

Identification of Risk Factors for Musicians in Catalonia (Spain)

Jaume Roset-Llobet, M.D., Dolors Rosinés-Cubells, M.D., and Josep M. Saló-Orfila, M.D.

Abstract—The present study analyzes the results from 1,639 questionnaires returned by Catalanian musicians from music schools, conservatories, orchestras, associations of professional musicians, and sundry other musical groups. The objective was to identify the principal risk factors associated with the appearance of health problems caused by the musicians' occupations. The most noteworthy results were that 77.9% of the respondents have or have had some occupation-related health problem during their playing careers, and 37.3% of these have had technique impairment. The musculoskeletal system was the most frequently involved area (87.7% of the affected respondents). Risk factors identified include age, grade, dedication, professional status, changes in routine, and the instrument played (especially percussion, brass, and strings). In contrast to other studies, no relationship was discovered between gender or dominant hand and higher risk. The areas of the body most affected were the upper extremities and the neck. There is some indication in the data that the problems in males may be related to pathologies produced by overuse—strain; while those experienced by females are linked more with tension—posture. The conclusion reached is that, in spite of there being common factors, each community of musicians, each with its specific social, employment, and educational characteristics, presents a distinct pathological model, which makes the epidemiological data obtained in any study difficult to extrapolate to other communities. *Med Probl Perform Art* 15:167–174, 2000.

Music has always been associated with well-being, emotional balance, and recreation. Possibly for this reason, when we think of musicians we link them with health, and it is difficult not only for the general public but also for the musicians themselves to recognize the health risks. Luckily, in the last decade the media coverage given to some cases of ruined careers and illnesses in musicians (perhaps the best known being Robert Schumann,¹ Max Weinberg, Gary Graffman, and Leon Fleisher²), the constant proliferation of articles concerning the problems caused by overuse in instrumentalists,^{3–7} and the growing realization among this collective of the need for specialist care, has started to change this misconception. However, we need to recognize that the level of function and acceptance of arts medicine in different countries is by no means uniform, and the road we must travel remains long and arduous.

The authors are in the Department of Trauma and Orthopaedic Surgery, Medical-Surgical Unit for Art, General Hospital of Manresa, Barcelona, Spain.

Address correspondence and reprint requests to: Jaume Roset-Llobet, Unitat Medicoquirúrgica de l'Art, Servei de COT, Hospital General de Manresa, La Culla s/n, 08240 Manresa, Barcelona, SPAIN. e-mail: <26920jrl@comb.es>.

Thanks to numerous studies, there is now recognition that musicians suffer health problems derived from their occupation and lifestyle. There is documented evidence^{8–13} that the constant search for perfection, the long and intense periods of practice in uncomfortable postures, increasing competition, irregular employment, and high levels of anxiety are parameters that clearly put musicians at risk of developing health problems. However, the publications that describe this situation have little impact on the general public. We believe this is because they are difficult for musicians to access, and they describe populations whose characteristics are different from country to country. This is the reason why, although we agree with Bejjani et al.,¹⁴ that even now there are few serious investigations of sufficient size and methodological rigor that deal with this subject, there may remain a need for small descriptive studies. This is especially the case in places where the level of consciousness about this subject is still minimal. These studies will constitute the foundation for more ambitious investigations in the future, which should provide a more rigorous basis for our specialty.

However, the importance of studying different populations is not only significant at this level, but also for the results themselves. Some studies^{15–17} have revealed that a very high proportion of musicians (nearly 75%) have or have had health problems of sufficient importance as to affect the way they play, and that the principal pathologies are related to the syndrome of overuse within the musculoskeletal system. While this is unanimously accepted and subsequent studies have confirmed this, there is less consensus when it comes to establishing what level of influence each of the risk factors may have in promoting this pathology. Perhaps the clearest example of this is in the discussion about whether men or women are most likely to suffer from these problems.^{16–22} The differences between the results of these studies are remarkable given that the rigor and veracity of the results appear unquestionable. The discrepancies arise because these epidemiological studies share a common factor of analyzing musicians, but this is very likely the only factor that the subjects of study have in common. It is evident that differences exist between populations, that study methods in conservatories and for professional training are distinct in each country, and that it is very hard to extrapolate results obtained by other centers of investigation to our own reference area. We believe it is essential to have data about our own population and identify, from this, the most relevant risk factors and, consequently, the most appropriate preventive measures.

METHODS

Subjects

The study population was defined as all the musicians in Catalonia (Spain), professionals and students, who have been playing their instruments for more than two years. Accordingly, 9,795 questionnaires were distributed in professional conservatories, music schools, different types of orchestras, music groups, *cobles* (traditional Catalan bands), and associations of professional musicians.

Most questionnaires were mailed, including instructions on how to fill them in and a stamped, addressed envelope for their return. In the conservatories and some of the more important orchestras, the questionnaires were delivered personally and handed out during classes or rest periods in rehearsals. Personal instructions were included with the questionnaires and specific instructions for the professors, in the cases of conservatories and music schools.

Questionnaires

The questionnaire, which was completely anonymous, had one page for personal details, such as age, sex, dominant hand, professional status, what kind of musical group the respondent belonged to, instrument played, years playing, hours spent each day, and the highest grade the respondent had reached for each of his or her instruments. The second section asked specifically about health problems, which system the problem had affected, the symptoms, how long the respondent had had it, whether the onset had been related to any event, whether the respondent had done anything to resolve it, and whether the problem had provoked a compromised technique. Finally, there was a front-and-back-view drawing of the human body so the respondent could indicate where the problem was located, a visual analog scale where the respondent could mark the intensity of the discomfort, and a Fry scale.^{4,5,7,16}

Everyone was asked to complete the questionnaire, both those with and those without health problems.

Statistics

The data were entered into a Microsoft Access (Redmond, WA) database and later exported to SPSS (Chicago, IL) for statistical analysis. The statistical tests used were Student's *t*-test for comparison of means, and Fischer's exact statistic and the chi-square test for contingencies of qualitative variables. The significance level was set in this study at $p < 0.05$.

The method of regression analysis used to evaluate the independence of the variables was step forward Wald with an inter-probability for stepwise of 0.05 and for removal of 0.10.

RESULTS

Description of the Sample

One thousand seven hundred thirty questionnaires were returned, of which 1,639 (16.73% response rate) complied

with the inclusion criteria and were completed correctly. The average age of the respondent was 25.08 years (range 7–79, SD 12.9). The distribution by sex was 54.6% men and 45.4% women. Of those who returned the questionnaire, 33.7% were professional musicians and 92.4% were right-handed. The piano was the most frequently played instrument (32.5% of the respondents), guitar second (9.9%), and violin third (7.7%). The average number of years the respondents had been playing their principal instrument was 12.74 years (range 3–70, SD 11.12); the average playing time per day was 2.91 hours (range 0–10, SD 2.26) and per week 11.38 hours (range 1–60, SD 9.77).

Description of Variables

Four-fifths (77.9%) of those who returned the questionnaire reported having or having had a related health problem (18.8% current and 59.1% in the past). More than a third (37.3%) of these stated that this had affected their playing technique. Of the musicians with health problems, 39.28% placed the onset within the preceding month, 14.85% between one and six months ago, 10.02% between six months and one year ago, 22.7% between one and five years ago, and 13.13% more than five years ago.

Table 1 shows problem frequency by system. The symptoms most often described were pain (63.3%), tension (41.4%), fatigue (41.1%), and stiffness (25.9%). The causes that the musicians linked to the onset of their problems are shown in Table 2. When attempting to relieve their symptoms, 35.1% had chosen to rest, 26.9% had done nothing, and 24.3% had consulted a doctor. The majority (50.35) had only occasional discomfort in a single body zone, and only 5.5% experienced continuous incapacitating pain. When referring to their pain using the visual analog scale, 38.0% of those affected placed their discomfort at level 5 (0 = no pain, 10 = maximum pain), and only 4.0% selected the maximum level. The frequency of discomfort by body zone is shown in Table 3.

Variation by Gender

The average age of the women represented in the sample was 20.70 years and that for the men was 29.40 years, which was statistically significant [degrees of freedom (df) = 1,466.38, $t = -11.50$, and $p = 0.000$]. Seventy-three percent of the professionals were male (27% female), whereas for non-professionals the proportion was 45.3% male and 54.7% female, which was statistically significant (df = 1, chi-square = 113.69, and $p = 0.000$).

No difference was found between the sexes with regard to their dominant hand, but there was a difference when considering the instrument played. The distribution of the sexes for each of the instruments was not homogeneous. Women respondents reported practicing on average 2.51 hours/day and men 3.25 hours/day (df = 1,466, $t = -6.44$, and $p = 0.000$); per-week averages were 9.30 hours for women and 13.15 hours for men (df = 1,437, $t = -7.79$, and $p = 0.000$). Finally, there were also significant differences in the number of years playing the instrument, with women averaging 9.89 years and men 15.10 years (df = 1,532, $t = -9.96$, and $p = 0.000$).

No significant difference was discovered between the percentages of men and women reporting discomfort or worsened technique, or with respect to the intensity of discomfort or the developmental stage of the illness. There were significant gender differences in the length of time since onset of the discomfort, with men strongly predominating the group who had onset more than five years ago [70.8% ($df = 5$, chi-square = 17.95, and $p = 0.003$)]. Some of the symptoms described also show significant sexual variation (Table 4).

The causes cited as possible triggers for the health problem also were different between the men and women. Women blamed change of study ($df = 1$, chi-square = 13.43, and $p = 0.000$), change of teacher ($df = 1$, chi-square = 11.75, and $p = 0.001$), change of repertoire ($df = 1$, chi-square = 6.30, and $p = 0.012$), and preparing for an exam ($df = 1$, chi-square = 44.51, and $p = 0.000$), whereas men blamed increased work schedule ($df = 1$, chi-square = 35.80, and $p = 0.000$). There was no difference in the methods of treatment the two sexes had chosen to alleviate their symptoms.

Variation by Profession

The professionals had a significantly higher average age than the nonprofessionals (36.07 years as opposed to 19.86 years, $df = 1,213$, $t = 23.79$, and $p = 0.000$). Within the nonprofessional group the average age of the musicians who had health problems was significantly higher than that for those who had never experienced discomfort (20.63 years old with problems and 17.83 years old with no problems, $df = 1,011$, $t = -2.87$, and $p = 0.004$), while for the professional group there was no difference in this respect. For each instrument the different proportions of professionals and nonprofessionals were statistically significant for percussion, violin, viola, double bass, trumpet, trombone, and voice, in which professionals predominated, and for the nonprofessionals, piano ($df = 38$, chi-square = 130.74, and $p = 0.000$). The professionals reported that on average they spend more hours per day and per week and have played more years than the nonprofessionals (3.95 hours/day pro, 2.38 hours/day nonpro; 17.46 hours/week pro, 8.42 hours/week nonpro; and 20.07 years pro, 9.02 years nonpro, $df = 956.73$, $t = 13.24$, $p = 0.000$; $df = 735.10$, $t = 16.60$, $p = 0.000$; and $df = 799.30$, $t = 18.88$, $p = 0.000$, respectively). Most (89.3%) of the professionals recorded currently having or having had some discomfort, in comparison with 72.1% of the nonprofessionals ($df = 1$, chi-square = 62.10, and $p = 0.000$). For compromise in technique, this affected 47.0% of the professionals vs 31.4% of the nonprofessionals ($df = 1$, chi-square = 30.51, and $p = 0.000$). Within the professional group, 17.7% reported discomfort during other activities, 17.2% in all other activities, compared with 11.8% and 5.8%, respectively, for the nonprofessionals ($df = 4$, chi-square = 57.56, and $p = 0.000$) (Fig. 1). The proportion of professional musicians also increased with the intensity of discomfort ($df = 10$, chi-square = 51.27, and $p = 0.000$), as shown in Figure 2. There was no significant difference in the location of the discomfort between these two groups.

The causes of the health problems were also significantly different between professionals and nonprofessionals. The

TABLE 1. System Affected in Musicians with Health Problems

Location	%
Musculoskeletal	85.7
Oral	22.4
Skin	3.4
Cardiorespiratory	2.0

TABLE 2. Cause Attributed by Musicians to Appearance of Problem

Cause	%
Increased practice hours	43.8
Increase in work	22.6
Exam	11.1
Concert	7.2
Not known	24.5

TABLE 3. Location of Discomfort

Zone Affected	%
Upper right extremity	43.6
Upper left extremity	41.3
Lumbar zone	28.8
Dorsal zone	26.6
Cervical zone	26.3
Right trapezium	25.1
Left trapezium	24.7

TABLE 4. Symptoms Presented by the Majority by Sex

Women	Men
Swelling	Inflammation
Stiffness	Numbness
Tension	Cramp

former indicated that the causes of the problems were an increase in work ($df = 1$, chi-square = 98.89, and $p = 0.00$) and preparation for a concert ($df = 1$, chi-square = 12.07, and $p = 0.001$), while the latter thought the cause was a change of study ($df = 1$, chi-square = 9.61, and $p = 0.020$).

Other Risk Factors

Analysis by families of instruments showed that the musicians with most problems were, in descending order, percussionists (87%), brass players (85.5%), bowed string players (85.1%), double reed woodwind players (84.6%), and vocalists (84.6%) ($df = 10$, chi-square = 22.29, and $p = 0.014$).

Table 5 shows the percentage affected in each anatomic zone against family of instrument. In relation to age, it was found that most musicians who currently have discomfort are between 10 and 20 years old (Fig. 3). It is also evident that the majority of problems begin to appear from school grade 5 onward (Fig. 4).

There was no significant difference related to dominant hand and the other variables analyzed.

A regression analysis was carried out for all the variables identified as significant in the bivariate analysis. The depend-

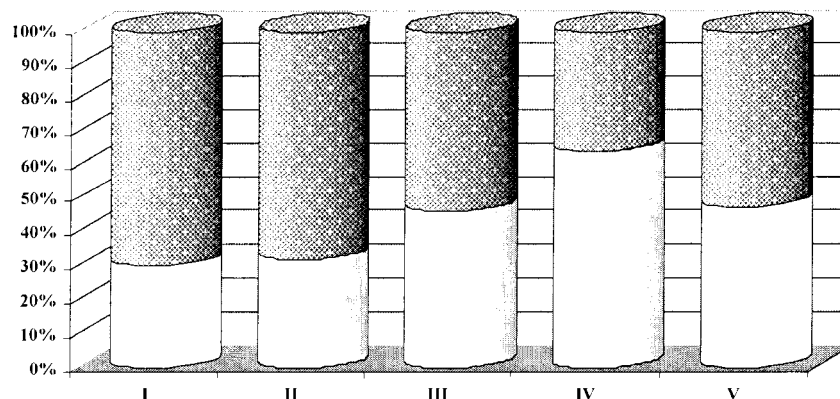


FIGURE 1. The proportion of professional musicians increases as the evolutionary stage of the health problem increases. (Top indicates non-professionals; bottom indicates professionals.)

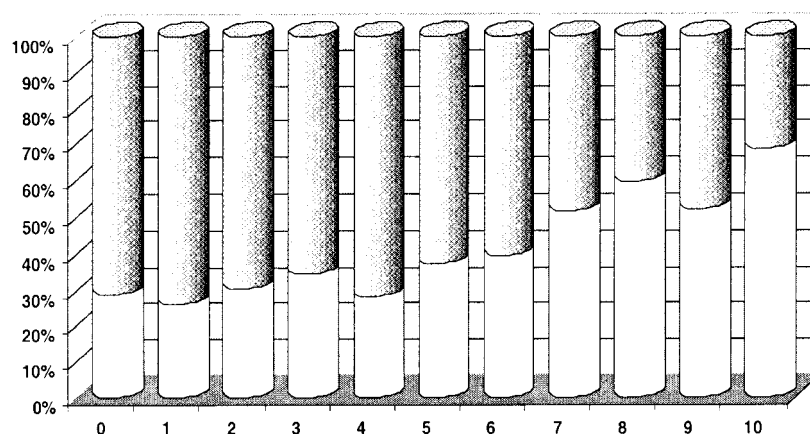


FIGURE 2. The proportion of professional musicians increases as the intensity of the discomfort increases. (Top indicates nonprofessionals; bottom indicates professionals.)

ent variable used was health problems (yes/no), with the independent variables used for scaling the discomfort being whether the subject was professional (OR of 1.76) and the daily practice hours (OR of 1.14).

DISCUSSION

Even though not directly related to medical matters, the

first noteworthy result of our investigation is the fact that, although the men and women in our population study music in the same proportions, the percentage of women who achieve professional status is very different from that of the men. One explanation, leaving aside possible social factors such as the process of integration of women in the workplace, may be the professional opportunities that exist in Spain for the different instruments, combined with the

TABLE 5. Percentage of Musicians, Grouped by Family of Instrument, Who Presented with Discomfort in Each Anatomic Zone*

Instrument	Mouth	Cervical	Dorsal	Lumbar	Upper Right Extremity	Upper Left Extremity	Right Trapezium	Left Trapezium
Keyboard		71.0	31.0	35.2	47.6	42.9	27.6	27.4
Plucked string		85.1	31.8	33.8	43.2	52.0	23.6	20.9
Percussion		68.1	29.8	38.3	61.7	55.3		
Bowed string		70.5	34.4	27.9	38.3	51.9	27.9	30.6
Brass	48.4	77.1			34.6	25.5		
Woodwind, single reed	41.0	76.3		25.1	37.4	33.8	24.5	25.9
Woodwind, double reed	50.9	76.4	20.0		43.6	25.5	23.6	
Flute		73.7	21.1	27.6	52.6	40.8	25.0	27.6
Recorder	26.3	63.2		26.3	42.1	26.3	36.8	42.1
Voice	21.2	57.6		30.3	45.5	36.4	30.3	30.3

*Percentages lower than 20% are not included.

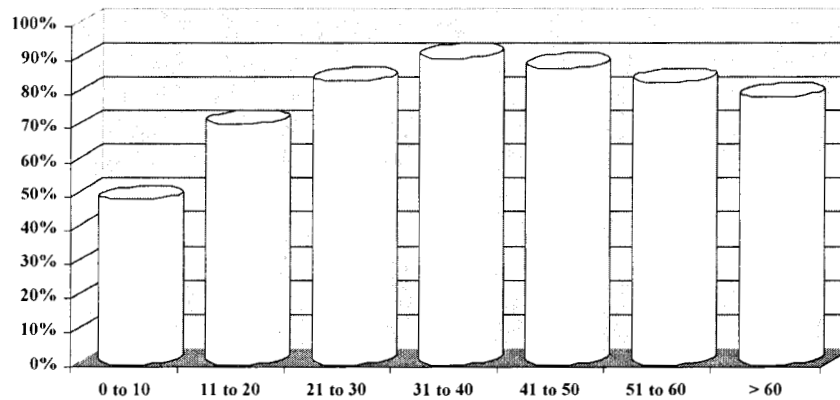


FIGURE 3. Percentage of musicians with health problems grouped by age.

choice of instrument made by the majority of each sex. In Catalonia, pianists and organists, for example, have fewer job openings than string or brass players, so the fact that most women select these instruments means that they face stiffer competition and more difficulty attaining professional status. This obviously has repercussions in how each of the sexes develops illnesses related to instrument use.

The statistic we report that up to 77.9% of musicians present at one time or another in their career with a medical problem, although in agreement with statistics from other countries,^{15,16,18} seems to us very high. One of the explanations for this result is that, although there were clear instructions that everyone should complete the questionnaire, regardless of whether they have had problems related to playing their instrument, it is very probable that a person with such a history is more motivated to complete the questionnaire than a person who has never had such problems. This would result in a higher percentage of musicians with medical problems responding to the questionnaire than really exists in the population of musicians. This is why we believe that the proportion of musicians who consider that their health problems have affected their playing techniques (37.3% of the respondents) gives us a much closer approximation of the real situation.

Although the maximum percentage of musicians affected appears in the age group 31 to 40 years, it is worth pointing

out the significant increase in the 11-to-20 age group. In the same vein, with reference to school grade, the area of concern comes at grades 4 and 5. These statistics lead us to think that when preparing preventive measures we should be focusing not on professionals or students in the higher grades, but on youngsters in the lower grades, where in addition it is probable that initiatives are more effective because postural problems and technical deficiencies are less firmly established.

Other authors have also studied young musicians who are still in conservatories. Fry⁵ reports that 13% of adolescent students present with problems associated with overuse during their studies, with increased incidence in females. Lockwood,²³ analyzing 113 high school musicians, found that 32% referred to medical problems, of which 17% were considered severe; Lockwood also confirmed the predominance of girls (68%). In our data we see once again that this subgroup shows a much higher percentage of sufferers.

We believe that a good indicator for measuring the importance of the problems that the musicians in our survey report is the duration they assign, in addition to the visual analog scale and the Fry measurement, which were also included in the questionnaire. In spite of the fact that the majority of problems have had a duration of less than one month, and therefore may be considered of little importance, the percentage of those with a longer duration appears significant.

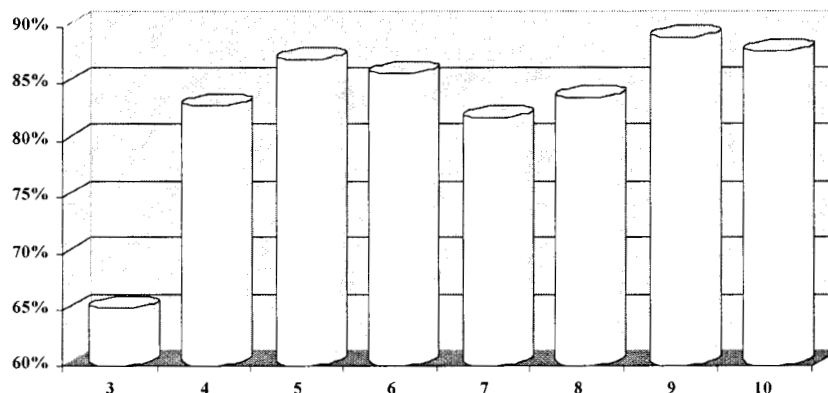


FIGURE 4. Appearance of discomfort related to school grade being studied.

Adding up the corresponding percentages, we find that 45% of the health problems have lasted more than six months and suggest that, just as stated by Brandfonbrener²⁴ in her article:

1. In a relatively high proportion of cases the problems are not trivial or are not treated effectively.
2. A large number of musicians live with their discomfort for a significant part of their careers.
3. There is no awareness among musicians of the importance of consulting experts when the first symptoms appear.
4. Doctors in general are not able to understand and therefore to solve these problems with sufficient efficiency.

Some authors⁹ have suggested that “artists” have a predisposition to look for solutions in “alternative medicine and techniques” and this may delay the resolution of the problem. However, it may be the case that musicians look for alternatives precisely because conventional medicine has not provided a useful response to their problems. It also has to be remarked that, according to the results of our survey, few musicians have done anything to alleviate their symptoms, and of those who have, the principal remedy was rest. Consequently, when the musicians do finally arrive at the arts medicine specialist, the pathologies are already very advanced and therefore more difficult to treat.^{2,6,9,25,26} Another reason why musicians may delay consulting is the fact that the majority suffer discomfort only sporadically in a single body zone, while only 5.5% present with continuous pain and incapacity.

Of those affected, 85.7% (66.9% of the total) report problems in the musculoskeletal system, a very similar percentage to that reported by other authors.¹⁸ We believe that this percentage is justified given that musicians have to maintain a more or less static posture for long periods, often in an “unpsychological” or “non-ergonomic” position, performing repetitive movements constraining the musculature, without prior physical preparation and in stressful psychological conditions or in an adverse social context.²⁷ Given what we have just described, if we see that among the causes of the problems we observe there is tension or stress and overuse, we should not be surprised to find that among the most frequent symptoms quoted are pain, tension, fatigue, and stiffness, all of these being very common in muscular hypertonic contractions and overuse syndrome.^{28–30} Nor is it surprising that the responses to the question “to what do you attribute the appearance of the discomfort?” include increased rehearsal hours, more work, and preparation for a concert or an exam, where anxiety and stress are not in short supply.³¹

We did not find significant differences between the percentages of men and women who had health problems, nor did we find a gender difference with respect to deterioration of technique, the intensity of the discomfort, or the stage of development of the illness. This contrasts with the studies by Fry,^{5,7,16} Middlestadt and Fishbein,¹⁷ Caldron et al.,¹⁸ Lockwood,^{13,23} Zaza and Farewell,²⁷ Manchester,³² and others, all of whom reported a predominance of health problems in females. The explanation for this may be because in our sample the females were, on average, younger (we report increasing health problems with increasing age), did not rep-

resent a high percentage of professionals (discomforts are more common in this collective), practiced fewer hours per day and per week, were students in the lower grades, and had been playing fewer years (all recognized risk factors). We have found differences related to the evolution of the discomfort: in the group who have suffered for more than five years, men predominate, and in that with less duration, women predominate. These data support our conclusions.

There were also differences in the causes alleged for the appearance of the discomfort: women gave causes appropriate for students or nonprofessional instrumentalists (change of grade, change of teacher, preparation for an exam), while men gave one more appropriate for professionals (increase in work), which agrees with the other observations made with respect to gender.

The symptoms described by the two genders are also different: women complained of swelling, stiffness, and tension, while men complained of inflammation, numbness, and cramps. The symptoms described by the women, in general terms, suggest muscle contractions, while those of the men suggest pathologies associated with strain. We believe that, once again, these results reflect the medical importance that social and employment factors have for musicians in Spain, above all that being a professional is a key risk factor: 89.3% of the professionals reported having or having had health problems stemming from their occupations as opposed to 72.1% of the nonprofessionals. Obviously, this is so because being a professional implies a whole series of additional risk factors:

1. Professionals are older.
2. The instruments most frequently played by professionals are percussion, bowed strings, and brass, precisely those that generate proportionally more problems and have needed more hours of dedication and longer studies.
3. Professionals play more hours per day and per week and have played more years than nonprofessionals.
4. Professionals predominate among those who have suffered their problems longer than five years (in contrast, nonprofessionals predominate among those with a shorter evolution).
5. The proportion of professionals increases with intensity of discomfort and its stage of development (Fig. 1 and 2).

Of particular note for us was the discovery that music teachers are those who, in proportion suffer the most health problems. It is surprising to think that the persons who dedicate their lives to teaching (and therefore should be correcting defective technique and poor posture and demonstrating healthy habits of physical preparation, etc.) probably have never learned these concepts and therefore are not likely to be able to teach them effectively.

With respect to dominant hand, in spite of what we may have thought, being right- or left-handed does not imply any additional risk of suffering health problems, whatever the instrument played.

As we have already commented, the instruments that, proportionally, have produced the most problems are percussion (87%), brass (85.5%), and bowed strings (85.1%). However, if

we take into consideration only musculoskeletal effects, the order changes: first are the keyboards, then plucked strings, percussion, and bowed strings. In the study by Zaza and Farewell,²⁷ plucked strings are cited as the principal source of problems, while in the ICSOM¹⁵ study, it is bowed strings (78%). With this in mind, and the evidence from other studies,^{11,13,27,33–35} we believe percussion and bowed strings to be an additional risk factor to consider.

In general terms, the anatomic zones most affected are the upper extremities and the neck, which agrees with other studies.^{2,5–7,11–13,16,25,27–30,33,34,36} These are the zones most exercised by musicians and where the un-physiological postures and muscular tensions have maximum impact, so it is not surprising that there is so much consensus among different investigations.

CONCLUSIONS

The following are the conclusions we derive from the results of this epidemiological investigation:

1. More than three-fourths (77.9%) of the respondents report having now or in the past some health problem, and 37.3% of these have felt that their ability to play was affected.
2. The musculoskeletal system is the most affected (85.7% of those with problems and 66.9% of all respondents).
3. The risk factors identified are: age (between 31 and 40 years), grade in school (4th or higher), professional status (being professional has implicit other risk factors), dedication (worse with more hours per day or per week, and with more years playing), changes to routine (concert preparation, sudden increase in practice hours, change of grade, etc.), and the instrument played (percussion, brass, and bowed strings), but not gender or dominant hand.
4. Problems presented by musicians are rarely trivial.
5. A significant number of musicians live with their discomfort for a large part of their careers.
6. Musicians possibly use alternative techniques or medicine because they do not find an effective response to their problems from conventional medicine.
7. Musicians are not very aware of the problems they have and therefore consult specialists too late.
8. The zones most affected are the upper extremities and the neck.
9. The discomfort described by the men in the study suggests that they predominantly suffer from problems derived from overuse—overstrain; while those for women suggest more problems of tension—posture.
10. With respect to preventive strategies, it is important to intervene with young musicians (11 to 20 years old and from 4th grade on) and with the teachers.
11. In spite of there being universal risk factors for musicians, each population, in response to parameters that are hard to quantify and standardize, such as the music curriculum or socioemployment factors of each country, demonstrates individual characteristics and peculiarities. We believe that this creates the need for specific investigation before it is possible to create a prevention plan for

the chosen population, given that this may present a distinctive pathological profile compared with musicians of other nationalities.

REFERENCES

1. Ostwald P: Schumann. The Inner Voices of a Musical Genius. Boston, Northeastern University Press, 1985, pp. 86–94.
2. Harman SE: Odyssey: The history of performing arts medicine. *Md Med J* 42:251–253, 1993.
3. Ramazzini B: Diseases of tradesmen. Goodman H (ed). New York, Medical Lay Press, 1993.
4. Fry HJH: Overuse syndrome in musicians 100 years ago: An historical review. *Med J Aust* 145:620–625, 1986.
5. Fry HJH: Prevalence of overuse in Australian music schools. *Br J Indust Med* 44:35–40, 1987.
6. Mandel S: Overuse syndrome in musicians. When playing an instrument hurts. *Postgrad Med* 88:111–114, 1990.
7. Fry HJ: Overuse syndrome of the upper limb in musicians. *Med J Aust* 144:182–183, 1986.
8. Ostwald PF, Baron BC, Byl NM, Wilson FR: Performing arts medicine. *West J Med* 160:48–52, 1994.
9. Sataloff RT, Brandfonbrener AG, Lederman RJ (eds): Textbook of Performing Arts Medicine. New York, Raven Press, 1991.
10. Browne CD, Nolan BM, Faithfull DK: Occupational repetition strain injuries: Guidelines for diagnosis and management. *Med J Aust* 140:329–332, 1984.
11. Brandfonbrener AG: The epidemiology and prevention of hand and wrist injuries in performing artists. *Hand Clin* 6:365–377, 1990.
12. Rozmaryn LM: Upper extremity disorders in performing artists. *Md Med J* 42:255–260, 1993.
13. Lockwood AH: Medical problems of musicians. *N Engl J Med* 320:221–227, 1989.
14. Bejjani FJ, Kaye GM, Benham M: Musculoskeletal and neuromuscular conditions of instrumental musicians. *Arch Phys Med Rehabil* 77:406–413, 1996.
15. Fishbein M, Middlestadt SE, Ottati V, Straus S, Ellis A: Medical problems among ICSOM musicians: Overview of a national survey. *Med Probl Perform Art* 3:1–14, 1988.
16. Fry HJ: Incidence of overuse syndrome in the symphony orchestra. *Med Probl Perform Art* 1:51–55, 1986.
17. Middlestadt SE, Fishbein M: The prevalence of severe musculoskeletal problems among male and female symphony orchestra string players. *Med Probl Perform Art* 4:41–48, 1989.
18. Caldron P, et al: A survey of musculoskeletal problems encountered in high level musicians. *Arthritis Rheum* 28:597, 1985.
19. Dawson WJ: Upper extremity problems of mature instrumentalists. *Med Probl Perform Art* 14:87–92, 1999.
20. Miller C, Moa G: Injury characteristics and outcomes at a performing arts school clinic. *Med Probl Perform Art* 13:120–124, 1998.
21. Yeung E, Chan W, Pan F, et al: A survey of playing-related musculoskeletal problems among professional orchestral musicians in Hong Kong. *Med Probl Perform Art* 14:43–47, 1999.
22. Zetterberg C, Backlund H, Karlsson J, Werner H, Olsson L: Musculoskeletal problems among male and female music students. *Med Probl Perform Art* 13:160–166, 1998.
23. Lockwood AH: Medical problems in secondary school-aged musicians. *Med Probl Perform Art* 3:129–132, 1988.
24. Brandfonbrener AG: The jazz musician: A challenge to arts medicine [editorial]. *Med Probl Perform Art* 3(3):iii, 1988.
25. Norris R: The Musician's Survival Manual: A Guide to Preventing and Treating Injuries in Instrumentalists. St. Louis, MO, MMB Music, 1993.
26. Lederman RJ, Calabree LH: Overuse syndromes in instrumentalists. *Med Probl Perform Art* 1:7–11, 1986.
27. Zaza C, Farewell VT: Musicians' playing-related musculoskeletal disorders: An examination of risk factors. *Ann J Ind Med* 32:292–300, 1997.
28. Hoppmann RA, Patrone NA: A review of musculoskeletal problems in instrumental musicians. *Semin Arthritis Rheum* 19:117–126, 1989.
29. Fry HJ, Rowley GL: Music related upper limb pain in schoolchildren. *Ann Rheum Dis* 48:998–1002, 1989.
30. Potter J, Jones IC: Medical problems affecting musicians. *Can Fam Physician* 41:2121–2128, 1995.
31. Sternbach D: Addressing stress-related illness in professional musicians. *Md Med J* 42:282–288, 1993.

32. Manchester RA: The incidence of hand problems in music students. *Med Probl Perform Art* 3:15-18, 1988.
33. Revak JM: Incidence of upper extremity discomfort among piano students. *Am J Occup Ther* 43:149-154, 1989.
34. Hoppmann RA, Reid RR: Musculoskeletal problems of performing artists. *Curr Opin Rheumatol* 7:147-150, 1995.
35. Van Reeth V, Chamagne P, Cazalis P, Valleteau de Moulliac M: Hand disorders in pianists. *Rev Med Interne* 13:192-194, 1992.
36. Fry HJ: Overuse syndrome in musician: Prevention and management. *Lancet* 2:728-731, 1986.



THANKS TO REVIEWERS

The Editor is, as always, indebted to the work and good counsel of MPPA's Editorial Board. In addition, the Editor and publisher express our appreciation to the following people for their willingness to serve as guest reviewers in 2000: **Gail Berenson**, **Robert Golub**, and **Michael Santucci**. Without the expert help of the editors, the Artistic Advisory Board, and these "volunteers," the quality of the journal would not have been possible.