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## The influence of music and stress on musicians' hearing

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### Abstract

Hearing and hearing disorders among classical and rock/jazz musicians was investigated. Pure tone audiometry was done in 140 classical and 139 rock/jazz musicians. The rock/jazz musicians answered a questionnaire concerning hearing disorders and psychosocial exposure. All results were compared to age appropriate reference materials. Hearing thresholds showed a notch configuration in both classical and rock/jazz musicians indicating the inclusion of high sound levels but an overall well-preserved hearing thresholds. Female musicians had significantly better hearing thresholds in the high-frequency area than males. Rock/jazz musicians showed slight worse hearing thresholds as compared to classical musicians. When assessing hearing disorders, a large number of rock/jazz musicians suffered from different hearing disorders (74%). Hearing loss, tinnitus and hyperacusis were the most common disorders and were significantly more frequent in comparison with different reference populations. Among classical musicians, no extended negative progress of the pure tone hearing threshold values was found in spite of the continued 16 years of musical noise exposure. In rock/jazz musicians, there was no relationships between psychosocial factors at work and hearing disorders. The rock/jazz musicians reported low stress and high degree of energy. On the average, the rock/jazz musicians reported higher control, lower stress and higher energy than a reference material of white-collar workers.

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## 1. Introduction

To be able to work as a musician implies a necessity to be able to hear and to hear correctly. It is not unusual, however, that both classical and rock/jazz musicians are exposed to high sound levels that may affect the auditory system in a negative way [1–4]. The lesion may be somewhere along the auditory pathway and result in disorders such as hearing loss, tinnitus, hyperacusis, distortion or diplacusis [5]. Another risk factor in the musicians' work environment is stress [6–8]. In 1987, Raeburn measured sources of occupational stress among professional rock musicians [9]. She found that nine out of ten musicians reported "high stress" from two to five of the following; lack of financial support, chronic job insecurity, negative career development, performance anxiety and conflicts between career, social or other family roles.

The aim of this study was to evaluate hearing and some of the hearing disorders that are commonly associated with long duration's and high sound levels of musical activities among two types of musicians; classical and rock/jazz. Another aim was to explore psychosocial work factors and their association with different hearing disorders.

## 2. Methods

Pure tone audiometry was performed in 140 classical and 139 rock/jazz musicians [10,11]. The rock/jazz musicians answered also a questionnaire concerning the presence of other hearing disorders besides hearing loss such as tinnitus, hyperacusis, distortion, diplacusis. Another questionnaire measured psychosocial exposure (demands, control, support, stress and energy) among the rock/jazz musicians [12]. A follow-up study evaluated pure tone hearing thresholds in 56 classical musicians in order to see the influence on hearing of 16 years of work in a classical orchestra [13]. All results were compared to different age appropriate reference materials [14–18].

## 3. Results

The results showed overall well-preserved hearing thresholds in both classical and rock/jazz musicians, considering the periodically high sound levels exposure. The female musicians had significantly better hearing thresholds in the high-frequency area than the male musicians in both types of musicians.

Among classical musicians, the woodwind and brass players displayed slightly worse hearing thresholds than the other musicians. Rock/jazz musicians showed slight worse hearing thresholds as compared to classical musicians. Hearing thresholds showed a notch configuration indicating the inclusion of high sound levels in both classical and rock/jazz musicians.

When assessing hearing disorders (hearing loss, tinnitus, hyperacusis, distortion, diplacusis) a large number of rock/jazz musicians were shown to suffer from different hearing disorders (74%) a significantly larger proportion among men (79%) than women (63%). Hearing loss (52%), tinnitus (45%) and distortion (19%) were significantly more commonly among men than in women, and hyperacusis (56%) was the most common among women as compared to men. As many as 24% of the musicians had distortion problems and 4% had diplacusis. Most of those

affected had troublesome combinations of disorders only 27% of the affected musicians had one discrete hearing disorder.

A 16 years follow-up study was done in 56 classical musicians to evaluate the risk of progressive hearing loss. Males showed a slightly more pronounced, although not significant, hearing reduction in the high-frequency region and a higher threshold distribution within the 90th percentile than the females. No extended negative progress of the pure tone hearing threshold values was found in spite of the continued 16 years of musical noise exposure, not even when comparison was made with a reference population [16].

Psychosocial exposure (demand, control and support) measured in 139 rock/jazz musicians showed no convincing evidence for associations between psychosocial factors at work and hearing disorders in general. Both women and men tended to have high levels of intellectual discretion, influence over decisions and social support. High levels of stress (negatively valued activation) were not common, but high levels of energy (positively valued) were reported by most of the musicians. Often being “tired after work”, “finding it difficult to relax after work” and “finding the job psychologically demanding” were common though. Very few perceived their job as consisting of mainly unattractive tasks.

Among women, tinnitus was associated with less energy during performances. For men on the other hand, tinnitus was associated with more positive emotions towards work and higher perceived sound level. Both women and men with tinnitus showed great difficulty relaxing after work. (Om de inte finns jämförelsegrupp är dessa data inte särskilt meningsfulla) Jag har ändrat greater till great. Detta var resultat som vi fick från vårt intervjuinstrument och bör finnas med.

Among men, hyperacusis was associated with higher psychological demands, higher stress during individual preparation, greater difficulty relaxing after work, not getting enough sleep and higher perceived sound levels.

#### 4. Discussion

Mild-to-moderate hearing losses, tinnitus and hyperacusis were the most common disorders and found to be significantly more frequent among the musicians studied in comparison with an age-related reference population. The male classical musicians displayed a characteristic noise-induced notch in the audiogram with its maximum at 6 kHz and the rock/jazz musicians a maximum notch at 4 kHz, which indicates an influence of high sound levels. Men had worse hearing than the women in both groups of musicians. One explanation for this could be that more men than women played the loudest instruments such as woodwinds, brass winds and percussions. Other differences between classical and rock/jazz musicians such as significant larger occurrence of tinnitus and distortion among rock/jazz musicians were also found (unpublished data). The musical style and performance may be some important factors that explain why some audiogram configurations and the occurrence of hearing disorders differed between classical and rock/jazz musicians. Differences in work conditions and environment could also play an important role [19].

Affected musicians are often able to tell the exact time of the first appearance of the hearing disorder, which often is associated with a period of excessive sound exposure, high workload and/or some form of emotional stress. Often being tired after work, perceive increased tinnitus, finding

it difficult to relax after work and finding the job psychologically demanding was a common symptom reported.

In summary, the results indicate that about half of the musicians suffered from psychological symptoms, such as negative feelings towards work, psychologically demanding work tasks, tiredness and problems relaxing. These symptoms may be stress related, but also indicate that the emotional stress level during work was relatively low. When comparing the results with a white-collar worker group, the musicians seemed to have the most favorable work situation. We suspect that there could be a risk for biased results due to the measure that could be less than satisfactory in terms of capturing the essential features of what makes up intellectual discretion in the work of rock/jazz musicians. (Oklart vad som menas?) Thus, illustrating a problem in working environment research in professions with very specific working conditions that may not be captured well by general “standard” instruments.

## 5. Conclusion

Musicians are dependent on a well functioning auditory system. A pure tone hearing loss may create difficulties with sound recognition, localization and loudness recruitment. Tinnitus, hyperacusis, distortion and diplacusis are an even greater handicap than a moderate high tone loss and may in some times be devastating for musicians. These disorders common among musicians in this study and may imply further difficulties with perception of pitch, loudness, duration, timbre and reduced auditory dynamic range. Thus it is vital that assessment of hearing disorders among musicians include tinnitus, hyperacusis, distortion and diplacusis as well as hearing loss.

There was low stress and high energy values among the rock/jazz musicians but also that musicians with hearing disorders often were tired after work, had difficulties to relax, perceived increased tinnitus and found the job psychologically demanding. There was no clear association between hearing disorders and psychosocial work factors except for men with hyperacusis who showed higher psychological demands, higher stress during individual preparation, greater difficulty relaxing after work, not getting enough sleep and higher perceived sound levels.

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