the use of hearing protection at discotheques and pop concerts.

A 2 x 3 factorial ANOVA was conducted in order to ascertain whether the effect of SES regarding adolescents' attitudes towards noise differed with age. Significant differences were found between SES groups and between age groups. The results indicated a trend; secondary school students tended to report more positive attitudes towards noise, than upper secondary school students. The most negative attitudes to noise were found among those students with a

high SES in both age groups, and the group having the most negative attitudes was upper secondary school students with high SES. Accordingly, the most positive attitudes were found in both age groups with low SES, and secondary school students held the most positive attitudes. Having a certain level of socio-economic status seems to be more significant to the individual's attitude to noise during early adolescence, than is the case during the latter stages.

We also analysed adolescents' use of hearing protection at 1) discotheques and 2) concerts, as dichotomous dependent variables. Two logistic regression models were tested in each case. The first model tested for theoretically interesting variables, such as hearing symptoms, the individual's attitude towards noise, and socio-economic status. The variables of gender, age and reported worry before noise exposure, and the individual's experience of playing in a band or orchestra in their leisure time, were also included in the second model.

Based on the questions regarding the experience of hearing symptoms such as tinnitus and noise sensitivity, the subjects were divided into four so-called symptom-groups. The symptom-groups, along with a set of other variables, were tested in order to analyse variables that could explain adolescents' use of hearing protection at discotheques and pop concerts. The result indicated that use of hearing protection at discotheques and concerts can be explained by variables such as experienced hearing symptoms, especially for individuals with a combination of tinnitus and noise sensitivity. Interestingly, the results also indicated that age, SES and attitudes to noise can have an affect on the use of hearing protection.

Attending noisy activities and the use of hearing protection can, theoretically, be considered as behaviours connected to the subjects' attitude to noise. Subjects with low SES had more positive attitudes towards noise and were, at the same time, less likely to be inclined to use hearing protection, whereas adolescents with high SES held more negative attitudes and reported a greater use of hearing protection. The findings indicate a difference in health orientated behaviour among adolescents with different levels of SES, which might contribute to future differences in actual health. This can play a role in the perception of risks and may affect behaviour and future health conditions, conclusions that are consistent with previous findings on SES and health risk behaviour (Piättilä, Hentinen & Myhrman, 1995; Schofield, Pattison, Hill & Borland, 2003).

Variables such as gender, worry and participating in musical activities were included and some of them significantly improved the model. Participating in musical activities during leisure time, e.g. playing in a band increased the probability of use of hearing protection at discotheques and concerts. To be worried prior to noise exposure seemed to significantly increase the probability of using hearing protection at discotheques. However, this variable

did not make a significant contribution to the explanation regarding the use of hearing protection at concerts. Finally, gender did not explain any variance regarding the use of hearing protection at either discotheques or concerts.

Study III

The aim of **Study III** was to compare one sample of young Swedes and one sample of young Americans regarding attitudes towards noise. Additionally, the study investigated some factors that can contribute to the explanation of hearing protection use at concerts. A 2 x 2 factorial MANOVA was carried out to analyse whether a possible effect of the two countries regarding attitudes towards noise differed due to gender. The dependent variables in the analysis were the entire attitude scale (YANS), and each of the four factors in the YANS. No significant interaction effects were found between gender and country. Significant main effects were however found for the entire YANS and all factors, except the Second Factor (attitudes towards the ability to concentrate in noisy environments). Country was not significant for Factor Four (attitudes towards influencing the sound environment), although gender was. The largest effect was found for Factor One (Attitudes towards noise associated with youth culture), with a total explained variance of 18%. More individuals from Sweden reported noise sensitivity compared to the USA (15.4% versus 7.4%). The difference was significant ($\chi^2 = 6.3$; $df = 2$; $p < .05$). However no significant difference was found between the two countries regarding reported prevalence of tinnitus.

Three models of multiple logistic regression analysis regarding individuals' use of hearing protection at pop concerts were constructed. The First Model explained 29% of the variance in the use of hearing protection. Factor One (attitude towards noise associated with youth culture) contributed significantly to the explanation of young people's use of hearing protection. Subjects with negative attitudes towards noise were 12.45 times more likely to report the use of hearing protection, compared to individuals with a positive attitude towards noise, although individuals holding a neutral attitude did not increase the odds ratios significantly. In Model 2, Factor One (attitudes towards noise associated with youth culture) again contributed significantly to the explanation of hearing protection use. Individuals holding a negative attitude were 8.81 times more likely to report the use of hearing protection at concerts, compared to those with a positive attitude. Furthermore, individuals who reported worrying thoughts before noise exposure due to previous experiences of noise-induced hearing symptoms were 4.26 times more likely to report the use of earplugs in comparison

with those who were not worried. This increase in odds ratios significantly contributed to the model with 35% of the variance explained. In the Third Model, Factor One again made a significant contribution. Individuals reporting a negative attitude were 5.09 times more likely to report the use of hearing protection compared to those with a positive attitude. Noise sensitivity did not make a significant contribution to the model. Interestingly, worry did not contribute significantly in model three when country was added. However, country did make a significant contribution in that individuals from Sweden were 12.78 times more likely to report use of earplugs compared to individuals from the USA. This Third Model explained 50% of the variance.

Study IV

The aim of **Study IV** was to gain an insight into risk-taking as regards exposure to loud music at e.g. concerts, and additionally to investigate whether exposure to loud music is perceived as a risk. “*Music as a mean in creating identity*” was found to be the core-category for the phenomenon studied. This core-category was built up by three categories identified as higher order categories, which emerged frequently in the interviews. These higher order categories are considered as relevant for the understanding of risk-taking in musical settings. The higher order categories were; “*Self-image*”, “*Risk consideration*”, and “*Norms and ideals*”. A summary of the higher order categories, categories and the sub-categories is presented in Table 1.

Table 1. Illustration of the three higher order categories with, categories, and sub-categories.

Self image	Risk consideration	Norms & Ideals
a) Identifying oneself as vulnerable -Perceived consequences of impairment -Motives to use protection	a) Risk awareness -Judgement of risk-taking -Locus of control	a) Acting in accordance with social norms -Things that are not socially acceptable
b) Identifying oneself as invulnerable -Ignoring signs of warning -Defence mechanisms	b) The meaning of risk-taking -Risk-taking and music experience -Risk-taking and identity	b) Acting in accordance with normative ideals -The ideal of how individuals should be -The ideal of how music should be

“Self-image” was constructed from two categories a) identifying oneself as vulnerable, and b) identifying oneself as invulnerable. These two categories deal with the individuals’ own self-image about their degree of susceptibility to negative consequences of risk-taking behaviour. Identifying oneself as vulnerable is based upon two sub-categories. First, there is “perceived consequences of an impairment”, which deals with the individual’s beliefs about the kinds of limitations an impairment would imply. However, perceived consequences of an impairment may also imply an existential crisis in terms of an altered self-image. Second, there are “motives to use protection”. This sub-category deals with motivating factors such as being concerned about getting hearing problems, or using earplugs because of pre-existing hearing problems. Identifying oneself as invulnerable is based upon two sub-categories, which are “ignoring signs of warning” and “defence mechanisms”. To ignore signs of warning deals, for instance, with not being worried by temporary hearing problems after exposure to loud music, or the reasoning that suffering from hearing symptoms or temporary hearing loss in musical settings is a natural part of going to concerts. Defence mechanisms deal, for example, with putting up defences against being affected by negative consequences of a risk-taking behaviour, such as through denial (It won’t happen to me). But defence mechanisms can also function as a defence against changing the behaviour, e.g. starting to use earplugs.

“Risk consideration” consisted of two categories a) risk awareness and b) the meaning of risk-taking. Risk awareness is based upon two sub-categories, “judgement of risk-taking” and “locus of control”. Judgement of risk-taking deals with whether or not the individual is prepared to take risks. According to some informants, exposure to loud music is not a risk-behaviour, nor is it perceived as risky since the informant has not personally been affected by any negative consequences of exposure to loud volume. Locus of control is another sub-category, which refers to the individual’s perception about where the control over the situation is located. Internal locus of control means that the individual views her- or himself as responsible for taking precautions about their own health e.g. the use of hearing protection, whilst external locus of control refers to the tendency of individuals to locate the responsibility to external factors, such as other people.

The meaning of risk-taking is based on two sub-categories, “risk-taking and music experience”, and “risk-taking and identity”. Risk-taking and music experience deals with the attraction of being ‘on the edge’, that is to say that, the music experience is perceived as greater when the volume becomes almost too loud. Loud music is regarded as a strategy for feeling released and as a distraction or escape from reality. Risk-taking and identity refers to

using loud music as a mean for creating or strengthen one's own identity which, in some cases, may be associated with other types of risk-taking behaviour.

Finally, the higher order category "Norms and Ideals" was constructed from two categories, a) acting in accordance with social norms, and b) acting in accordance with normative ideals. Acting in accordance with social norms deals with the perception that there are things that, in some groups, are not socially acceptable, such as, in the case of non-musicians, the use of hearing protection. Group pressure seems to have a particular influence on the behaviour of younger people regarding noise exposure and the use of earplugs.

Acting in accordance with normative ideals refers to the idea of how you should be as a person and, in addition, the ideal of how music should be played. The ideal of how you should be refers to the ideal of not being sensitive or vulnerable. The ideal is to be "healthy" and "strong" and to be able to cope with a noisy environment. To be sensitive to loud music is associated with "weakness", and having a hearing impairment is seen as something to be "embarrassed" about or even "ashamed" of. Thus it is better to grit your teeth when the music becomes too loud, rather than being seen as sensitive and vulnerable. The ideal of how music should be played deals with the opinion that the music experience becomes intensified by loud music. The goal is to be able to sense the music inside your body, which enhances the music experience.

General discussion

The four studies that together form the basis of this thesis focus on aspects of the prevalence of hearing related symptoms among adolescents, and their attitudes to, and habits in loud musical settings. The results of Study I reveal that reported tinnitus is more common among older, than it is among younger adolescents. This might imply an increase in tinnitus related to age as a consequence of exposure to noise over a longer period of time. Our results confirm previous findings by Jokitalppu et al. (1992). Moreover, habits and activities differ between older and younger adolescents. Upper secondary school students report more frequent visits to concerts and discotheques, which may be the reason why they experience more hearing-related problems. These results point to the possible importance of contemporary youth culture, since participating in activities where e.g. loud music is present, may cause hearing-related problems.

There is always a problem in self-reports as to how to measure symptoms such as tinnitus. The formulation of the question will, inevitably, have consequences for how the participants respond. The prevalence of tinnitus among adolescents in our study is somewhat lower compared to that found in other studies. One study, for example, found that approximately 15% out of a sample of 316 adolescents (13-19 years of age) reported daily problems of tinnitus (Hellqvist, 2002). Holgers (2003) found that tinnitus was reported by 12% in a sample of 964 children (7 years of age). One problem is that no nation-wide studies aimed at establishing the prevalence of tinnitus among adolescents have, as yet, been conducted in Sweden. This fact stresses the need to conduct epidemiological studies where an agreement has been made on how to formulate the question about tinnitus. In our study we have deliberately been restrictive concerning the definition of tinnitus. The question, “Do you have permanent tinnitus (buzzing or ringing) in your ears all the time?” might result in a low positive response rate, compared to the other two Swedish studies¹ previously mentioned. On the other hand, this question might exclude individuals who have temporary tinnitus or hear peeps or buzzing sounds in their ears once in a while. There seems, as yet, to be little agreement among researchers about the definition of tinnitus, which may sometimes result in large differences when the prevalence of tinnitus is analysed.

¹ Holgers (2003) asked the question concerning tinnitus in the following way: “Have you heard a ringing, buzzing or other sort of noise in your ears, without first having listened to loud music or other loud sounds?”

No significant differences were found between SES levels regarding tinnitus, as might have been expected from previous research on SES and health. Pietilä et al. (1995) suggest that there are differences between adolescents from different SES groups regarding health risk behaviours, although there are no differences in health during this period of life. Pietilä et al. argue that differences in health risk behaviour might cause poor health later in life. It is thus an interesting finding in Study II, that SES is associated with the use of hearing protection when loud sounds are present. Individuals with high SES are more likely to use hearing protection at concerts and discotheques than those with low SES. This finding indicates a social difference in health orientated behaviour, which might contribute to future differences in actual health. One possible reason for this might be that there is a difference in the way individuals with different levels of SES tend to value and perceive risk-taking and the consequences of such behaviour. Arguably, this can be seen as a consequence of different living experiences due to socio-economic background (Marks et al., 2000; Bronfenbrenner, 1981).

Noise sensitivity was reported by 17% of the participants in Study I. Again, this problem was more common among upper secondary school students (approximately 20%) than among secondary school students (14%). Additionally, approximately two thirds of those who reported having both tinnitus and noise sensitivity stated that they used hearing protection when visiting concerts, compared to approximately slightly more than a third respectively of those reporting only one of these symptoms. In the group consisting of symptom-free subjects, only one fourth used hearing protection at concerts. The pattern repeats itself when discotheque visits are analysed. This result can be understood from the perspective of the Health Belief Model (HBM Rosenstock, 1974). Subjects having experienced symptoms related to the ears and hearing, become more focused on sounds in general and are more aware of the importance of protecting their hearing than subjects who are free of such symptoms. However, Rosenstock (1974) argues that it is often not sufficient for the person to accomplish the desirable health behaviour; hence there is a need for a “trigger”. In the case of hearing-related symptoms, the "trigger" can for example be, tinnitus or noise sensitivity.

In Study II, socio-economic status (SES) was found to be associated with attitudes. Adolescents from families with low SES were generally more positive towards noise, compared to those with higher SES. When SES was controlled for age, the results indicated that attitudes became more negative with increases in age, and this was the case independent of SES group. Chen et al. (2002) suggest that the association between SES and health

changes with age, and that the effect of SES is stronger during certain periods of life than it is during others, which is consistent with our findings. The fact that individual attitudes contributed significantly to the explanation of hearing protection use, is what can be expected based on the Theory of Planned Behaviour (TPB). Adolescents with a positive attitude to noise are less likely to report the use of hearing protection. The likelihood of use of hearing protection increased significantly for those having a negative attitude.

Age had some effect on the use of hearing protection, where the probability of using hearing protection increased with age. The largest effect was found in older adolescents attending concerts. Participating in a musical activity during leisure time, e.g. playing in a band also increased the use of hearing protection at discotheques and concerts. It is possible that someone who plays an instrument is more aware of the risks of being exposed to loud sounds. The occurrence of worry prior to noise exposure also seemed to significantly increase the use of hearing protection at discotheques. This result is consistent with the results obtained by Bogoch et al. (2005) who found, in a logistic regression, that concern about developing hearing loss and experiencing hearing disturbances is associated with concert-goers' use of hearing protection. However, in Study III we found that the variable "worry" no longer made a significant contribution to the explanation regarding the use of hearing protection at concerts, once the variable "country" had been controlled for. This suggests that cultural differences between countries are crucial for the understanding of health preventive- and risk behaviours. It is possible that cultural differences in risk discourse in society influence people's perceptions and awareness about the types of behaviours that can be perceived as risky. Hence, we would like to emphasise the importance of conducting more cross-cultural research, since cultural differences in behaviours are seldom taken into consideration in research. Finally, gender did not explain any variance regarding the use of hearing protection at discotheques or concerts. The variables in the analysis explained about 25% of the variance of use of hearing protection at concerts, and 32% at discotheques.

The use of hearing protection must be considered to be an important step towards the prevention of hearing impairments in adolescents, and arguably second only to the reduction of loud sound levels in society. Exposure to levels of loud sounds, e.g. at concerts or discotheques, can contribute to the prevalence of tinnitus and hearing impairments, as has been suggested by Kroener-Herwig et al. (2000). Study II indicates, interestingly enough, that age and SES have an effect on behaviour regarding the use of hearing protection. Attending noisy activities and the use of hearing protection should be considered as behaviours connected to the subject's attitude towards noise. Subjects with low SES had more positive

attitudes towards noise and were at the same time less inclined to use hearing protection, whereas adolescents with high SES reported more frequent use of hearing protection. This group, as a whole, expressed more negative attitudes towards noise and, significantly, larger numbers of individuals with high SES also reacted with worry to temporary hearing related symptoms, than the group with low SES did. This can, to some degree, support the hypothesis about latent differences suggested by Tuinstra et al. (1998). We did not find any SES differences regarding the prevalence of tinnitus, which can be supported by West's (1997) explanation regarding a process of equalisation during adolescence, which effects health outcomes. We did however, find SES differences in attitudes towards noise, and in the use of hearing protection. Attitudes and risk taking behaviour may be some of the explanations for why health inequalities exist between levels of SES in adulthood (Stronks et al., 1996). The results of our studies imply that latent differences, such as attitudes and health risk behaviours *do* exist in adolescence as suggested by Tuinstra et al. (1998). This conclusion may call in question West's explanation regarding the process of equalisation, since adolescents from different socio-economic backgrounds tend to behave and react to symptoms differently and, additionally, hold different attitudes to noise and the use of hearing protection. This indicates that characteristics which can be associated with adolescence, e.g. school, peers, youth culture etc, may not be shared across social borders, and that these characteristics do not break down structures associated with social class, e.g. family and neighbourhood.

In Study III we investigated attitude differences between young women and men in Sweden and in the USA. Gender differences were found for attitudes towards noise. A general tendency was that women viewed noise more negatively than men. Furthermore, the US sample held more positive attitudes towards noise than the Swedish sample. Men from the USA were most positive, whilst women from Sweden were most negative towards noise. There may be different explanations for this. One possible explanation for the country-related attitude differences is that information and knowledge may be crucial factors in achieving attitude and behavioural change in health risk behaviours. Information about the harmful effects of loud music may cause individuals to be more aware of the dangers to their hearing and ways of avoiding such risks. Targeted information campaigns have, however, often proved to have had a limited impact on changing health risk behaviours. For instance Weichbold & Zorowka (2003) investigated whether a hearing education campaign would prompt adolescents to display hearing-protective behaviour when attending musical events such as discotheques. The results indicated that the percentage of hearing protection use rose only marginally from 0% to 3.7% after the campaign.

There may however, be some cultural differences between Sweden and the USA regarding the tradition of educating and informing about risks. In Sweden there have, for quite some time, been information campaigns highlighting the risk factors associated with environments where loud music is played. In contrast, noise awareness campaigns in the USA have, until very recently, been aimed more at workplace-based than leisure-time noise exposure. The Wise Ears' Campaign in the USA was started in 1998 as a national campaign to prevent noise-induced hearing loss for all ages (NIDCD, 2005). It is reasonable to conclude that people's awareness of a health risk problem and the ways to protect themselves, is one important step in all forms of preventive work. The awareness of noise being a health risk problem can, at least to a certain extent, be considered to be a result of social discourse (Binde 2002). According to Prochaska's (1995) work on changing high-risk behaviours, the key to success in preventive work is directly related to the stage during the overall process of change that participants are in. There are some similarities between the Theory of Planned Behaviour's (Ajzen, 1991) i.e. the concept of intention to perform a behaviour and Prochaska's stages of change. Prochaska identifies six stages of change, where behavioural change is in fact just one of these six stages. The six stages are precontemplation, contemplation, preparation, action, maintenance, and termination. Prochaska's conclusion is that stage-matched programs provide an important element in health preventive work and can actually result in much higher participation rates in health programs than traditional action-oriented programs (80 to 85% versus 1 to 5%). It is possible that Prochaska's idea about changing high-risk behaviour could be generalised to the area of hearing preservation. There are, however, certain criticisms that could be made of Prochaska's theory. One, for example, is that it can be difficult to identify a specific stage of behavioural change that a person is in. It is more likely that behavioural change can be regarded as a continuum. Additionally, it is most likely that a person will hover between stages over time and that there are differences between individuals in the process of behavioural change. Some individuals may, for example, go through all of the stages, whereas others do not. Most noise-induced hearing losses are thought to be preventable through education. Whereas education may be necessary and sufficient to prevent noise-induced hearing loss in some cases, additional interventions may be necessary for individuals who exhibit extensive music-listening habits (Florentine, Hunter, Robinson, Ballou & Buus, 1998). Florentine et al. (1998) found that the behaviours of people who listened to music extensively showed strong similarities to those of many substance addicts who continued to use addictive substances despite knowledge of the harm arising from such use. In addition in Study IV we also found that the individual's perception

of being either vulnerable or invulnerable to the negative consequences of noise exposure in musical settings may be a central aspect of explaining risk-taking behaviour. It is likely that the perception of being vulnerable or invulnerable differs between the two countries as a consequence of different risk discourses.

In the multiple logistic regression analysis performed in Study III, we could see that the attitudes associated with youth culture made a significant contribution to the explanation of the use of earplugs at concerts. However, of even greater interest, is the fact that the variable “worry” seems to covary with Factor One (attitudes towards noise associated with elements of youth culture), which can be seen in the decrease of odds ratios in the Second Model. Our interpretation of this finding is that worry and attitudes towards noise are probably associated in the way that individuals with previous experience of temporary hearing problems following noise exposure (e.g. occasional tinnitus, temporary threshold shift, noise sensitivity), tend to react with worry, which in turn can induce a more negative attitude. This idea is consistent with the results gained by Bogoch et al. (2005) that concerns about developing hearing loss and experiencing hearing disturbances were associated with concert-goers’ use of hearing protection.

However, in this cross-cultural study, as mentioned previously, the variable “worry” in turn covaries with the variable “country”. In Sweden, greater numbers of individuals reported worry when experiencing noise-induced hearing-related symptoms, than was the case in the USA. In fact, in the Third Model, when the variable “country” has been added, the variable “worry” no longer makes a significant contribution to the use of hearing protection. We can also see that the introduction of the variable “country” causes a decrease in the odds ratios of the attitudes in the “youth culture factor” (8.81 versus 5.09). The combination of worry and attitude differences between the countries offers a likely explanation for the large differences in actual use of hearing protection between the two countries. This result underscores the need to conduct more cross-cultural studies in order to understand health preventive- and risk behaviours.

The reasons underpinning the gender differences in attitudes are somewhat more difficult to explain. In Study I we found that girls (13-19 years of age) reported more noise sensitivity than boys (21.2% versus 12.7%). One tentative suggestion is that noise sensitivity is associated with attitudes, so that the different levels of perceived noise sensitivity between genders is an underlying variable to gender-related attitude differences towards noise. However in Study IV we found that the ideal of not being sensitive or vulnerable was an interesting aspect of normative ideals, which may play an important role for risk-taking

behaviour. One suggestion may therefore be that differences between boys' and girls' reported experiences of noise sensitivity can be explained in terms of that it is more acceptable for women to express vulnerability e.g. noise sensitivity, than it is for men. Hence, we find a lower degree of reported noise sensitivity among boys, than among girls.

In Study II we found that about 30% of the respondents reported the use of hearing protection at concerts. The higher percentage (6%) found in Study III is probably too high to be representative of the Swedish population as a whole. Even though the study was conducted on a small sample basis, the results indicate the presence of interesting cultural differences regarding attitudes and the use of hearing protection. It is therefore important to continue to undertake larger comparative studies between countries to determine how cultural differences, including general health risk behaviours, influence hearing conservation initiatives. The way in which information about health risks is disseminated and ways in which these risks can be avoided, should be examined in order to determine their effects on individuals' attitudes and behaviour.

Even though all of the informants in Study IV knew that loud music could be harmful to their hearing, very few of them perceived attending musical settings where loud music was played as a form of risk-taking behaviour. We believe this is interesting since information and knowledge are often regarded as health preservation variables. However, research has found that information campaigns on their own have often only a limited impact on changing health risk behaviours (Weichbold & Zorowka, 2003). The three higher order categories identified in this study may provide some theoretical contribution to the concept of risk-perception and health-risk behaviour change. Self-image deals with the individual's perception of being either vulnerable or invulnerable to the negative consequences of a particular type of risk behaviour. Risk-taking can therefore be understood from the concept of vulnerability, which means that risk-taking is a self-image where it is not "permissible" to perceive oneself as being vulnerable. To have a self-image that includes identifying oneself as vulnerable deals with, for example, the ability to perceive the consequences of a hearing impairment or symptoms such as tinnitus. Therefore we would argue that self-image plays a central role in the transformation of a health-risk behaviour into a health-preventive behaviour. If the individual perceives him- or herself as invulnerable to negative consequences, no amount of information or knowledge will have an impact in changing the risk-behaviour. Indeed, it is probable that defence mechanisms against the negative consequences of a risky action and additional defence mechanisms against altering such behaviour, play important roles in maintaining a self-image of being invulnerable.

The higher order category “Risk-consideration”, deals with the individual’s evaluation of a risk-behaviour. Risk consideration includes the categories “risk awareness” and “the meaning of risk-taking”. Risk awareness deals with people’s awareness of the fact that loud music is harmful to their hearing, whereas the meaning of risk-taking deals with the enjoyment of loud music in spite of the fact that the individual knows that loud music can be potentially harmful to the hearing. Locus of control may play an important role for the individual’s risk awareness. We found that individuals holding an internal locus of control thought it was their own responsibility to protect themselves from noise, whereas individuals with an external locus of control thought it was someone else’s responsibility to lower the volume. Locus of control has previously been linked to risk-taking behaviour. Crisp and Barber (1995), for example, found that individuals with an internal locus of control knew they that were taking risks in the decisions they made, while those with an external locus of control showed a greater tendency to believe that they were invulnerable to the negative consequences of a risk-taking behaviour. Risk-consideration should also be related to self-image, that is to say, it is easier to identify yourself as invulnerable if you don’t see any negative consequences of the behaviour you engage in i.e. getting tinnitus. This idea is supported by the theoretical implications of HBM (Rosenstock, 1974).

Social norms and ideals consist of two categories, “acting in accordance with social norms” and “acting in accordance with normative ideals.” It is important to draw a distinction between the two categories. Acting in accordance with social norms deals with how individuals perceive that other members of a group behave or the types of behaviour that are socially acceptable, whereas acting in accordance with normative ideals deals with the individual’s own perception about the ideal of how one should be as a person, for example “strong” “healthy”, “capable” etc. Social norms and ideals may also have an important impact on the individual’s self-image, and may therefore be important variables for the decision whether or not to take risks.

In this study the core-category “music as a mean in creating identity” was identified. Music can be used as one strategy for creating or maintaining an identity in contemporary youth culture (Sernhede, 1995). According to Mead (1934) the social self is created through an interaction between the individual and significant others such as family, peers and the society in general. The individual self-image in our model deals with the perceived vulnerability to negative consequences of a risk-behaviour. The self-image or, the identification as being vulnerable or invulnerable to negative consequences of a risk-behaviour, may be created through an interaction between the individual, social norms and

existing normative ideals held by e.g. the peer-group or the society. However, the creation or maintenance of identity by means of music may involve some risks to the health e.g. listening to music on loud volume in musical settings. The individual risk consideration can be seen as a consequence of the interaction between self-image, social norms and norms and ideals. If the self-image is characterised as being vulnerable to loud music, but the normative ideals is that music on clubs or concerts *should* be loud, the discrepancy between self-image and normative ideals may lead to a risk consideration where this kind of activities is regarded as something risky. However, if the self-image is that you are invulnerable to loud volume there will be no discrepancy between self-image and the normative ideal of how music should be played on clubs, concerts etc. As a result the individual will not perceive this environment or activity as risky.

Theoretical proposals – a framework of risk-perception

The combined implications of the four studies that together constitute this thesis can be summarised in a theoretical framework of risk perception. The framework is an initial attempt to provide an explanation for risk-taking behaviour from a “social-constructivist” perspective, where not only the individual’s own perception and decisions, but also the context in which the individual’s perception about risks is shaped, are taken into consideration. According to Giddens (1991) lifestyle choices are increasingly crucial in the constitution of self-identity and daily activities. Risk-taking could therefore be seen as a consequence of creating a self-identity in a particular culture holding certain norms and ideals. The framework of risk-perception, based on the results of the four studies, is presented in figure 1 on the next page.

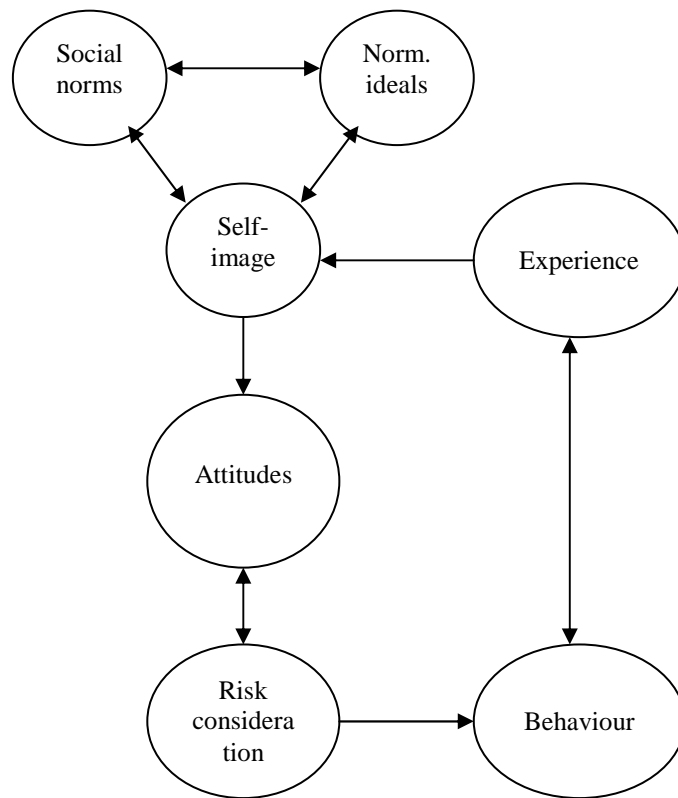


Figure 1. Framework of risk-perception.

The central variable in this framework is self-image, which deals with the individual's own perception about being either vulnerable or invulnerable to the negative consequences of risk-taking behaviour. Self-image is influenced by variables such as social norms, normative ideals and experience. Social norms can be defined as the subjective experience of others expectations about how you ought to *behave*, whereas normative ideals can be defined as the subjective experience of expectations of how you should *be* as a person. According to Self Categorisation Theory (Turner, Hogg, Oakes, Reicher & Wetherall, 1987) social norms play an important role for all social groups. The members in a group shape social norms collectively and an emphasis on voluntary participation is placed on collective behaviour. The influence of a peer group norm on the individual's behaviour is moderated by the strength of the *identification* with this group. Therefore, the group norm may be expected to influence behaviour-related cognition and behaviour itself among individuals who strongly identify with their social group. On the other hand, the group norm would be expected to have less impact on an individual's intentions and behaviour among those who are weak identifiers with the group norm (Turner & Oakes, 1986). For instance, in Study II, we found that musicians as a group were more inclined to use hearing protection at concerts and discotheques. It is

possible that the reason for this is that the social norm for musicians is to use hearing protection, since musicians, as a group, are dependent on maintaining good hearing to be able to work professionally. Thus for musicians, their motives for using hearing protection are perceived as stronger than the barriers against using hearing protection. The social norm of using hearing protection may influence the individual's self-image, where identification as being vulnerable to loud sound is emphasised. However, the motives for using hearing protection for non-musicians or the perceived consequences of suffering from a hearing impairment may not be as strong or self-evident as they are for musicians. Hence, the social norm may be not to use hearing protection, which in turn influences self-image and, consequently, the identification as being invulnerable to the harmful effects of loud noise may be enhanced.

Normative ideals, impact upon the perception of how you should be as a person and may be regarded as ideals hold by for instance the peer-group or the society. In contemporary society, we would argue, there is a "health culture" in which it is not acceptable to be "weak" and vulnerable. The ideal instead is to be "strong", capable to cope and "healthy". One ideal identified in Study IV was the ideal of not being sensitive or vulnerable. Using hearing protection was, among some of the informants, perceived as a sign of weakness, or failure to cope with loud music. Some informants' experiences were that other people regarded the use of hearing protection at concerts as a sign of having a hearing impairment. Having a hearing impairment was also seen as something embarrassing. Our results are in line with the suggestion made by Héту (1996) that experience of a hearing impairment represents a threat to social identity, and that reluctance to acknowledge impairment stems from the perceived negative social consequences of impairment. The stigma associated with a hearing loss can be understood in terms of shame. The process of stigmatisation, according to Héту, needs to be considered as an interactive process between micro (interpersonal) and macro (social) levels. We believe that if the motives to use hearing protection are not sufficiently strong, as they are for example in the case of the musicians, it is easier to identify oneself with the normative ideal of being strong, healthy, capable etc, and to avoid a "negative" social identity. This may in turn be associated with a "positive" self-image in which the self-identification as invulnerable to loud music is strengthened. In this case, the normative ideal may affect the social norm of the group you belong to, which in turn influences self-image and, ultimately may lead to risk-taking behaviour. The social norm of a group may sometimes be affected by the normative ideal, and in some cases, such as with the musicians, the social norm of the group and the normative ideal of the society, may be contradictory.

It is reasonable to believe that the individual's self-image as being either vulnerable or invulnerable, may have an affect on the individual's attitude towards noise. Attitudes have theoretically and empirically been linked to risk-taking- and health-preventive behaviours (TPB Ajzen, 1991). In our studies we have found that attitudes towards noise have an impact on the use of hearing protection, which can be regarded as a health preventive behaviour. We believe that attitudes in turn are associated with risk-consideration, which deals with the individual perception of a specific behaviour as either risky or not and, additionally, the purpose that risk-taking behaviour has in terms of perceived benefits. However, Binde (2002) argues that an individual's understanding about risks is formed in two ways. One way is to learn about risks through discourses in society. The other way to learn about risks is from one's own experiences. It is possible that the discourse about hearing risks affects social norms, normative ideals, attitudes and risk-consideration. In line with Binde's suggestion we found that experience, such as having hearing problems yourself, increased the odds for using hearing protection, results that have been confirmed by Bogoch et al. (2005). This is also what could theoretically be expected from the Health Belief Model (Rosenstock, 1966). We thus propose that attitudes have an impact on behaviour and that the linkage between attitudes and behaviour is mediated through risk-consideration.

Specific behaviours also result in an individual experience, which may be either positive, such as the appreciation of loud music, the experience of freedom, or feelings of strengthened identity, or negative, such as suffering from temporary or permanent hearing symptoms, or knowing someone who has been so affected. We suggest that the individual experience could be connected to self-image and may either strengthen a pre-existing self-image, or alter it. In Study IV we found that, within the self image, there were defence mechanisms that could be used to preserve a self image as being invulnerable, either through defence against becoming affected by negative consequences of the behaviour, e.g. getting hearing problems, or defence against altering the behaviour itself, e.g. starting to use hearing protection.

There are some differences between the theoretical framework proposed here and some of the existing theories presented previously. In short, the present theoretical framework that we propose places an emphasis on the interaction between self-image, social norms and normative ideals for the understanding of risk-taking behaviour. Costs, benefits and barriers are not advanced as the main explanations for risk-behaviour and behaviour change, as they are for example, in the Health Belief Model. We also suggest a distinction between social norms and normative ideals, where identification with existing normative ideals is dependent

on the strength of a person's identification with the social norm in a specific group. A weak identifier with a social norm may be a strong identifier with a normative ideal existing in a specific society, and vice versa. In some cases the normative ideal and the social norm may be the same. Further, the Theory of Planned Behaviour makes no distinction between social norms and normative ideals nor places any emphasis on the strength of an individual's self-identification with the existing social norms in a particular group in the way that the Self Categorisation Theory does. As demonstrated in figure 1, there is a loop between self-image, attitude, risk-consideration, behaviour and experience. This loop may explain risk-taking, attitude- and behaviour change in a more dynamic sense than, for example the Theory of Planned Behaviour, since the individual *experience* of behavioural outcomes may influence the perception of being either vulnerable or invulnerable, which in turn may influence attitudes, risk consideration and behaviour.

Other variables identified in research as being crucial to individual attitude and risk-taking behaviour are, for instance, socio-economic background, gender, knowledge and information. In our framework, we suggest that these variables should be regarded as background variables, which may have an influence on all single variables in the framework. Attitudes and behaviour regarding the use of hearing protection are potentially important factors to the development of future hearing impairments. Therefore it is important to continue investigating the relationships between variables such as SES, gender, attitudes and the use of hearing protection. Research on the association between SES and health should take into account latent factors, e.g. the individual's attitudes and behaviour, in order to explain and understand the relationship between SES, health and health-risk behaviour. However, our framework is just a tentative theoretical construction and an initial step towards the understanding of adolescent risk-taking behaviour. The framework needs to be tested further and undoubtedly modified in future research in order to get a more comprehensive understanding of adolescent risk perception and behaviour. For example, it is likely that knowledge about risks, which has not been investigated in any of the empirical studies in this thesis, may influence self-image, attitudes, risk considerations and behaviour. Another area for future research is to investigate whether small hearing changes, which can be detected by measuring pure tone audiometry, can be linked to attitudes towards noise and behaviour as regards exposure to loud music and the use of hearing protection. One hypothesis would be that changes in hearing thresholds could be linked to positive attitudes towards noise and infrequent use of hearing protection, whereas experienced symptoms such as e.g. tinnitus and

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noise sensitivity, would be associated with negative attitudes towards noise and an increased use of hearing protection.

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