

Medical Problems in Secondary School-aged Musicians

Alan H. Lockwood, M.D.

Abstract

Questionnaires administered to high-level secondary school-aged musicians were used to determine the frequency of instrument-related problems. These students played 19 ± 7.6 hours per week (mean \pm standard deviation). Among 113 respondents, 51% had no problem, 32% had mild problems, and 17% more severe problems, prevalence rates higher than previously reported in presumably older conservatory students. Problems were significantly more common in females (68%) than males (47%), and more common in players of large string instruments ('cello and bass) 78%, than among players of small string instruments (violin and viola) 42%. Seventy-nine percent believed that pain is acceptable in overcoming technical problems, but there was no difference in the prevalence of problems among those who subscribe to this belief compared to those who do not. Attempts to measure hand size were unsuccessful. Teaching students that pain is not an acceptable part of playing and possibly including instrument-specific hand conditioning programs in music pedagogy may lead to reductions in the prevalence of instrument-related medical problems.

Introduction

The incidence and severity of medical problems in high-level instrumental musicians have been well documented. However, little information is available concerning the early natural history of these problems or the factors and attitudes that may lead to their development.

Methods

With the approval of the University of Texas Committee for the Protection of Human Subjects and the Houston Independent School District Research Committee, a two-page questionnaire* was administered to orchestral music students at the High School for the Performing and Visual Arts (HSPVA) and the instrumentalists of the Houston

Youth Symphony (HYS). Respondents were asked to indicate their instrument, handedness, age, sex, whether they had completed the questionnaire before, the number of hours per week in lessons, individual practice, group practice and other playing, whether they rested during practice (if so, how long), whether they believed "a certain amount of pain is acceptable when attempting to overcome technical difficulties (no pain, no gain)" (exact quote from questionnaire), and to report whether they had had any problem playing an instrument using a 0-5 grading system modified from Fry (Table 1).¹

Respondents were asked to trace their dominant hand with the fingers spread apart as far as possible. Hand size was evaluated by drawing lines through the long axis of the thumb and the small finger. The angle at their intersection (termed angle in the table) and the length of the line from the tip of the thumb to the intersection of the lines then to the tip of the small finger (termed distance in table) were measured.

Chi-square tests, corrected for continuity, and Student's *t* test were used to determine the significance of differences between groups of variables.²

Results

Houston, Texas is the fourth largest city in the United States. The HSPVA is a public school in the Houston Independent School District (HISD). Students are admitted after competitive auditions. The HYS positions are also filled by competitive auditions of students from the greater Houston area. It includes students from many suburban school districts as well as HISD. Both groups perform music in the standard symphony orchestra repertoire. Several stu-

From the Performing Artists Clinic, University of Texas Medical School and Hermann Hospital, Houston Texas. Address correspondence to Alan H. Lockwood, M.D., Department of Neurology, University of Texas Medical School, P.O. Box 20708, Houston, TX 77225.

*A copy of the complete questionnaire is available from the author on request.

Several students have won significant competitions, and many aspire to careers as professional musicians; thus there is a high level of musicianship in the population surveyed.

TABLE 1. Grading System for Problems Related to Playing an Instrument

Grade	Description
0	I have never had pain, or any other physical problem associated with playing my instrument that lasted more than a day or so.
1	I have had pain at one site while playing that stopped when I stopped playing. Although it occurred fairly regularly, this was never a serious problem and did not interfere with my ability to play.
2	I have had pain in one or more sites along with minimal signs of injury (such as tenderness) perhaps associated with transient weakness or loss of control of the hand. For a time, it was almost always present every time I played, and was quite annoying.
3	I have had pain in one or more sites that lasted for an hour or more after I stopped playing. It was possibly associated with mild weakness, loss of control, or dexterity. Other uses of the hand were also associated with pain. This definitely interfered with my ability to practice and play.
4	I have had pain severe enough that all common uses of the affected area cause pain. Playing my instrument was almost out of the question.
5	I have had pain that was so severe that I was unable to use the affected part of my body for any purpose.

dents have won significant competitions, and many aspire to careers as professional musicians; thus there is a high level of musicianship in the population surveyed.

A total of 131 questionnaires was returned, accounting for virtually 100% of all musicians in both groups. There were 9 players who belonged to the HYS who had completed the questionnaire at HSPVA: these 9 questionnaires were eliminated when data from the combined groups were tabulated. When HSPVA and HYS data are presented separately, the data from these 9 questionnaires were included with the HYS group. There was no way to identify the HSPVA students who later completed the questionnaire a second time at the HYS. Only two questionnaires were totally unusable. Thus, there were 120 separate individuals who completed questionnaires that contained usable data. Totals of less than 120 represent the failure of some respondents to complete an item.

There were 55 HSPVA musicians aged 16.2 ± 1.5 years (mean \pm standard deviation), range 14–18, and 76 HYS musicians aged 15.8 ± 1.8 years. The HYS had one player aged 10, 7 aged 12–13, with all others between 14 and 18.

The average number of hours spent playing per week was 22.5 ± 6.5 for HSPVA students and 17.4 ± 7.2 for HYS players, a highly significant difference ($p < 0.001$, two-tailed t test) undoubtedly reflecting in-class time spent playing at HSPVA (2–3 class hours per day). However, the proportion indicating no medical problems (grade 0) compared to the total in grade 1–5 did not vary between the two groups. Therefore, for most analyses the two groups were combined. The mean playing hours per week was 19.0 ± 7.6 for the combined groups (range 5 to 42).

There were 113 respondents to the medical grade question: 51% indicated no problem, or grade 0. The proportions with problems were: 32%, grade 1; 8%, grade 2; 6%, grade 3; and 3%, grade 4. There were no grade 5 responses. The details by instrument are shown in Table 2. A χ^2 test supported the hypothesis that the reported frequency of problems is lower among players of small string instruments (violin and viola) than among players of large string instruments ('cello and string bass) (Table 3).

TABLE 2. Instrument-specific Incidence of Problems

Instrument	Grade					Total
	0	1	2	3	4	
Violin	21	10	2	4	0	37
Viola	8	2	3	0	0	13
'Cello	5	12	1	2	0	20
Double bass	1	5	1	0	0	7
Woodwind	9	3	2	1	0	15
Brass	12	1	0	0	2	15
Percussion	2	3	0	0	1	6
Total	58	36	9	7	3	113
Percent	51	32	8	7	3	100

Numbers represent total respondents in each category.

TABLE 3. The Incidence of Problems According to Type of Instrument, Gender, and Attitude Toward Pain

Factor	Problem Rate*	Chi square	p value
Instrument			
violin + viola	42.0% (21/50)		
'cello + bass	77.8% (21/27)	7.67	< 0.01
Gender			
male	46.6% (27/58)		
female	67.7% (42/62)	4.67	< 0.04
Acceptability of			
no pain, no gain			
yes (79% of survey)	48.8% (40/82)		
no (21% of survey)	45.5% (10/22)	0.0014	> 0.9

*Problem rates reflect total number of respondents in grades 1–4 divided by size of sample as shown in parentheses.

The prevalence of problems by gender is shown in Table 3. The 68% incidence of problems among females is significantly higher than the 47% incidence among males.

The acceptance of pain in overcoming technical difficulties by 79% of the total group of respondents was not different in players with grade 0 problems vs. players with grade 1–4 problems as shown in Table 3.

The reported frequency of problems is lower among players of small string instruments than among players of large string instruments.

Practice habits are summarized in Table 4. Most players in grade 0 and grades 1-4 rested during practice sessions (65% in grade 0, 80% in grades 1-4). The mean duration of uninterrupted practice was 42 ± 20 minutes and 41 ± 20 minutes in the two groups, respectively. The mean length of rests was 9 ± 6 and 10 ± 8 minutes, respectively. Although fewer players with grade 1-4 disability took no rests while practicing (35% of grade 0 vs 20% grades 1-4), this difference was not statistically significant. Similarly, the slightly greater propensity for grade 1-4 players to practice longer without resting was not significant.

The angle and distance data from traced dominant hands are shown in Table 5. The "angle" data included responses ranging from 74 to 151°. There was less variation in the distance data. However, there were no significant differences between grade 0 respondents and those in grades 1-4 by either measure of hand size in either group. The large variance precluded subdivision of these larger samples into smaller groups.

Discussion

Numerous studies have shown that instrument-related medical problems are common among adult professional and amateur musicians and also among conservatory students.^{1,3-6} In this questionnaire-survey of secondary school-aged musicians, a high prevalence of problems was encountered, approaching the proportions in symphony orchestra musicians reported by Fry.¹ Among all respondents, 51% reported no significant problems, while 32% reported very mild problems (grade 1) and 17% reported more severe problems (grades 2-4). This is almost five times higher

than the prevalence of 9.3% among Australian music school students of unspecified age, reported by Fry.⁶

This difference in the prevalence of problems in this study is not easily explained on the basis of the available data; however, the long hours of playing per week, 19.0 ± 7.6 in the present sample, and possibly a younger population that may be more susceptible to overuse injury, are possible factors of importance. It is not hard to imagine that continued intense practice and performance demands could ultimately lead to the higher frequency of problems reported by Fry and others.^{1,3-6}

Female players were more likely to be symptomatic, a finding in accord with virtually all published data.

Players of 'cellos and double basses were the most commonly affected instrumentalists. This is probably due to the longer distances that hands must stretch to play advanced music on these larger instruments. However, no group of players was free of problems. Although brass players were the most likely to be symptom-free, two of the three grade 4 respondents played brass instruments.

Practice habits showed little variation between affected and nonaffected musicians. Both groups spent significant numbers of hours per week playing their instruments, and appear to recognize the importance of regular rest periods during individual practice. Although there were no differences between the grade 0 and 1-4 groups, the unaffected group had more respondents who never rested, suggesting that the presence of pain may force some instrumentalists to rest, whereas those who are pain-free perceive no need for regular rest.

The data concerning hand size, as collected in this study, were not correlated with the likelihood of developing a problem. It is likely that a questionnaire is not a satisfactory approach to this important variable, since a great deal of the variance found in the data is likely to be the result of how the respondent performed the task and thus somewhat independent of the variable to be measured. Because of the potential importance of data concerning hand size and the development of instrument-related problems, a prospective, hands-on measurement approach should be adopted.

In future studies, it will be important to collect enough data so that the influence of gender, which is likely to affect hand size, can be separated clearly from the potential influence of hand size. The fact that playing large string instruments is much more likely to be associated with problems ($p < 0.01$) strongly suggests that hand size and the ease with which finger stretches can be made deserve careful scrutiny.

There was a striking regularity with which respondents agreed that pain was acceptable in attempting to overcome technical difficulties, the so-called "no pain, no gain" philosophy: 79% of all respondents agreed that this was appropriate. The origin of this belief is likely to be complex, and may include elements of pain being a desired end-point: "If I don't have pain, I'm not practicing enough," and possibly a remnant of the feelings of invincibility and omnipotence of teenagers, "I'm tough, and a little pain won't

TABLE 4. Practice Habits

Rest	Grade 0	Grades 1-4
Interval without rest		
0-30 minutes	4	6
30-39 minutes	17	18
40-49 minutes	7	5
50 or more	17	21
Never rest (% of total)	20 (35%)	11 (20%)
Mean rest time (min)	9 ± 6	10 ± 8

χ^2 test for difference in number not resting in grade 0 vs. grades 1-4 = 2.46, $0.25 > p > 0.1$. Numbers, except where indicated, represent the total number of respondents in each category.

TABLE 5. Measures of Hand Size*

Group	Angle (degrees)		Distance (cm)	
	Grade 0	Grades 1-4	Grade 0	Grades 1-4
HSPVA	108 ± 20	104 ± 12	25.2 ± 2.3	24.7 ± 1.9
HYS	113 ± 17	115 ± 15	24.5 ± 2.1	23.6 ± 1.4

*No significant differences were found for any groups. Angle and distance are defined in the text.

There was a striking regularity with which respondents agreed that pain was acceptable in attempting to overcome technical difficulties, the so-called "no pain, no gain" philosophy.

hurt me." This attitude was not universal: 21% did answer "no" to this question, and one asymptomatic male trumpet player wrote, "Not in music!" in the margin next to the question.

The development of instrument-related problems is undoubtedly multifactorial. This hypothesis is supported by the results of this survey in which problems were associated with female gender, playing large instruments, and long practice hours all superimposed on an attitude that accepts pain as a normal, or perhaps even desirable part of playing. To prevent the development and exacerbation of problems, teachers need to take special care to foster proper technique, especially in girls, and to teach their students that pain is a symptom of injury that is potentially dangerous to their careers.

The prevalence of problems in this group of secondary school-aged musicians may be the harbinger of more serious problems in the future. The data also suggest that the proper education of music teachers should include an upper extremity conditioning program, tailored to the specific demands of the instrument, designed to be taught to students as an integral part of learning to play. Proper physical conditioning is a critical aspect of injury-prevention in athletics. The same may be true of musicians.

References

1. Fry HJH: Incidence of overuse syndrome in the symphony orchestra. *Med Probl Perform Art* 1:51-55, 1986.
2. Snedecor GW, Cochran WG. *Statistical Methods*, 6th ed. Ames, Iowa, Iowa State University Press, 1967.
3. Fishbein M, Middlestadt SE, Ottati V, et al: Medical problems among ICSOM musicians: overview of a national survey. *Med Probl Perform Art* 3:1, 1988.
4. Calderon PH, Calabrese LH, Clough JD, et al: A survey of musculoskeletal problems encountered in high-level musicians. *Med Probl Perf Art* 1:136-139, 1986.
5. Manchester, RA: The incidence of hand problems in music students. *Med Probl Perform Art* 3:15-18, 1988.
6. Fry, HJH: Prevalence of overuse (injury) in Australian music schools. *Br J Indust Med* 44:35-40, 1987.