

Identification of Risk Factors for Musicians in Catalonia (SPAIN).

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Abstract: The present study analyses the results from 1,639 questionnaires returned by Catalan musicians belonging to 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 their occupation. The most noteworthy results were that 77.9% of respondents have or have had some occupation related health problem during their playing career and 37.3% of these had technique impairment. The musculoskeletal system was the most frequently involved (87.7% of affected respondents). Risk factors identified include; age, grade, dedication, professional status, changes to 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 cervicals. There is some indication in the data that the problems males experience may be related to pathologies produced by overuse – strain while those experienced by females are linked more with tension – posture. The conclusion is reached that, in spite of there being common factors, each community of musicians, each with their specific social, employment and educational characteristics, present different pathological models which make the epidemiological data obtained in any study difficult to extrapolate to other communities.

Music has always been associated with well being, emotional balance and recreation. Possibly for this reason, when we think of a musician we link them with health and it is difficult not only for the general public but also for the musicians themselves to recognise 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 Schumann¹, Max Weiberg, Gary Graffman and Leon Fleischer²), the constant proliferation of articles concerning the problems caused by overuse in instrumentalists^{3,4,5,6,7}, and the growing realisation among this collective of the need for specialist care has started to change this misconception. However we need to recognise that the level of implantation and acceptance of the Medicine of Art in different countries is by no means uniform and the road we have to travel is still long and arduous.

Thanks to numerous studies, there is now recognition that musicians suffer health problems derived from their occupation and lifestyle. There is documentary evidence^{8,9,10,11,12,13} 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 which 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 published in circles that are difficult for musicians to access, especially since they describe populations whose characteristics are too different from that in their own country. This is the reason why, although we agree with Bejjani ¹⁴ that even now there are few serious investigations of sufficient size and methodological rigour which deal with this subject, there may still be 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 that should provide a more rigorous basis for our speciality.

However the importance of studying different populations is not only significant at this level but also for the results themselves. Some studies ^{15,16,17} 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 are fewer 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 these problems ^{16,17,18,19,20,21}. 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 analysing musicians, but this is very probably 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 professional development are very different in each country and that it is very hard to extrapolate results obtained by other centres 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 in consequence the most appropriate preventive measures.

METHODS

Subjects

The study population was defined as all the musicians in Catalunya (Spain), both professionals and students, who have been playing their instrument for more than 2 years. Amongst these 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 posted out, including instructions on how to fill in the questionnaire 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 case 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 they belong to, instrument played, years playing, hours spent each day, and the highest grade they had reached for each of their instruments. The second section asked specifically about health problems, which system it had affected, the symptoms, how long they had had it, if the onset had been related to any event, if they had done anything to solve it and if the problem had provoked a worsened technique. Finally there was a front and back view drawing of the human body so they could indicate where the problem was located, also an analogue scale where the respondent could mark the intensity of the discomfort and an indication using the 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 an MS Access database and later exported to SPSS for statistical analysis. The statistical tests used were student-t for comparison of means, Fisher 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

1,730 questionnaires were returned, of which 1,639 (16.73% response rate) complied with the inclusion criteria and were completed correctly. The average age of respondent was 25.08 yr. (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 respondents), guitar the second (9.9%) and the violin came third (7.7%). The average number of years playing their principal instrument was 12.74 yr. (range 3 – 70, SD 11.12), average playing hours per day 2.91hrs (range 0 – 10, SD 2.26) and per week 11.38 hrs (range 1 – 60, SD 9.77).

Description of Variables

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). 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 last month, 14.85% between 1 and 6 months,

10.02% between 6 months and 1 year, 22.7% between 1 and 5 years and 13.13% over 5 years ago.

Table 1 shows problem frequency by system. The symptoms most often described were pain (63.3%), tension (41.4%), tiredness (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 (50.3%) 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 analogue 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 women represented in the sample was 20.70 yr. and for men was 29.40 yr. which was statistically significant (Degrees of freedom (df)=1466.38, $t=-11.50$ and $p=0.000$). 73.0% of professionals were male (27% female), whereas for non-professionals the proportion was 45.3% male, 54.7% female which was statistically significant (df=1, chi-square=113.69 and $p=0.000$).

No difference was found between the sexes and 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 practising on average 2.51 hrs/day and men 3.25 hrs/day (df=1466, $t=-6.44$ and $p=0.000$), per week averages of 9.30 hrs for women and 13.15 hrs for men (df=1437, $t=-7.79$ and $p=0.000$) and finally there were also significant differences in the number of years playing the instrument with women averaging 9.89 yr. and men 15.10 yr. (df=1532, $t=-9.96$ and $p=0.000$).

No significant differences were discovered between the percentages neither of men and women reporting discomfort or worsened technique nor with respect to the intensity of discomfort or the developmental stage of their illness. There were significant gender differences in the length of time since onset of the discomfort, with men strongly predominating the group with onset over 5 years ago with 70.8% (df=5, chi-square=17.95 and $p=0.003$). Some of the symptoms described also demonstrate significant sexual variation, see Table 4.

The causes cited as possible triggers for the health problem also were different between men and women. Women blamed change of course (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 $p=0.00$). There was no difference in 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 non-professionals (36.07 yr. as opposed to 19.86 yr., $df=1213$, $t=23.79$ and $p=0.000$). Within the non-professional group the average age of musicians who had health problems was significantly older than those who had never experienced discomfort (20.63 years old with problems and 17.83 with no problems $df=1011$, $t=-2.87$ and $p=0.004$), while for the professional group there was no difference in this respect. For each instrument the different proportion of professionals to non-professionals was statistically significant for percussion, violin, viola, double bass, trumpet, trombone and voice for which professionals predominate and for the non-professionals the 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 non-professionals (3.95 hrs/day pro. 2.38 hrs/day non-pro., 17.46 hrs/wk pro. 8.42 hrs/wk non-pro. and 20.07 years vs. 9.02 years for the non-professionals $df=956.73$, $t=13.24$, $p=0.000$, $df=735.10$, $t=16.60$, $p=0.000$ and $df=799.30$, $t=18.88$, $p=0.000$ respectively). 89.3% of professionals recorded having or having had some discomfort in comparison with 72.1% of non-professionals ($df=1$, $chi-square=62.10$ and $p=0.000$). For technical deterioration this was 47.0% professionals versus 31.4% non-professionals ($df=1$, $chi-square=30.51$ and $p=0.000$). Within the professional group 17.7% reported discomfort during other activities, 17.2% in all other activities, compared to 11.8% and 5.8% respectively for non-professionals ($df=4$, $chi-square=57.56$ and $p=0.000$), see figure 1. The proportion of professional musicians also increases 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 non-professional. The former indicated that the cause of the problems was 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 course ($df=1$, $chi-square=9.61$ and $p=0.020$).

Other risk factors

Analysis by families of instruments showed that musicians with most problems were, in descending order, percussionists (87.0%), brass players (85.5%), bowed strings (85.1%), double reed woodwind (84.6%) and vocalists (84.6%), ($df=10$, $chi-square=22.29$ and $p=0.014$).

Table 5 shows percentage affected of 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 (Figure 3). It is also evident that the majority of problems begin to appear from grade 5 onwards (Figure 4).

There were no significant differences related to dominant hand and the other variables analysed.

A regression analysis was carried out for all the variables identified as significant in the bi-variant analysis. The dependent 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 result of our investigation which is noteworthy is the fact that, although men and women in our population both study music in the same proportions, the percentage of women who achieve professional status is very different. 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 our country for the different instruments combined with the choice of instrument made by the majority of each sex. In Catalunya pianists and organists, for example, have fewer job openings than string or brass and so the fact that most women select these instruments means that they face stiffer competition and more difficulties to attain professional status. This obviously has repercussions in how each of the sexes develops illnesses related to instrument use.

The statistic that we report that up to 77.9% of musicians present in one moment or another of their career a medical problem, although in agreement with statistics from other countries^{15,16,18} seems to us very high. One of the reasons that may explain this result is that, although there were clear instructions that everyone should complete the questionnaire, regardless of whether they have or have not had problems related to their playing of an instrument, it is very probable that a person with a history of illness of this type is more aware and therefore 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 the fact that a musician considers their health problem has affected their playing technique (37.3% of 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 it is worth pointing out the significant increase in the 11 to 20 age band. In the same vein, with reference to grade, the point of inflexion to highlight comes at grade 5 (Figures 5 and 6). These statistics lead us to think that when preparing preventive measures we should not be focussing on the professionals nor in the higher grades, but especially in the youngsters in the lower grades where in addition it is more probable that initiatives are more effective because postural problems and technical deficiencies are less established.

Other authors have also studied the collective of young musicians who are still in the conservatories. Hunter J. Fry⁵ reports that 13% of adolescent students present with problems associated with over use during their studies, with increased incidence in females. Lockwood²³, analysing 113 musicians in the final grade found 32% referred

to medical problems of which 17% were considered severe, also confirmed the predominance of girls (68%). In our data we see once again that this subgroup shows a much higher percentage of sufferers (figure 3).

We believe that a good indicator for measuring the importance of the problems which the musicians in our survey report is the duration they assign, in addition to the visual analogue scale and the Fry measurement which were also included in the questionnaire. In spite of the fact that the majority of problems has 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. Adding up the corresponding percentages we find that 45% of the health problems have lasted more than 6 months and suggest that, just as stated by Brandfonbrener ²⁴ in his 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 amongst 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 authors ⁹ 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 that 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 they may delay consulting is the fact that the majority only suffers discomfort sporadically in a single body zone, only 5.5% present with continuous pain and incapacity.

85.7% of those affected (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 a "un-physiological" or "non-ergonomic" position, performing repetitive movements constraining the musculature, without prior physical preparation and in stressful psychological conditions or in 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 amongst the most frequent symptoms quoted are pain, tension, tiredness and stiffness, all of these being very common in muscular hypertone-contractions and overuse syndrome ^{28,29,30}. Nor that the response to the question "to what do you attribute the appearance of the discomfort?" includes; increased

rehearsal hours, more work, 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 deterioration of technique, nor with respect to the intensity of the discomfort nor the stage of development of the illness. This contrasts with the studies by Fry ^{5,7,16}, Middlestadt and Fishbein ¹⁷, Caldron ¹⁸, Lockwood ^{13,23}, Zaza ²⁷, Manchester ³² and others who reported a predominance of health problems in females. The explanation for this may be because in our sample the women are, on average, younger (we report increasing health problems with increasing age), not such a high percentage of professionals (discomforts are more common in this collective), do less hours of practice per day and per week, studying the lower grades and have been playing fewer years (all recognised risk factors). We have found differences related to the evolution of the discomfort: in the group who have suffered for more than 5 years men predominate and in that with less duration, women predominate. This data supports our conclusions. There were also differences in the causes alleged for the appearance of the discomfort: women gave causes appropriate for students or non-professional instrumentalists (change of grade, change of teacher, preparation for an exam) while men gave ones more appropriate for professionals (increase in work) which agrees with the other observations made with respect to gender.

The symptoms described by each sex are also different; women complain of hardening, stiffness and tension while men complain of inflammation, numbness and cramps. The symptoms described by women, in general terms, suggest muscle contractions while those of the men in pathologies associated with strain. We believe that once again these results reflect the medical importance that social and employment factors have for musicians in our country, above all that being a professional is a key risk factor: 89.3% of professionals have or have had health problems stemming from their occupation as opposed to 72.1% of non-professionals. 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 which generate proportionally more problems and have needed more hours of dedication and longer studies.
3. They play more hours per day and per week and have played more years than the non-professionals.
4. Professionals predominate amongst those who have suffered their problems longer than 5 years (in contrast non-professionals predominate amongst those with a shorter evolution).
5. The proportion of professionals increases with intensity of discomfort and its stage of development (figures 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 person

who dedicate their life to teaching (and therefore should be correcting defective technique and poor posture and demonstrating healthy habits of physical preparation, etc.) probably has never learned these concepts and therefore is 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 which, proportionally, have produced most problems are percussion (87%), brass (85.5%) and bowed strings (85.1%). However, if we only take into consideration musculoskeletal effects the order changes: first are the keyboards, then plucked strings, percussion and bowed strings. In the study by Zaza²⁷ 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^{11,13,27,33,34,35} 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 cervical area, which agrees with other studies^{2,5,6,7,11,12,13,16,25,27,28,29,30,33,34,36}. These are the zones most exercised by musicians and where the un-physiological postures and muscular tensions have maximum impact so it is not strange that there is so much consensus between the different sources.

CONCLUSIONS

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

1. 77.9% of respondents report having now or in the past some health problem and 37.3% of these have felt their ability to play 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), grade (5th or higher), professional status (being professional has implicit other risk factors), dedication (worse with more hours per day, or 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 nor 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 career.
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 cervicals.

9. The discomfort described by the men in the study suggest 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 5th grade on) and with the teachers.

11. In spite of there being universal risk factors for musicians, each population, in response to parameters which are hard to quantify and standardise, such as the music curriculum or socio-employment factors of each country, demonstrate 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 to musicians of other nationalities.

TABLES

Table 1: System affected in musicians with health problems.

Location	%
Musculoskeletal	85,7%
Oral	22,4%
Skin	3,4%
Cardio-respiratory	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
Hardness	Inflammation
Stiffness	Numbness
Tension	Cramp

Table5: Percentage of musicians, grouped by family of instrument, who presented with discomfort in each anatomic zone. Not included percentages lower than 20%. (*Ww=woodwind; r = reed; URE=Upper Right Extremity; ULE=Upper Left Extremity; R=right; L=left*).

Instrument	mouth	cervical	dorsal	lumbar	URE	ULE	R. trapeze	L. trapeze
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		
Ww simple r	41,0	76,3		25,1	37,4	33,8	24,5	25,9
Ww double r	50,9	76,4	20,0		43,6	25,5	23,6	
Ww transverse flute		73,7	21,1	27,6	52,6	40,8	25,0	27,6
Ww 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

FIGURES

Figure 1: The proportion of professional musicians increases as the evolutionary stage of the health problem increases. (Blue indicates non-professionals, red indicates professionals).

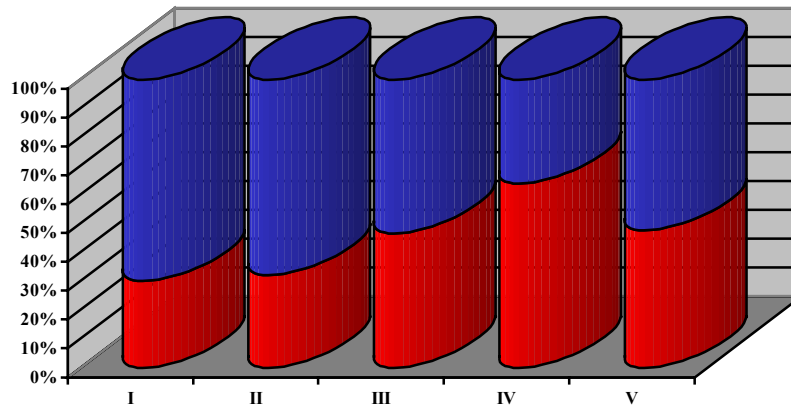


Figure 2: The proportion of professional musicians increases as the intensity of the discomfort increases. (Blue indicates non-professionals, red indicates professionals).

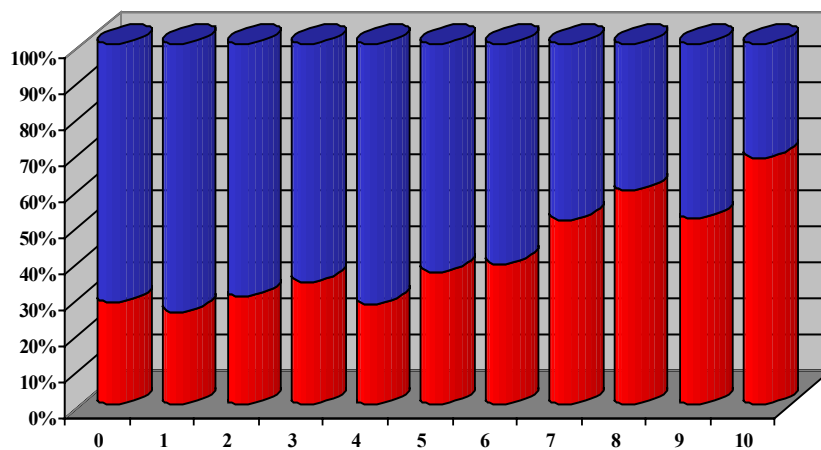


Figure 3: Percentage of musicians with health problems grouped by age.

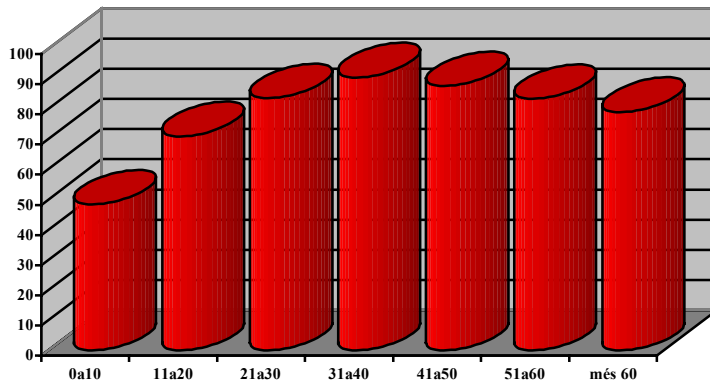
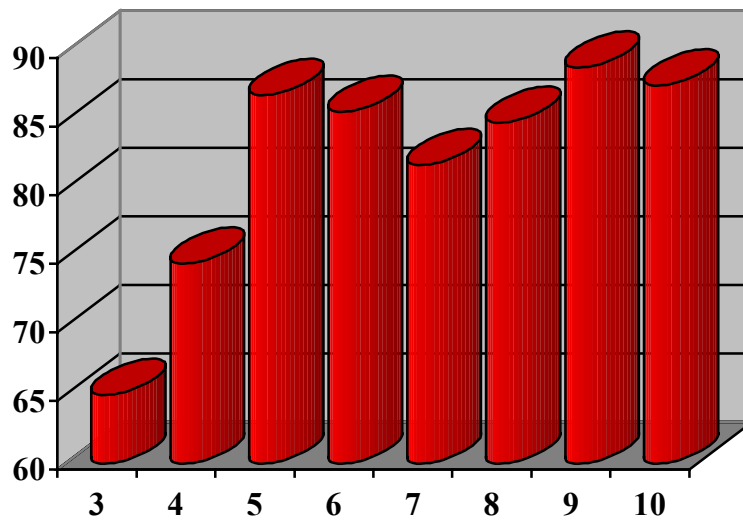


Figure 4: Appearance of discomfort related to grade being studied.



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