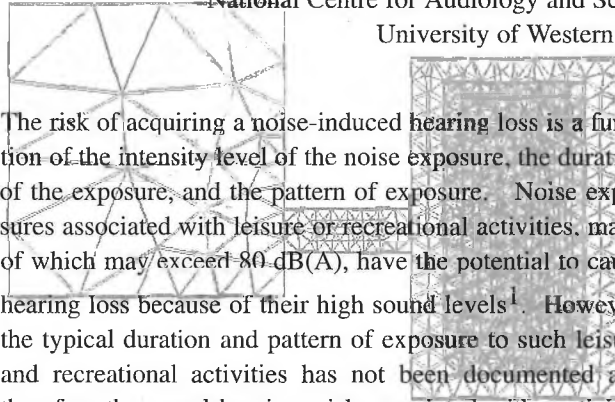


based on PARTICIPATION RATES IN NOISY LEISURE ACTIVITIES BY THREE SAMPLES OF STUDENTS (a). compared with the uncertainties of the Young's moduli of each substructure.

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The risk of acquiring a noise-induced hearing loss is a function of the intensity level of the noise exposure, the duration of the exposure, and the pattern of exposure. Noise exposures associated with leisure or recreational activities, many of which may exceed 80 dB(A), have the potential to cause hearing loss because of their high sound levels¹. However, the typical duration and pattern of exposure to such leisure and recreational activities has not been documented and therefore the actual hearing risk associated with participation in such activities is unknown.

An increased incidence of high-frequency hearing loss in young adults has been attributed to noise exposure from such leisure activities^{2,3} however the rate and pattern of participation by youth in noisy activities is unknown. Recreational activities of youth, particularly those activities that use high fidelity, high intensity sound delivery systems such as personal stereo systems and movie theatres, impulse noises such as fireworks and hunting rifles, and high powered motorized vehicles such as motocross bikes and drag race cars, have been implicated as potentially damaging to the human auditory system.¹ The present research was an initial attempt to quantify the participation by Canadian teens and young adults in noisy leisure activities in terms of participation rates, hours per activity, and frequency of participation as well as the number of noisy activities in which youth participate.

RESULTS
The simulated load was a uniform static pressure applied on the long process of the malleus. A few simulation results are shown in Figure 5. As the displacements of the ossicles are on the order of μm , the simulated deformations presented here were scaled up so that the displacements can be seen.

Method
The participation of three samples of students in noisy leisure activities was examined using a cue-recall questionnaire format. Three hundred and forty-six students completed a questionnaire during the summer months of July and August. The respondents were students from a high school ($n=55$), a community college ($n=101$), and a university ($n=122$). The questionnaires were administered by telephone for the high school students, and in person for the post-secondary students. The questionnaires elicited information about participation rates and participation durations for 32 activities that have been identified as capable of producing sound levels of 80 dB(A) or greater. For each activity, respondents were asked if they participated in the activity over the past seven days and, if so, the total duration of

In (a) the Young's modulus of the capsule was reduced to 20 MPa which is the value used for the eardrum in a previous model (Funnell, 1978). Again, lowering the stiffness of the capsule does not make much difference to the results compared with (a).

their participation. In (d) the Young's moduli of the joint gap and the capsule were both reduced to values of 5 MPa and 20 MPa respectively.

Results and Discussion
As the joint becomes more flexible, there is more deformation at the joint and relatively less bending of the pedicle. Most students reported participating in at least one noisy leisure activity during the week, with many reporting that they had participated in five or more activities. The mean total duration of participation in noisy activities was 20.7 hours. Of course, this does not account for simultaneous participation in multiple activities, such as listening to a personal stereo system while riding a motorcycle or mowing the lawn. Table 1 provides a summary of the mean number of activities reported and the mean total duration for each of the three student samples.

Table 1 provides a summary of the mean number of activities reported and the mean total duration for each of the three student samples. The value estimated for subchondral bone specimens from a human tibia (Murray, 1984). In this case the pedicle bending becomes quite large.

4. DISCUSSION

The results presented here suggest that load transmission from the malleus to the stapes is affected by both the pedicle and the total malleostapedial joint. For this model, at least, the pedicle was significantly stiffer even though it is made of bone.

	high school	college	university	all
number of activities	6.6	5.3	4.2	5.1
total duration (hrs)	24.4	20.2	19.5	20.7

Due to the similarity of the cat and human middle ears, the results presented here suggest that load transmission from the malleus to the stapes is affected by both the pedicle and the total malleostapedial joint. For this model, at least, the pedicle was significantly stiffer even though it is made of bone. This pattern may be related to the age of the student groups, but may also be affected by the summer school attendance of the college and university students, who may have had less leisure time. A more valid comparison might be made during the winter and spring months, when all students were in full-time attendance in educational programs.

Table 2 contains a summary of participation rates and participation durations for a selection of the 32 leisure activities included on the questionnaire. Only activities in which at least one group had >6% participation has been included. Music-related activities, such as listening to music via headphones and speakers, were the most commonly reported activity in all three samples. The older students, in college and university, had higher attendance rates at pubs and bars than the high school students. Other activities, such as vac-

uuming and lawn mowing, differed between the student groups, perhaps as a result of the living situation of the students (more dorms and apartments for older students and parental homes for high school students).

References

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	high school		college		university	
sample size (n)	55		101		113	
age range (years)	14-19		18-30		18-29	
music via speakers	94.5 %	6.7 h	83.2 %	7.2 h	89.4 %	7.8 h
attend movie	60.0	2.1	34.7	2.4	32.7	2.6
vacuum	56.4	0.8	50.5	0.9	29.2	0.8
lawn mower	49.1	2.5	28.7	1.7	7.1	2.8
music via headphones	43.6	2.8	22.8	5.6	31.0	5.0
sports events	43.6	3.5	26.7	3.0	17.7	3.7
boom car	41.8	1.6	44.0	5.2	23.0	4.7
loud restaurant	34.5	1.7	25.0	2.3	28.3	2.7
farm equipment	20.0	7.0	8.9	3.0	0	-
ATV	18.2	1.4	8.9	2.5	0.9	0.5
clubs/disco/bar	18.2	4.2	53.5	5.6	58.4	5.7
drag race	18.2	3.5	5.0	10.2	0	-
rock concert	18.2	3.0	8.9	3.1	15.9	2.9
power tools	16.4	4.9	18.8	2.4	2.7	0.4
motor bikes	16.4	1.3	7.9	1.5	1.8	3.0
jet ski	14.5	3.0	8.9	2.6	2.7	1.3
attend dance	12.7	2.9	7.0	2.6	15.9	4.1
arcade	10.9	3.9	6.9	1.1	6.2	2.2
model plane/cars	3.6	1.8	8.9	6.4	4.4	5.2
fitness class	3.6	0.9	20.8	4.3	21.2	4.2
carnival/midway	0	-	4.0	5.8	6.2	3.1
other	25.5	17.7	15.8	9.1	9.7	7.2

Table 2. Participation Rates (in percent) and mean number of hours (in bold) for selected activities.