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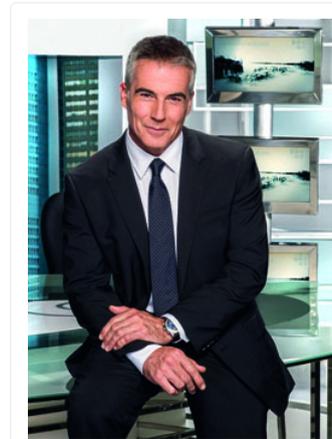
Fundación **MAPFRE**

David Cantero. Journalist

Interview

'I know older people who are very skilled at driving and I know young people who are absolutely incapable'

'Much work remains to be able to speak of good drivers, true awareness and proper driving', says David Cantero, presenter of Informativos Telecinco (3 pm). The journalist was interviewed by 'Road Safety for Seniors', Accident Prevention and Road Safety Area of Fundación MAPFRE, to discuss road safety, awareness, speed, radar, medical examinations and the elderly, among other topics. David Cantero is an avowed motorcyclist. 'Roads are not designed or built for motorcyclists but for cars' he says.



First, how do you see Spanish drivers? Are they more conscientious? Do they commit fewer violations?

In Spain, in general, much work remains to be able to speak of good drivers, true awareness and proper driving. Possibly, there is more awareness about safety but in a way that is sometimes very confusing and misleading. The problem of road safety is not simply a matter of obeying speed limits like automatons. It must be done, of course, but with sense, with prudence and intelligence, and as citizens, drivers must require that those who dictate these rules do so with common sense, intelligence and wisdom. We must apply all possible talent to traffic, driving, good training, good judgment and expertise. Unfortunately, there are people lacking in all those things.

Do you think that the expected economic recovery increases road accidents? Is it inevitable?

I think the accident rate does not diminish because good drivers and good people are not being formed in school. Driver education should be a compulsory and prominent subject in schools. It will hasten the day when people are aware that it can happen to them and they will start driving smarter and more skillfully, more cautiously at the wheel. However, caution is not synonymous with fear, which is what they seem to want to instill, what they would have us believe.

What do you think should be changed to further reduce road accidents in Spain? Roads, enforcement, education, etc.

Again, it is primarily a matter of good training (vial and general). Of course, we should improve roads, invest in new roads and better maintain the roads we have. Some are a real disaster, with the surface in bad condition and poor signage. And on the subject of enforcement, it would be very interesting stop having that feeling of persecution that prevails today every time you go on the road, since they do not always go after those who pose the real danger with their recklessness and stupidity. Before, the Traffic Civil Guard was on the road to command respect and to help, and also to punish when necessary. Now drivers often see them as mere fine collectors.

The media provides traffic accident data every weekend but are we aware of the harsh reality of traffic accidents? Do they have the means bring this important issue to society?

Relatively. The usefulness of messages and campaigns is not entirely clear. I think most people do not even imagine that it could happen to them. They believe that what's on TV always happens to others. In my work, I have seen closely the cruelty of many fatal accidents, death and terrible tragedies on the highways, and despite all its horror it is not easy to transmit

the reality through the screen. And when you do it is not clear that it will have much effect.

You're a motorcyclist. Do you consider yourself passionate?

I have been passionate cyclist since the age of 14. I have ridden a motorcycle with absolute passion all my life and I have never had an accident. I have not had a car accident either, and have had a license since 1979. I have been driving cars and motorcycles for 36 years, millions of kilometers and I've never had an accident, not even a minor one. Knock on wood.

Do you consider that motorcyclists as a whole are less well protected than other road users?

Completely. The roads are not designed or built for motorcycles but for cars. They are full of dangers, especially guard rails which are much more than a threat, they are a real death trap in the event of a fall. Many streets and roads still have slippery paint, cracks, patches, oil stains, gravel, sand, stones, hazardous debris and deep potholes. Hitting the road on a motorcycle in Spain is a test of survival. All this without even considering that many drivers do not respect those who are on a motorcycle, or are unaware of their vulnerability.

What do you think of radar? Do you think it is for collecting fines?

Ah, but do they serve another purpose? It seems like a fine collection tool and a double-edged weapon used in a tortuous and completely wrong manner. Its current use is mainly for that, to collect money, to impose fines, in mass, the more the better, and raise hundreds of thousands, millions of euros quickly and very easily. They are placed in unnecessary, often absurd, areas in places where there is no danger or no need for lower speeds. I also believe that they cause traffic jams, irritate, mislead and disturb drivers. Many people are more focused on not being caught than on driving correctly. I think they should only be used in very limited areas, which are really dangerous, and with very different criteria than today.

Are you for or against raising the speed limits on the roads?

For. It is ridiculous to have to drive 100 or 120 on absolutely safe highways, and even more so with the safety and technology currently offered in vehicles. There is no danger in driving 140, at least on these roads, and of course always cautiously, wisely and with full attention. In fact, many people drive at that speed, though, more aware of the radar and not being fined than enjoying driving with safety and confidence. Reducing speed is not the solution. Going slow is not always synonymous with safety. On the contrary, I think those that go too slow cause driving hazards, create tension, impatience, improper passing, confusion and, in many cases, accidents. I think that since drivers have been taught that "walking on eggshells" is the solution people drive much worse. And so traffic jams are created each day. Poor planning of roads, funnels, stupidity and slowness cause traffic collapse, no doubt.

Do you consider it important that drivers continue to learn throughout their life? Do you think there should be mandatory training?

That is, or should be, a task for life, from school, and then especially for some individuals who I doubt who are trained to operate vehicles and so drive very cautiously. DGT exams are a kind of process to get a license or permit, and do not prove anything, do not prove that someone is really qualified to be a good driver. Many barely pass and that's it. After they let you out on the road and you have to manage, it is your job to gain experience and learn, something that does not always happen, not in all cases.

A lot of people claim that more extensive tests are made for the renewal of driving licenses, especially to identify health problems in older people. Do you think that current the examinations are too permissive?

We should do reviews that are more comprehensive from the beginning, and not just for the elderly. It would be good to be more vigilant of the possible health problems that could incapacitate drivers, of course, but we should also keep a very careful watch on the intellectual and psychological capacity of a person before allowing them to drive a car, be they young or old.

Many defend setting an age limit for driving.

That is an over simplification. I know older people who are very skilled at driving and I know young people who are absolutely incapable. That depends on each person, in each case. What we should do is not set age limits, but monitor the true capacity of anyone who intends to drive, but that, like almost everything mentioned above, is part of a kind of utopia. Much remains to be done so that most of those who drive are really good drivers. The wisdom, skill, agility, good training, mental and physical health, respect and empathy should be the norm, the real test for getting behind the wheel or handlebars of any vehicle.

Finally, a message for drivers.

That's the message. Respect and good training, driving skills, prudence and wisdom are what really matters. They are what could actually improve things and avoid accidents and not rules and outdated and unnecessary speed limits in many cases.

Risks and prevention in adolescence: Intergenerational Educational Strategy: Does it make any sense?

Health Promotion

There is a Spanish saying that runs as follows: «Wherever the body goes, danger follows». Put like that, it might well seem that risks are part and parcel of our daily life, so chancy as to be out of our control. Against this, however, other sayings tell us: «Prevention is better than cure», «Forewarned is forearmed» or «The older, the wiser». This praising of experience suggests we might well pay more heed to the elderly, who have lived long enough to weigh up judiciously the risks of life and the ways of minimising them. Bring together elderly peoples' experience and adolescents' risk-prevention needs, and what do you get? Intergenerational relationships, that's what. And this is exactly what has been the kernel of our research.



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First and foremost, this project has been based on the organized groups of volunteers by means of which the Confederation of Active Elderly (*Confederación de Mayores Activos*: CONFEMAC) has been working towards active ageing and trying to build up a sense of solidarity and fellow feeling to the benefit of the whole community. CONFEMAC invites elderly people to carry out community work as volunteers, training them up beforehand and coordinating their activities. Some of them work from an intergenerational point of view. Nonetheless, there is as yet little to go on in terms of exactly what might be achieved by intergenerational volunteer work. For that reason we decided to tap into the experience of the elderly and bring it to bear on new generations now taking their compulsory secondary education courses in Spain to make them more aware of the commonest everyday risks they face in their school life and the best ways of preventing them.

All too often we turn our backs on risks; most of us overlook or ignore the daily risks we run. We see accidents happening to other people but think this can never happen to us. This devil-may-care attitude is perhaps even stronger among the young. There is therefore a pressing need for studying risk attitudes in the interests of proposing more efficient preventive activity.

Younger people tend to be more vulnerable to these daily perils due to their inexperience and corresponding imprudence. Witness the fact that the biggest external cause of death in the under 34s (53.74%) is accidents of various types. With proper guidance, however, the vitality of youth can be steered towards prudence.

People in the first decades of life, after all, tend to be more receptive to new messages than in later stages of life and hence more prone to take on awareness-raising messages. Action is therefore needed in childhood and adolescence to inculcate proper risk-prevention behaviour; this is a much more promising option than trying to correct ingrained behaviour afterwards. Another factor argues in favour of this activity: the importance of gauging the worth and potential of intergenerational activity, i.e., systematic interaction between persons of different generations to come up with answers to real needs. Some of the initial signs are good. Specialised literature has already vouched for the efficacy of

intergenerational work in terms of reducing risky behaviour among adolescents (Kuehne, 2005).

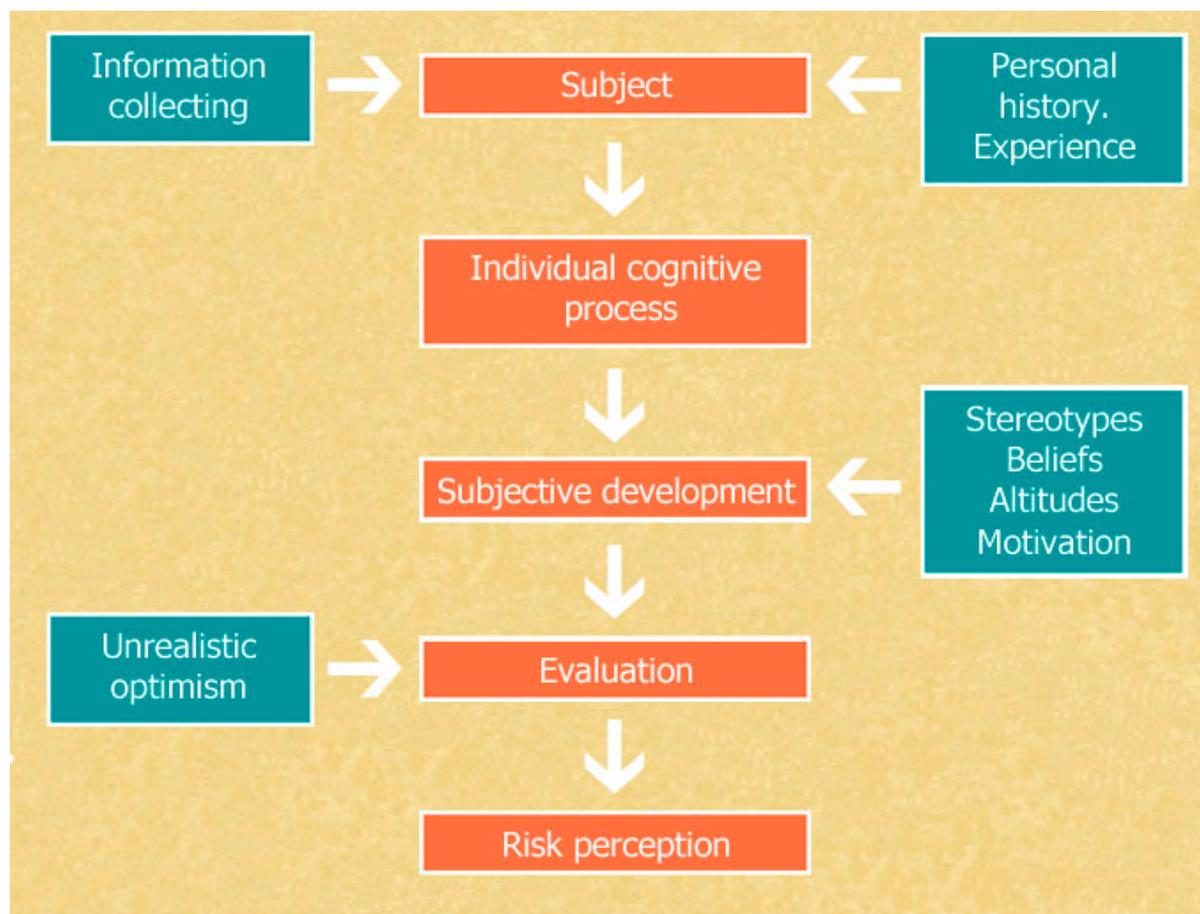
It is easy to theorise about the value of experience but it also has to be recognised that in today's model of social relations it is by no means so easy in practice for people of different generations to swap experiences. It is rare nowadays to find children, adolescents or youngsters listening to elderly people to benefit from their advice and experience, especially if there is no family bond. This makes it all the more interesting to conduct a project in which risk prevention and age-gap-bridging actions go hand in hand.

Objectives, theoretical framework and working hypothesis

The general objective we set ourselves was to gauge the efficiency of elderly-volunteer intergenerational intervention in raising children's and adolescents' awareness of the risks of daily life and encouraging positive risk-preventing attitudes in this age group. We decided to concentrate on risks related to ICT use and alcohol consumption.

Risk perception tends to be built up from any person's ongoing life experiences. Any research into risk perception therefore needs to pay attention to subjective appreciations of risk, based on individual perceptions and beliefs built up in coexistence with other social groups. Working from the findings of García (2012), we decided to understand the risk-perception configuration process as shown in Figure 1.

Figure 1. Configuration of risk perception



Source: García, 2012, p. 140.

Elderly people, drawing on their own first-hand life experience, can pass on to new generations at school the importance and worth of taking preventive action against some common daily risks

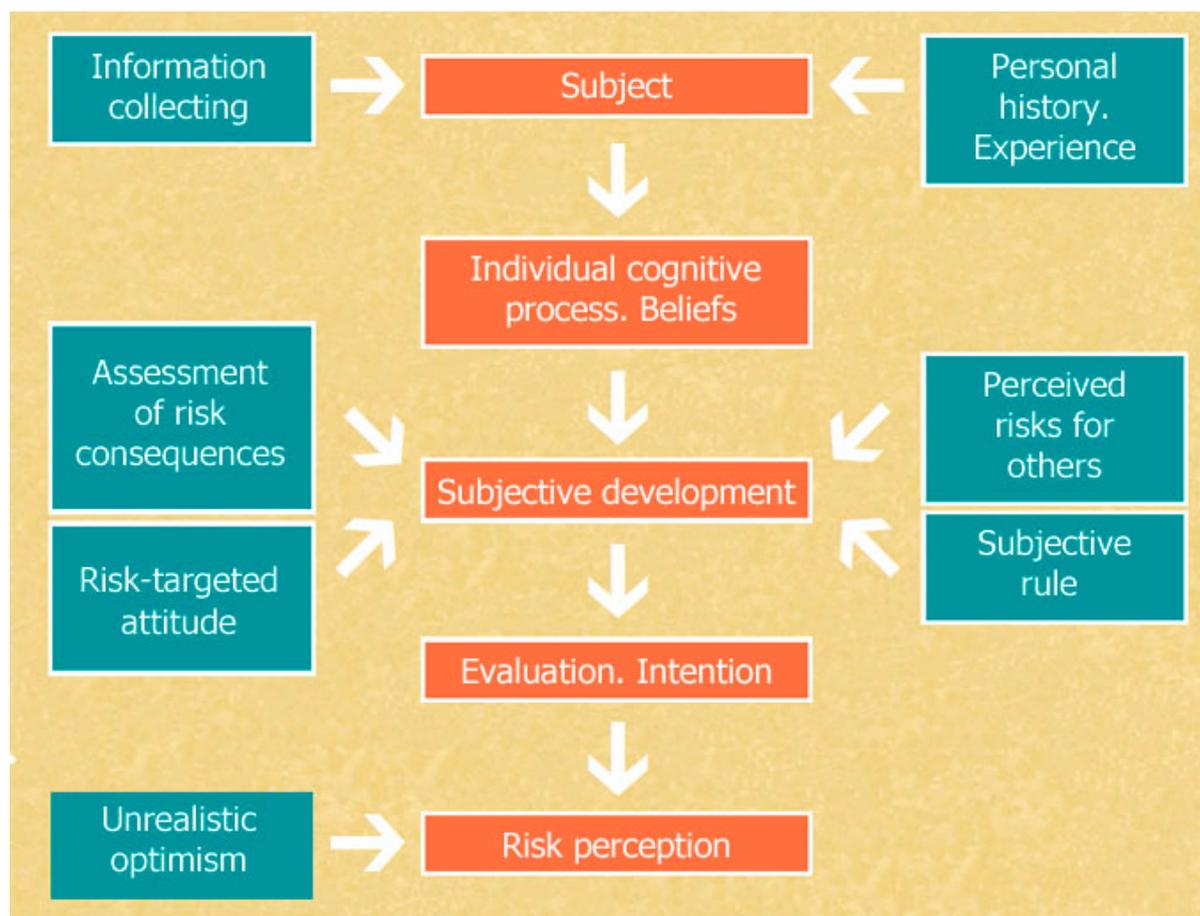
The personal experiences of each particular adolescent are, by definition, unalterable in hindsight, although they can be crosschecked against the experiences of others. In view of this, the shrewdest option would seem to be to concentrate on alterable components of the risk-perception-formation process, such as subjective development or unrealistic optimism. In our case we were particularly interested in two basic aspects: firstly to specify how interaction with elderly people during a set period of time, as an exchange of subjective appreciations and experiences, might be qualitatively different from the adolescents' daily classroom interaction with their teachers. And secondly to

find out if the appreciations of elderly people and teachers in classroom interaction might impinge (and how) on three constructs: namely, perception of the internet- and social-media risk, perception of the alcohol-consumption risk and the attitude to prevention.

García (2012) refers to three theoretical models to tweak the above scheme: the Health Belief Model, the Theory of Reasoned Action and Planned Behaviour, and Protection Motivation Theory. We then find that the Theory of Reasoned Action includes, within its risk-perception configuration, a component that seems very close to the intervention

arrangement proposed by the research project: perceived risks for others (Figure 2).

Figure 2. Configuration of risk perception according to the Theory of Reasoned Action



Source: García, 2012, p. 145

This model allows us to present our planned intervention in this research as follows: the teachers' and elderly persons' perception of risks associated with internet and social-media use, on the one hand, and alcohol consumption inside and outside leisure situations, on the other, could impinge in diverse ways on the adolescents' ongoing subjective perception of these risks.

This project has precisely set out to test the abovementioned working theory in school classrooms. Another aspect under study herein is how a change in the perception of these risks might, in turn, lead to a changing attitude amongst these adolescents about the need to prevent these risks and act accordingly.

Intergenerational strategy in risk prevention

In line with all the above, the hypotheses (H) of this research were formulated as follows:

- **H1:** The adolescents' perception of the risks associated with alcohol consumption - in general and in leisure situations - and the use of internet/social media increases after listening to the perceptions of this same risk by elderly people acting as classroom educators in the framework of a structured educational process.
- **H2:** The increase in risk awareness hypothesised as H1 is greater than that achieved in interaction with the adolescents' daily teachers.
- **H3:** The attitude towards prevention of the alcohol consumption risk - in general and in leisure situations - and the internet/social media risk is more positive in the intervention proposed in H1 than in H2.

Method and Sample

A quantitative quasi-experimental, non-equivalent group strategy was designed with repeat measurement (pretest-posttest comparison) and with a three-tier educational intervention, namely intergenerational intervention with elderly people, non-intergenerational intervention with teachers and non-intervention. At the same time a qualitative approach was also followed. This involved six discussion groups, four of them formed by first-, second- third- and fourth-year secondary pupils who had participated in the H1 working group - with elderly persons acting as classroom monitors - and two groups of elderly volunteers from among those who took part in the research. Each one of these groups was made up by 6-7 participants.

Adolescents' perception of the risk of alcohol consumption or

The data collection questionnaire for the quantitative survey was built up from two instruments vetted in previous work: the questionnaire on adolescents'

the use of social media varies after hearing the opinion of elderly people or teachers and also their attitude towards the prevention thereof

perceptions of social-media and internet use (Rial, Gómez, Braña and Varela, 2014) and the alcohol-attitude assessment scale ASA-RAM (Ramos, 2013). The obligatory pilot-testing of the questionnaire was then followed by internal consistency tests (Cronbach's alpha, calculated for each item as suggested by Tavakol & Dennick, 2011) and discrimination capacity test (Student's t-test of mean scores per item, differentiated for groups of low-medium-high values). A definitive questionnaire was then designed, broken down into four blocks (with

Cronbach's alpha values of 0.7 or higher in the blocks retained after the pilot test).

The fieldwork was carried out from October 2014 to January 2015, consisting of 12 teaching sessions run both by teachers and elderly volunteers in 5 state secondary schools in Andalucía. The answers only of pupils who had taken part in at least 10 of the 12 sessions were then retained for subsequent analysis, since the literature on in-school intergenerational interventions calls for an even longer duration for ascertaining its impact (Morrow-Howell, Jonson-Reid, McCrary, Lee, & Spitznagel, 2009).

After data debugging, the final sample consisted of 381 pupils organized in three groups of equal size (n=127) - to facilitate post hoc two-by-two comparisons - with regard to each one of the three intervention factors. Table 1 gives an overview of the definitive sample.

As Table 1 shows, the tests to check for any initial data differences concluded that only in two cases (school and school year) were distribution differences significant; this is explained by post-hoc data-debugging sample reduction. After carrying out Kolmogorov-Smirnov Z tests of normality, and bearing in mind that a random selection of schools and groups for allocating pupils to the three levels of the factor under study was not possible, it was decided to conduct a nonparametric analysis.

Table 1. Description of the sample (n= 381).

Item	Total	%	Difference Test
Gender			
Male	174	45.8	$\chi^2=5.638$. $p=0.060$
Female	206	54.2	
Age			
12	35	9.3	$\chi^2=1.226$. $p=0.542$
13	117	31	
14	105	27.8	
15	88	23.3	
16	22	5.8	
17	11	27.8	
School			
Pedrera	124	32.5	$\chi^2=67.093$. $p=0.001$
Picasso	16	4.2	
Quiñones	135	35.4	
Trafalgar	106	27.8	
School year			
1 st year secondary.	31	8.1	$\chi^2=116.65$. $p=0.001$
2 nd year secondary.	134	35.2	
3 rd year secondary.	117	30.7	
4 th year secondary.	99	26	
Internet connection frequency			
Daily	300	80	$\chi^2=9.308$. $p=0.676$
Weekly	51	13.6	
Occasional	13	3.5	
Almost never	6	1.6	
Never	5	1.3	
Alcohol intake frequency			

Daily	1	0.0	
Weekly	7	1.9	
Occasional	43	11.5	$\chi^2=5.316$. $p=0.947$
Almost never	95	25.5	
Never	227	60.8	
Street-drinking frequency			
Daily	2	0.6	
Weekly	3	0.8	
Occasional	20	5.6	$\chi^2=10.045$. $p=0.437$
Almost never	53	14.9	
Never	297	78.1	

Quantitative analysis was carried out according to the General Inductive Approach (Thomas, 2003), implying the following steps:

- Preparation of raw data files: responses were computerised for subsequent processing with the software ATLAS.ti 5.0.
- Close reading of text: the text was read in detail by researchers to familiarise themselves with the content and gain an understanding of the themes and details in the text.
- Thematic analysis of frequencies: with the support of the Word Cruncher tool of ATLAS.ti 5.0, a count was made of word frequencies to ascertain the most recurrent themes.
- Creation of categories: each researcher identified and defined categories or themes, bearing in mind that the categories «alcohol consumption», «internet use», «risk perception», «elderly person» and «teacher» had previously been considered and could be understood as the main categories in the study design.
- Continuing revision and refinement of the category system: after completing this process, and as a study validation strategy, researchers crosschecked the category systems - peer review - (Creswell and Miller, 2000; Suárez, del Moral and González, 2013), eliminating those about which there was no agreement.
- Creation of a model of main and secondary categories and their properties. In this stage the categories, subcategories, properties and relations between them were pooled in descriptive or explanatory conceptual networks.

Proof of the hypothesis

The first of the three working hypotheses (H1) has been partially refuted. In the first place, in relation to the adolescents' mooted increase in the perceived internet and social-media dependence risk after classroom contact with elderly volunteers, such an increase was recorded only in the case of neglecting study tasks due to internet use (Table 2).

Table 2. Risk perceptions and internet and social-media use. Increasing perception in the intergenerational group (n= 127).

Item	Wilcoxon (Z)	Sig. (p)	Increase?
(13) I've sometimes lost sleeping hours due to internet use	-0.093	0.926	-
(14) I sometimes connect to internet more than I should	-1.096	0.273	-
(15) I sometimes sulk if I can't connect when I want	-0.988	0.323	-
(16) When I'm connected the time flies by without my noticing	-0.300	0.764	-
(17) I've sometimes neglected study tasks due to internet use	-3.026	0.002	Yes

Nonetheless, although the aforementioned increase (item 17) did not occur in the case of pupils who addressed the matter with their teachers, it did in the control group of pupils (Wilcoxon Z test, -2.428 , $p: 0.015$). We should therefore rule out the intergenerational intervention as the cause of this increase. Nonetheless, there was a significant difference ($\chi^2=16.986$, $p=0.001$) in the post-test responses to item 17, with a higher average range (212.84) in the intergenerational group with elderly people than the group with the teachers (190.17) and the control group (159.52).

Still within the context of H1, if we now pass on to the alcohol consumption risk, in 5 of the 15 items used there was a significant increase in the perception of pupils who worked with the elderly volunteers, as shown in Table 3.

Table 3. Risk perceptions and alcohol. Increase in the perception of the intergenerational group (n= 127).

Item	Wilcoxon (Z)	Sig. (p)	Increase?
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(21) The drinker cannot stop whenever he or she wants	-1.836	0.066	-
(22) Drinking alcohol can lead to bad things	-1.441	0.149	-
(23) Drinking alcohol is less risky than any other drugs	-5.623	0.001	Yes
(24) Alcohol poses a big risk because drinkers can't control it	-1.717	0.086	-
(25) Most people drink and come to no harm	-1.344	0.179	-
(26) If you know your own limits you can drink without problems	-2.638	0.008	Yes
(27) Alcohol and adolescence are an explosive mixture	-1.478	0.139	-
(28) Nobody gets hooked on drugs from drinking alcohol	-1.369	0.171	-
(29) People exaggerate the consequences of weekend drinking	-3.692	0.001	Yes
(210) There always has to be alcohol in any hang-out of friends	-1.709	0.087	-
(211) Even weekend-only drinking can affect your daily life	-1.552	0.121	-
(212) Street drinking affects and annoys many people	-0.695	0.487	-
(213) People exaggerate the bad effects of street drinking on youngsters	-2.667	0.008	Yes
(214) I prefer to drink alcohol so other people think I'm good fun to be with	-1.078	0.281	-
(215) Partying doesn't necessarily mean drinking alcohol	-2.380	0.017	Yes

As regards the 5 items recording a statistically significant increase, complementary analysis shows that none of them varied in the control group and that two of them (23 [Wilcoxon Z test:- 3.846, p: 0.001] and 213 [Wilcoxon Z test:-2.901, p: 0.004]) did increase after pupil sessions with their respective teachers; in the case of item 23 we know that the intergenerational group's recorded perception was significantly higher ($\chi^2=9.741$, $p=0.001$, mean range: 120.74) than that recorded in the pupils of the teacher group (mean range: 97.40). H1 is thereby partially refuted in terms of the alcohol-consumption risk perception.

Moving on now to H2, and with reference to the items where H1 analysis confirmed a change, we believe that our intergenerational strategy -elder volunteers working with secondary school pupils in the classroom - has shown itself in a couple of items to be more powerful than the alternative, i.e., the same pupils discussing the issue with their teachers; it has also been clearly proven that intergenerational intervention with elderly volunteers was significantly more efficient than non-intervention in this matter, given that the pupils' perception of the risks partially increased in 6 of the 15 items studied.

The intergenerational strategy - elderly volunteers working with adolescents in the classroom - has proven to be more effective than the students themselves addressing the issue only with their teachers

The best conclusion in this case is that, in the interests of boosting the perception of risks related to internet and social-media use and alcohol consumption, a choice would have to be made between organising intergenerational activities in the presence of elderly citizens or leaving pupils to address the question themselves with the help of their teachers. The first strategy would be most promising when the only alternative is to do nothing. Only in one case of all those analysed (item 23, $\chi^2=5.835$, $p=0.016$, mean range: 112.20) when speaking about alcohol-consumption risks, did the point of view of pupils who had addressed the issue with their teachers turn out to be

significantly different from the points of view of pupils who had attended no session; nonetheless, the variation in points of view recorded in intergenerational groups - in contrast with control groups - was significant on a greater number of occasions (items 22, 23, 24, 27, 29 and 211).

The qualitative analysis allowed us to delve a little deeper into the reasons why work with elderly volunteers - some of them with past experience of alcohol risks and problems - achieved much higher pupil awareness of the falseness of the claim that alcohol poses less risk than other drugs (item 23). The adolescents themselves distinguished two types of information received in the preventive workshops: firstly referring to contents (information on alcohol consumption, myths, consequences, etc.) and, secondly, referring to past experiences of the problem. Although both types of information are related with the «information collecting» dimension of the theoretical risk-perception configuration model as adopted herein (García, 2012), the information pertaining to past experiences of the problem ties in more closely with the «perceived risk of others» (in this case of the elderly volunteers). It is the second type of information that seemed to make most impression on the adolescents, changing their attitude towards the risk and making a change in their drinking attitude more likely. One of the girl pupils even spoke about her change of behaviour: «1: 162 Girl pupil 3: I don't really drink because people tell me to. I drink because I like it. But truth is... after hearing the elderly people... you know... It's been some time since I've touched a drink. Must be three months or more...».

3: 263 Girl pupil 3: The man told us he would get up and say «today I won't have a drink» and when he turned in... at the end of the day... he would congratulate himself for keeping it up another day. And the other bloke who came

disagreed; he said this was very hard, that he'd been in hospital loads of times, that he'd had many illnesses, that he couldn't kick the habit, and he wanted to try to spend Christmas with his family again, because his family had cut him off; he only went home now to have a shower and then off out into the street again. He was sleeping rough.

Girl pupil 2: It's this that makes you realise what drinking really means. Because you see with your own eyes what it's doing to them.

The fact that the educational agents have actually experienced an alcohol problem - or not - comes across as a necessary but not sufficient condition for raising the adolescents' awareness of the problem, because they also need to see that the lesson has been learned, i.e., the prevention agent needs to show this change of attitude and get across that he or she is there to help the adolescents.

4: 326 Girl pupil 1: Truth is you have to have guts to come out with what they've told us, what's happened to them. Not everyone would do it.

Boy pupil 2: It's really tough.

Girl pupil 1: Many people are ashamed to say things like that, especially in front of us, who might come out with «we couldn't care less», you know?

Boy pupil 2: It's not even shame any more. No one wants to come to that and see themselves like that and now have to spiel it out and others find out.

Boy pupil 1: But they don't really do it for that; they do it to help us.

In short, H2 has also been refuted: with the study results in hand, it cannot really be claimed, barring some exceptions, that the intergenerational intervention has more awareness-raising potential than interaction with teachers.

Lastly, as regards our third hypothesis, Table 4 shows the most salient results of the quantitative analysis on this matter:

Table 4. Prevention attitude. Increase by experimental group (n= 127).

Item	Wilcoxon (Z)	Sig. (p)	Increase? Significant?
Group with elderly volunteer			
(41) Internet and social-media risks need to be forestalled	-3.988	0.001	Yes
(42) Alcohol consumption risks need to be forestalled	-2.142	0.032	Yes
Group with teachers			
(41) Internet and social-media risks need to be forestalled	-0.647	0.517	-
(42) Alcohol consumption risks need to be forestalled	-0.632	0.527	-

The figures of Table 4 show as an initial conclusion that H3 cannot be ruled out. Why? Because we found that pupils who have worked with elderly volunteers are much more conscious of the need for prevention after the intervention (the median value has risen from 7 to 8, out of a maximum of 10); this did not happen with the group that dealt with the prevention issue with their teachers (the median value remained at 8). From this point of view it can be claimed that the intervention proposed in H1 (intergenerational approach) has indeed been more positive than that suggested in H2 (working with teachers).

On the other hand, however, it is no less true that the intergenerational group pupils' prevention attitude differed significantly only from the control group pupils ($\chi^2=17.194$, $p=0.001$, $\eta^2: 0.071$) but not from the pupils who were guided by their own teachers ($\chi^2=2.811$, $p=0.094$). From this latter point of view H3 has to be rejected because there has been no proof of significant differences in the achievements of these two groups in terms of their post-test prevention attitude.

Notwithstanding the above, the qualitative analysis shows a unanimous agreement among respondent teenagers about the usefulness of this workshop arrangement with elderly volunteers as compared with their usual interaction with their teachers. In the drink prevention workshops they can see with their own eyes that the unknown elderly volunteers have suffered the drink problem themselves and want to stop them from making the same mistake. Their teachers, on the other hand, in their eyes, are only carrying out these activities as their professional obligation and lack any in-depth knowledge of the matter, merely passing on stale information; they therefore do not feel that their teachers are really trying to help them. The teachers' risk perception is therefore unlikely to be felt as legitimate and produce any subjective change in the adolescent pupils' attitude towards the alcohol risk.

3: 216 Moderator: What about if it had been your normal teacher saying these same things instead of the elderly volunteer?

Girl pupil 3: I don't reckon I would have taken so much notice as when they told me... (Interruption)

Girl pupil 2: The thing is I see the teacher and he's telling me this and I'm thinking «it's the teacher; it's his job to tell me this», but when I see the elderly volunteer I say to myself «this person has actually experienced this and no one has told him to tell me».

Girl pupil 3: I'm going to level with you. A teacher tells me this and I'm thinking, «but you're a teacher and you're paid to worry your head about these things!», so you don't take it so seriously, right? I don't take any notice and it even tickles me because I think «you know nothing about life». It's just not normal; everyone thinks the same.

Mention must, however, be made of one exception that is crucially important for teachers' in-school prevention work: if pupils perceive and feel that the teacher running the preventive workshop is close to them, keen to help them, then their risk perception is seen as legitimate and, ipso facto, worthy of being taken into account. In other words the habitual teachers' emotional link with their pupils will be the variable bearing the closest relationship with the impact of the preventive actions on the adolescents' attitude.

Finally, in terms of the pupils' readiness to take part in risk-prevention activities to do with internet and social-media use and alcohol consumption, the intergenerational group was found to have a significant high intermediate effect, especially in comparison with the control group ($\chi^2=30.298$, $p=0.001$, $\eta^2: 0.133$) but also with the working group with schoolteachers ($\chi^2=17.100$, $p=0.001$, $\eta^2: 0.075$). The quantitative analysis has shown the readiness to take part in prevention activities changed significantly after the intervention in the group with elderly volunteers (Wilcoxon Z test, $Z: -2.823$, $p: 0.005$); this before-and-after change did not occur in the group with teachers ($Z: -0.273$, $p: 0.785$) or in the control group ($Z: -1.547$, $p: 0.122$).

Main conclusions

On the internet and social-media dependence risk

Under the survey conditions neither the intergenerational intervention (elderly volunteers in the classroom) nor the intervention with teachers managed to produce a significant change in the participating pupils' perception of the internet and social-media dependence risk. Nonetheless this perception was much sharper among the pupils who had been with the elderly volunteers than those who remained with the normal teachers.

On the alcohol consumption risk

The secondary school students involved in 10, 11 or 12 educational sessions with elderly volunteers gained a greater appreciation of alcohol consumption risks, as measured by a change of opinion about the following 5 items: (23) Drinking alcohol is less risky than taking other drugs, (26) If you know your own limits you can drink without problems, (29) People exaggerate the consequences of weekend drinking, (213) People exaggerate the bad effects of street drinking on youngsters, and (215) Partying doesn't necessarily mean drinking alcohol. In 4 of these 5 items (23, 26, 29 and 215) only pupils who had worked with elderly volunteers showed an increase in their risk perception.

In the specific case of item 23 («Drinking alcohol is less risky than taking other drugs»), not only was there an increased perception of the risk but also a significantly higher result in the intergenerational group than in the other two study groups. The qualitative research comes up with an explanation for this: the fact that some elderly volunteers had suffered the alcohol risks themselves was seen as a cogent argument by the secondary school pupils.

On the attitude towards prevention

The intergenerational intervention, with elderly volunteers in the classroom, significantly boosted the participating pupils' positive attitude towards prevention; the same effect was not observed in the working groups with teachers.

On the readiness to participate in prevention activities

As for the readiness to participate in risk-prevention activities to do with internet and social-media use and alcohol consumption, the conclusion can quite firmly be drawn - this time forthrightly backed up by the figures - that the intergenerational option of working with elderly volunteers clearly made the pupils keener to participate in said prevention activities.

On the preferential intervention

In general, as compared with the decision to do nothing about the matter, the option of bringing the secondary school pupils of our sample into contact with elderly volunteers to speak and learn about prevention risks and attitudes (*vis-à-vis* internet use and social media and alcohol consumption) is much more promising than the alternative of working with the pupils' own teachers on the same matter.

Recommendations

Taken as a whole it can be claimed that the results are promising. In what sense? The overall impression gleaned from the quantitative analysis of the data is that an unhampered data collection procedure would in all likelihood have thrown up

sharper differences and advantages in favour of the intergenerational intervention. This at least is the trend suggested by the subsequent analysis. In general, the classroom presence of elderly volunteers has proven to be more significant than the alternative intervention (with teachers) or the option of no intervention at all. We therefore conclude that this line of work is well worth continuing.

After listening to and dialoguing with these volunteers, the pupils not only acknowledged their better perception of some risks but also their conviction that they need to do something about it and their desire to get involved

The tradition of organizing intergenerational mentoring programmes involving minors in risk situations, in general, and with addictions in particular, has been well documented. In our case, and to ensure project feasibility within established conditions, we opted for a brief guidance scheme with a maximum of 12 working sessions. Should future opportunities arise to proceed with this first effort, attempts should be made to randomise the sample as much as possible and, above all, to lengthen the intervention period: the ideal duration would be a complete academic year, in view of the stricter standards indicated by the scientific literature on this matter. Furthermore, combining the group-based work - a group of elderly volunteers *vis-à-vis* a group of pupils - with interpersonal contact - pairing up pupils with elderly tutors in some sessions - might also reinforce the impact.

Another important recommendation has to do with the effect of the intergenerational intervention carried out herein on the secondary pupils' readiness to take preventive action. The careful selection of elderly volunteers with direct, first-hand experience of alcohol consumption risks seems to have made a strong impact on the participating pupils; after listening to and dialoguing with these volunteers, these pupils not only acknowledged their better perception of some risks but also their conviction that they need to do something about it and their desire to get involved. We can only imagine the type of positive change that might be brought about if this diagnosis-centred type of project was fleshed out with some well-designed and systematic prevention activities. For this reason it would be recommendable in the future to try to tie in the risk-perception and prevention-attitude study with the immediate implementation afterwards of a specific prevention education programme.

In fact this last recommendation bears out the project title: inputting direct, first-hand experience seems to be a cogent force of conviction in prevention education. A final caveat, however: to be effective this experience has to come from people perceived by the secondary-school pupils as much older and belonging to a previous generation. This criterion has been recognised as one of the crucial quality standards of the most recent intergenerational learning programmes (Sánchez & Díaz, 2014).

Acknowledgements

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Computer Vision Syndrome: a New Challenge for Prevention

Safety

This epidemiological study was conducted on a sample of 314 people, classified into two groups according to the time of use of devices with backlit screens: users (more than 3 hours) and non-users (less than 3 hours). Given that the effect of these practices on the development of sometimes irreversible eye problems has been established, the conclusions of the study indicate the need for specialists to suggest prevention strategies, such as lighting changes, the adoption of healthy posture habits when using computers, the use of artificial Tears, and the use of glasses and contact lenses that are specially designed and treated to protect the eyes.



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Technological advances have had an impact on almost all aspects of our lives. As a result, a personal computer is now a common element in homes, offices, universities, etc. Access to computers has increased rapidly. For example, in 1997, only 18% of homes in the United States had computers; in 2009, this figure increased to 68.7% (U.S. Census Bureau, no date), and in 2013, 83.8% of homes had at least one computer (File & Ryan, 2014). In recent years, other devices have been added to computer use. These include tablets and smartphones that are characterized, among others, by being lightweight and therefore more portable than computers. All of these devices have a backlit screen. These devices are referred to jointly as *video display terminals* (VDTs).

In addition to computers, people now also continually use other terminals, such as telephones and tablets, which increase eye health problems and the need for their prevention

Computers and associated devices are essential in many aspects of modern academic, professional, and social life. Millions of people including children, students, adolescents, adults and the elderly are using VDTs for several hours a day, many days per year and many years of their lives. These hours of use and exposure have consequences for the visual system, neck, and back. The symptoms most commonly reported by users of these devices are eye strain, tired eyes, headache, irritation, burning sensation, red eyes, double vision, neck pain, and back pain that could be caused by the combination of visual problems,

improper working conditions and/or usage habits (Cole *et al.*, 1996; Collins *et al.*, 1998). The condition of a person who experiences one or more of these eye symptoms as a result of using VDT is known as asthenopia in the field of optometry.

In 1987, Grant *et al.* published reports on the problems of asthenopia related to computer use, but the increasing number of people with these symptoms and the increase in the ease of access to VDTs encouraged the American Optometric Association (AOA, 2014) to study, assess, and diagnose the associated symptomatology in greater depth. According to the AOA, these symptoms jointly constitute Computer Vision Syndrome (CVS). CVS is defined as a group of ocular and visual problems caused by the prolonged use of VDTs (AOA, 2014). Specifically, the symptoms identified by the AOA as associated with CVS are: visual fatigue, headache, blurry vision, dry eyes, and neck/shoulder pain. Other commonly occurring

complaints include irritation, red eyes, or burning eyes. Shantakumari *et al.* (2014) found that women had a 78% greater risk than men of developing headaches related to CVS. Furthermore, stress, anxiety, and computer-related difficulties were associated with combined symptoms of eye strain and tense/neck shoulders. The most commonly reported problem in approximately 40% of subjects studied was tired eyes, followed by dry eyes and/or eye discomfort (Wiholm, *et al.* 2007).

The purpose of this study was to evaluate the effect of using devices with backlit screens on visual fatigue and its symptomatology. For this purpose, the refractive status, signs and symptoms associated with visual fatigue and the accommodation effort were studied in a sample composed of two groups of individuals: VDT users and non-users.

Sample, Materials, and Method

Sample

An epidemiological study was designed in which 314 people participated, classified according to the time of use of devices with backlit screens into users: more than 3 hours/day (n=122) and non-users: less than 3 hours/day (n=192). All participants in the study signed the informed consent following the guidelines of the Declaration of Helsinki, and the personal information collected remained encoded at all times in accordance with the Data Protection Act currently in force. The following parameters were evaluated in the study: (i) refractive status (ii) symptomatology associated with CVS (iii) binocular vision through analysis of phorias, fusion and stereopsis (iv) dynamic visual fatigue.

Materials and Method

To evaluate the refractive status, a complete optometric laboratory was used with the instruments and tests commonly used for this purpose in optical/optometric practice consisting of a phoropter, cross cylinders, pinhole occluder, slit lamp, ophthalmometer, retinoscope, and other optical devices. Once the refractive assessment was completed, each participant in the study filled out a questionnaire on the symptomatology presented when using the VDT, the questions always being asked by the same examiner.

Binocular Balancing Test

The heterophoria assessment test used, based on the Hugonnier dissociation method, consists of a green stripe and a red dot. Using red-green anaglyphs, the independent vision of each eye is attained and the subject is asked to indicate the position of the dot on the stripe. The width of the stripe is one prism diopter. The classification criterion assumed for the binocular balance status was 6 to 10 prism diopters for orthophoria and below or above these values determined the existence of heterophorias. It should be noted that the evaluation was carried out at two distances: intermediate vision (0.66 m) and distance vision (5 m).

Fusion Test

The fusion evaluation was carried out using a red-green test consisting of a red line (right eye), a green line (left eye) and a cross with two triangles (seen by both eyes). The classification criteria used were as follows: when the 2 lines were perceived to be aligned with the cross, this was considered total fusion; when one or both lines could not be seen, this was assessed as a fixation disparity; and suppression was considered when one line was seen, and alternating vision when the individual saw one line first and then the other.

Stereoacuity Test

Two slightly displaced images are presented that, using polarized filters, independently stimulate each retina. Each eye selects the image corresponding to its filter and, upon fusing them, the system perceives the simulated depth. The complete test assesses stereoscopic visual acuity (SVA) in an assessment range from 3000" of arc to 40" of arc. The patient puts on polarized glasses and was shown a card 40 cm away in photopic light conditions. Methodologically it aims to indicate which of the diagrams the patient considers to stand out from the rest of the figures.



Figure 1. Stereoscopic visual acuity (SVA) test

Dynamic visual fatigue Test

Fatigue can be caused by a prolonged accommodation effort or by rapid alternation of accommodations at different distances. This test consists of presenting 4/10 optotypes alternately in distance (5 m) vision and near (0.33 m) vision. It consisted of two different plates of 5 lines with 3 numbers on each. The time interval between each presentation was two seconds. In each presentation, the keyboard displays indicate the numbers of the lines that the evaluator asks the subject to read. The results were classified as normal (10 correct presentations) or accommodative fatigue when mistakes were detected when reading at the same pace.

Results

The descriptive analysis of the sample can be summarized in the following data. 314 subjects were evaluated, 142 men and 172 women who were between 18 and 30 years old. The average age of the sample studied was 22.4 ± 2.8 years.

Sample composition: Gender

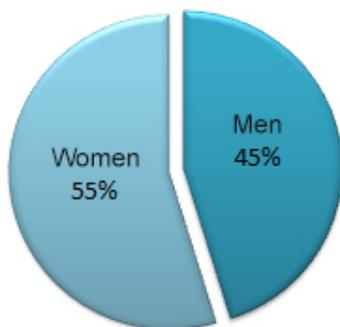


Figure 2. Composition of the sample in terms of gender.

Age

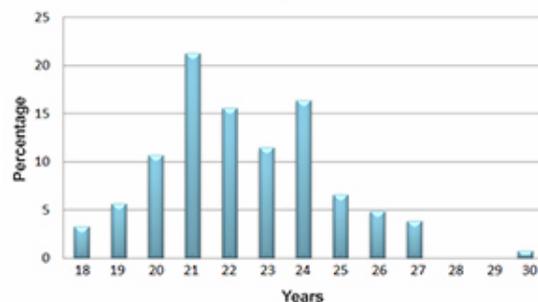


Figure 3. Composition of the sample in terms of the age of participants in the study.

The frequency of use of optical compensation of VDT users as well as the circumstance in which they used glasses are indicated in the following graph 3.

Habitual optical compensation

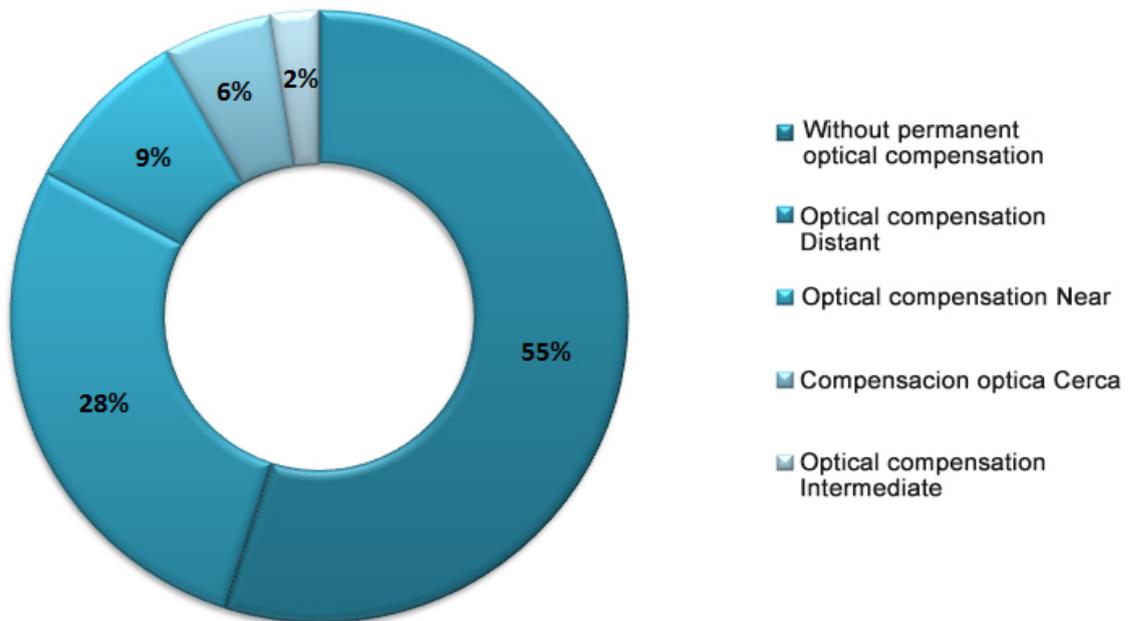


Figure 4. Percentage of people evaluated who used or did not use habitual optical compensation

Analysis of the Refraction Statuses of the Sample

Regarding the analyses of the refraction status of the sample, it should be clarified that the assessment of the refractive statuses was done monocularly, on both eyes, using an objective method (autorefractor). 5 groups were differentiated for analysis of the results: simple myopia and hyperopia, astigmatic myopia and hyperopia and simple astigmatism.

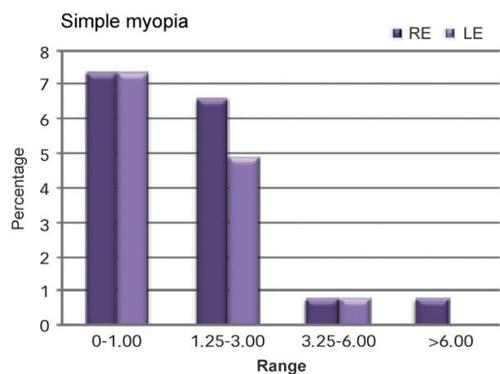


Figure 5. Percentage of eyes (right and left) with simple myopia.

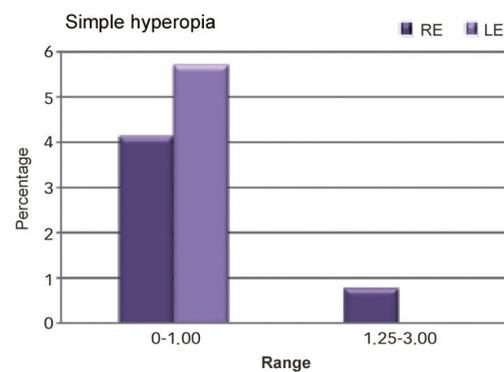


Figure 6. Percentage of eyes (right and left) with simple hyperopia.

In the previous charts, the percentages of eyes with simple myopia and hyperopia are shown. It follows from these charts that around 12% of the eyes evaluated had simple myopia and 6% simple hyperopia. Both ametropias present in different proportions according to the range of classification under consideration.

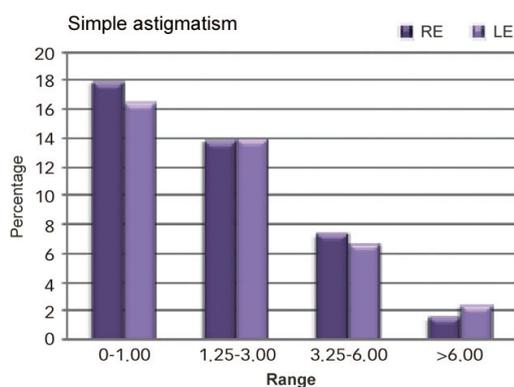


Figure 7. Percentage of eyes (right and left) with myopia and astigmatism

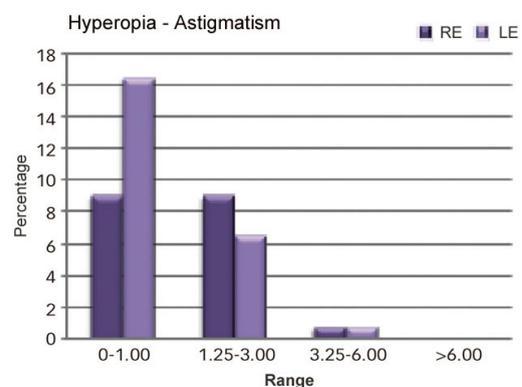


Figure 8. Percentage of eyes (right and left) with hyperopia and astigmatism

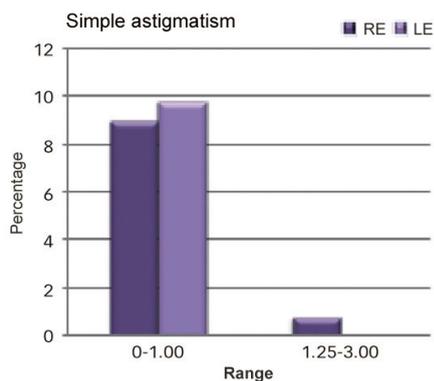


Figure 9. Percentage of eyes (right and left) with simple astigmatism.

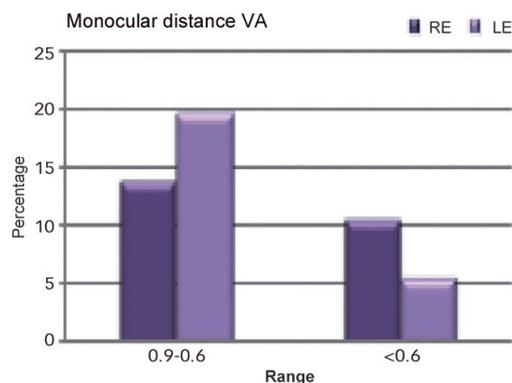


Figure 10. Percentage of eyes (right and left) according to the ranges of visual acuity between 0.6 to 0.9 and less than 0.6.

The three preceding charts show the results obtained for myopia-astigmatism, hyperopia-astigmatism and simple astigmatism. As was expected, for both myopia and hyperopia combined with astigmatism, the percentage of individuals increases regarding simple ametropias.

Analysis of Visual Acuities (Near, Intermediate and Distance)

The results for the analysis of visual capacity diagnosed using a traditional method with maximum contrast optotypes, obtained for both eyes, evaluated monocularly for a long distance and binocularly for three distances, are shown: near (0.33), intermediate (0.66), and distance (5 m). As a classification criterion, visual acuities equal to or greater than 1 in the highest stage were considered. The second value includes visual acuities between 0.6 and 0.9 and finally, in the third group, visual acuities equal to or less than 0.6.

Distance Monocular Visual Acuity

Monocular visual acuity was assessed for both eyes at a long distance.

The results in the entire group show that, for the right eye, 75.8% of the individuals had a visual acuity equal to or greater than 1 with their usual optical compensation while 14.3% had average capacities and 9.9% had deficient visual acuities. Regarding the left eye, visual acuities equal to or greater than 1 were detected in 74.8% of the evaluated individuals, 19.4% in the range from 0.6 to 0.8 and 5.7% with visual acuities less than 0.6.

Distance Binocular Visual Acuity

The binocular visual capacity of the subjects obtained with both eyes for the long distance of 5 meters was evaluated. The results obtained showed 3.5% with binocular visual acuities less than 0.6, 7.3% with visual acuities between 0.6 and 0.9 and 89.2% greater than or equal to 1.

Binocular Visual Acuity for Intermediate Distance

Binocular acuities for intermediate distance showed an improvement in visual capacities when the distance was shorter. The most notable characteristic was the decrease in frequency of deficient visual acuities up to values of 1.6%. Visual acuities between 0.6 and 0.9 were seen in 2.5% of the cases and acuities greater than or equal to 1 were seen in 95.9% of the evaluated individuals.

Near Binocular Visual Acuity

The results were concentrated in high values of visual acuity, and it was observed that 97.1% of the cases presented visual capacity equal to 1 and the remaining 2.9% presented visual acuities in the range between 0.6 and 0.9.

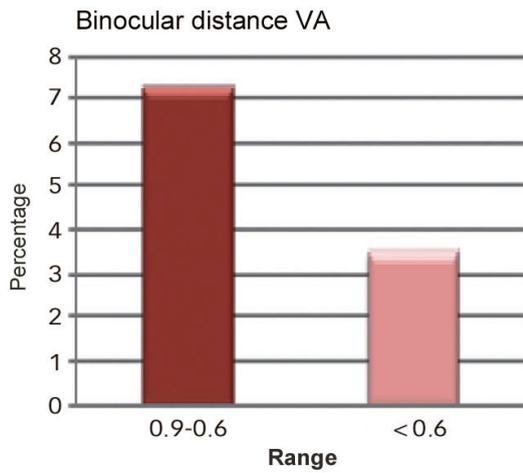


Figure 11. Percentage of distance binocular visual acuity between 0.6 - 0.9 and less than 0.6.

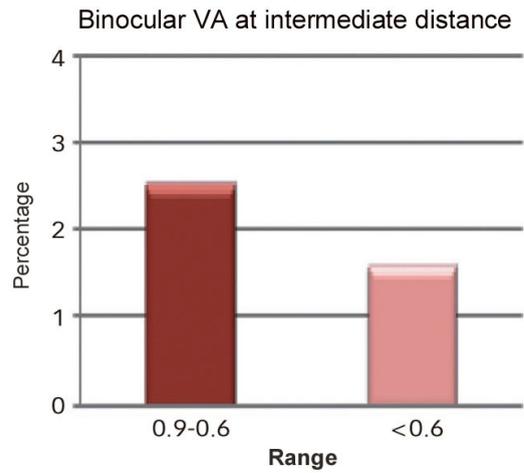


Figure 12. Percentage of binocular visual acuity for intermediate distance between 0.6 - 0.9 and less than 0.6.

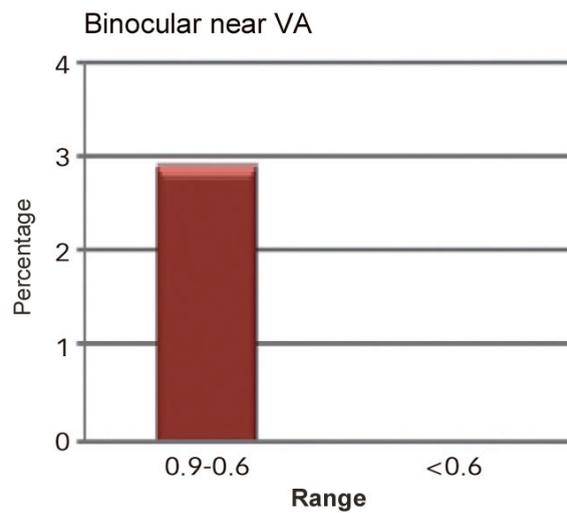


Figure 13. Percentage of near binocular visual acuity ranges between 0.6 - 0.9 and less than 0.6.

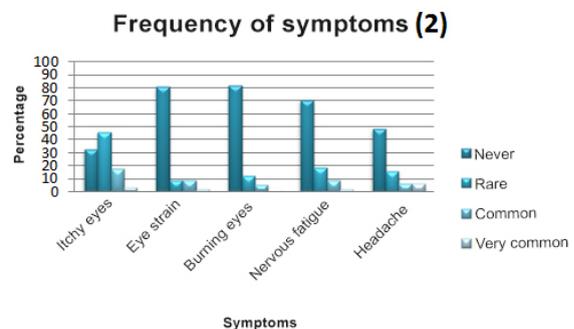
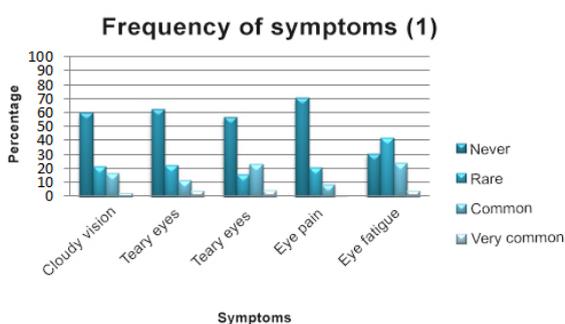
Symptomatology Associated With Using Screens

The results corresponding to the analysis of ocular and visual signs and symptoms related to VDT use will be presented in charts that indicate the presence of signs and symptoms and their intensity. It should be taken into account that the results shown were obtained through a questionnaire in which the analyzed subjects answered questions asked by the evaluator.

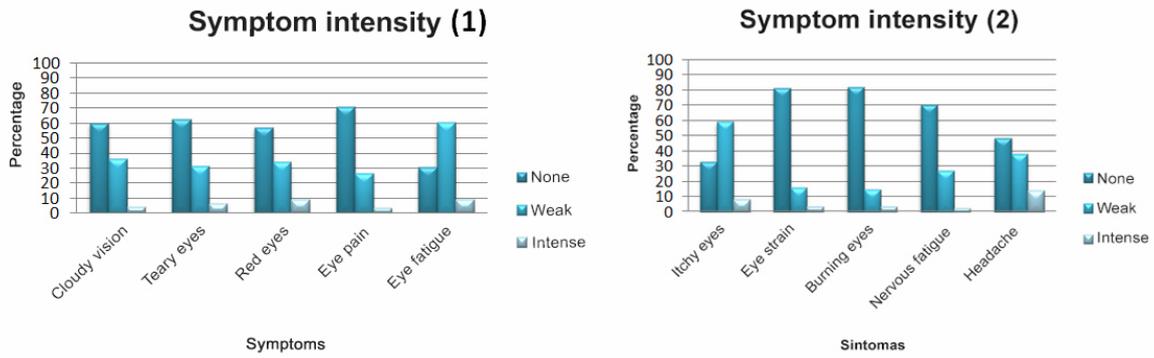
Screen protectors, contact lenses, and eyeglass lenses have been designed, developed, and marketed whose ability to absorb short wavelengths decreases CVS symptoms

In the first two charts, the symptoms are represented with the data corresponding to the frequency of presentation, and the next two charts show the percentages of intensity with which the previously analyzed subjective symptoms were presented.

Regarding the percentages obtained for the different symptoms, eye strain and burning eyes stand out, and are probably related to the accommodation needs of working at close and intermediate distances from screens.



Figures 14 and 15. Frequency of symptomatology associated with the use of device screens (smartphones, tablets, computers).



Figures 16 and 17. Intensity of the symptoms associated with the use of device screens (smartphones, tablets, computers).

Study of the Binocular Balance Status

Distance vision

The values obtained for the entire sample (n=314) corresponded to a frequency of 158 individuals (50.3%) with heterophorias as compared to 156 individuals with orthophorias (49.7%).

In the analysis of the results for each group, the differences were not significant with very similar averages and identical typical deviations of 0.50. Regarding the percentages, in the sample of users, heterophorias were detected in 45.9% of the cases and orthophoria in 54.1%. In the group of non-users, heterophorias were presented in 53.1% of the cases and 46.9% had orthophorias.

Intermediate vision

In the entire sample, values were obtained with a greater frequency of orthophoria (60.2%), followed by exophorias (27.7%) and lastly, endophorias (12.1%). These percentages do not coincide with the individual study of groups in which significant differences with a p-value ≤ 0.001 were seen.

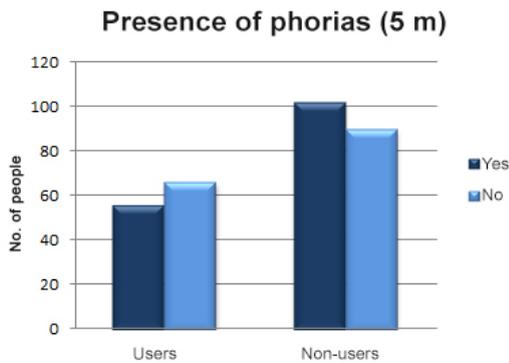


Figure 18. Frequency of individuals with and without phorias, classified according to whether or not they are backlit screen users.

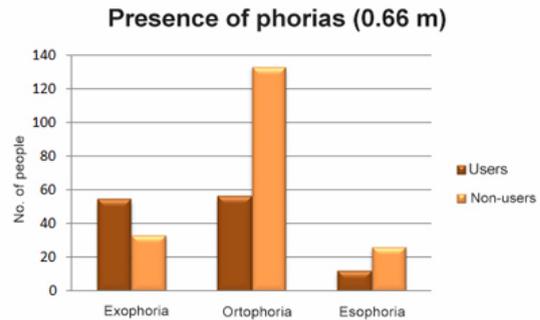


Figure 19. Individuals with exophoria, orthophoria or endophoria, classified according to whether or not they are users of devices with backlit screens.

The variation of frequencies of heterophorias in terms of the study of the entire group stood out. For the group of screen users, 54 individuals were detected with exophoria, 56 with orthophoria and 12 with endophoria, corresponding to 44.3%, 45.9% and 9.8% respectively. For the group of non-user individuals, the values were: 17.2% with exophoria, 69.3% with orthophoria and 13.5% with endophoria.

Fusion Analysis

When comparing the groups, statistically significant differences were obtained, with a p-value ≤ 0.01 . In the total population, 77% (244 individuals) presented an appropriate fusion mechanism while in 22.3% of the cases (70 individuals) this mechanism was deficient.

Regarding the sample that uses devices with screens, 104 individuals (85.2%) presented a good fusion mechanism as compared to 14.8% who had inadequate fusion.

In the sample of non-users, 72.9% presented an appropriate fusion while 27.1% had a deficient mechanism.

Stereoacuity

In this last analyzed variable of binocular vision, no statistically significant differences were found in the total sample. The results obtained for the groups of users and non-users were very similar, being adequate in 85.2% and 85.9% and deficient in 13.9% and 13.0% respectively.

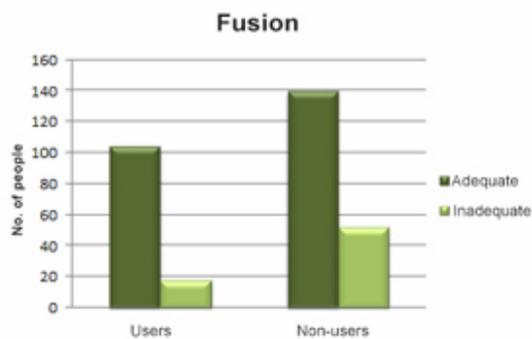


Figure 20. Frequency of individuals with adequate or deficient fusion according to whether or not they are users of devices with backlit screens.

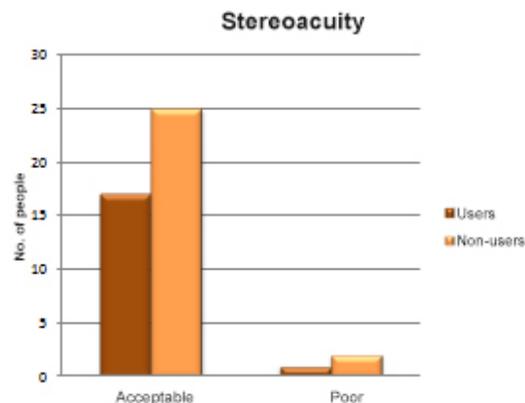


Figure 21. Frequency of individuals with acceptable or deficient stereoacuity according to whether or not they are backlit screen users.

Evaluation of Dynamic Visual Fatigue due to Accommodation Effort

In the test explained in Materials and Method, panels were presented at a close distance and long distance alternately, requiring an extra accommodation effort. The accommodation status in the study population was verified in this way.

The results indicate, without significant differences, a high percentage in both evaluated groups whose error was null; thus, for the total group, 92.4% had an adequate accommodation capacity while 7.6% had errors. Regarding the comparison of the two groups, a value of 94.3% was obtained for user subjects and a figure of 91.1% was obtained for non-users regarding the adequate accommodation levels. This result can be explained by the age range of the members of the sample.

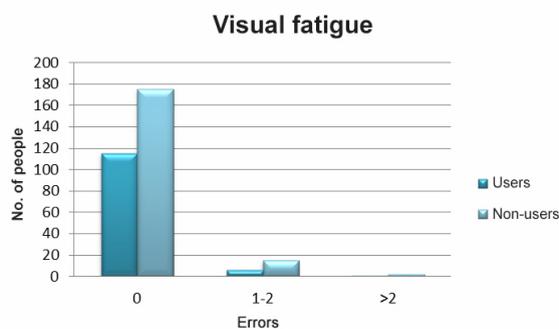


Figure 22. Visual fatigue due to accommodation effort evaluated in users and non-users.

Discussion

As stated in the section Materials and Method, the ametropias in the sample were evaluated in this study, classifying them as simple myopia and hyperopia, myopia and hyperopia combined with astigmatism and simple astigmatism. The purpose of this evaluation was not only to characterize the sample regarding the presence of ametropias but also, which was of significant interest for this work, to evaluate if there were excessive compensations with a spherical equivalent or if, conversely, the astigmatisms were treated as such and used as optical compensation.

The equality between the right and left eyes regarding simple myopia was the first data confirmed from the results, as was the data for individuals with myopias and astigmatisms. The differences were not statistically significant in any case. In this regard, the works of Sanz González Martínez and Muñoz (1994) coincide with the results obtained in this study. The work undertaken by these authors on a population of 103 university students that related the effect of their visual activity to the refraction status shows the inexistence of a refractive difference between both eyes. In the bibliography consulted, many other authors obtained similar results. However, Vázquez (1990), in a study undertaken with a population of younger students, detected a greater number of ametropias, both spherical and cylindrical corresponding to the right eye. In the results, he clarified that these are more abundant in myopic values. The analysis of hyperopia in the studied population focused from the same point of view as myopia and, like ametropia, significant differences were not found in the total population or for each specific sample.

The degree of detected ametropias is moderate, i.e. we found a high percentage of anomalies classified as mild. The result is similar to that obtained by Múelenaere (1970) in his research to determine the prevalence of composition ametropias (more than 6.00 diopters) in which he concludes that they only affect 3% of the general population.

Headache, eye strain, dryness, burning, feeling of grittiness, stiff shoulders, back pain, and general fatigue are the

Moreover in the doctoral thesis published in 2015 by González, different publications were analyzed to determine if VDT users have long-term alterations in visual function variables such as refraction, amplitude of accommodation (AA) or lateral phoria. In his document, some studies such as those mentioned below

symptoms associated with intensive VDT use

are notable: firstly, the study published by Yeow (2013) who refers to data make it possible to relate the increase in myopia to the use of vision at close distances for long periods of time. In this regard, Yeow *et al.* published, in 1991, a two-year longitudinal study on a cohort of 243 subjects (178 cases: VDT users + 65 controls: non-VDT users) which describes changes depending on the initial refractive status of the participants with myopias who were under 30 years old with an increase of 0.12 D. Along the same line, Kinge *et al.* monitored the development of myopias over 3 years in a group of 224 Norwegian university students who experienced a significant myopization with an average value of 0.51 D. In contrast to the previous studies, the study presented by Rechichi and Scullica (1996) in which they evaluated the refractive status of 23,000 VDT users and non-users in two phases, with an interval of four years between both, stands out. In this study, the authors did not find significant differences in the development of refractive status between both analyzed groups. It should be clarified that this study was undertaken 20 years ago and that VDTs were not the same and were not used as frequently as they are now.

In populations similar to ours (university students), there are European and American studies that analyze the refractive status leading to widely varying results (Parnell, 1951; Midlefart *et al.*, 1992).

Regarding binocular VA and computer use, there are noteworthy studies in which specific tools for visual analysis of VDT users (distance 0.66 m) are designed and they relate them to visual symptoms. Finally, with respect to visual acuity at near distance, the results presented in this study are very positive, even better than those obtained at intermediate distance. Accordingly, the good status visual acuity is confirmed in general in college students who make up the study population. It is also noteworthy that visual acuity improves on bringing the fixation point closer; this statement does not contradict the refraction defects detected, as most of these were due to simple myopic errors or errors associated with astigmatism, ametropia in which an approximation of the near point occurs.

Recommendation for easing eye fatigue: someone using video display terminals (VDTs) for 20 minutes should look at a distant object (six meters) for 20 seconds

In this regard, the study published by Yeow *et al.* evaluated the development of the amplitude of accommodation over two years, detecting a widening distance from the near point of accommodation among VDT users compared to non-users, although this difference was only significant in subjects aged under forty. The values obtained in the study presented in this paper show that, even considering the start of the decline in accommodative capacity from the age of 20, a very high accommodative reserve remains in the 20-30 age range. Furthermore, the degree of the ametropies detected is mild, allowing for an acceptable visual

capacity at different distances.

Regarding the presence of heterophorias, the results presented are consistent with those obtained by Serra *et al.*, where the presence of exophorias is verified in regular computer users. In this regard, it is important to highlight the extensive epidemiological study published by Von Noorden and Burian comprising 739 computer users and 126 control subjects in whom different aspects of binocular vision were studied, such as the presence of examined heterophorias and near and far distances and their relation to ocular discomfort. The authors found an increased presence of exophorias followed by esophoria in VDT users. Also they found signs of possible relationships between exophoria and CVS.

An attempt was made to determine, in general terms, the amount of time on average that users must spend in front of the screen before the signs and symptoms of visual fatigue increase significantly. The data item of highest quality in this regard comes from a cross-sectional study conducted in Japan on a sample of more than 25,000 workers, among whom a significant increase in the prevalence of eye strain occurred once length of use exceeded five hours (Nakazawa, 2006). However, when it comes to designing and interpreting studies on this issue, more than the time of daily use should be considered, because recent studies on risk factors associated with the use of VDT have indicated the effect of the amount of time spent staring at a screen without breaks on the increase in ocular and visual symptoms, (Porcar-Izquierdo, 2013; Toomingas, 2014).

Also of note is a study published in 2008 by Fenga, which documented a high prevalence (74.3%) of Meibomian gland dysfunction among a group of seventy VDT users. Although the high proportion of subjects with this dysfunction was subsequently attributed to peculiarities of the sample studied, the study published by Reddy in 2013 recommended the use of artificial tears for rehydrating the ocular surface, as they help maintain tear volume while decreasing symptoms of eye fatigue, dryness and difficulty with concentration, and therefore assist in improving visual acuity.

Health professionals, and especially vision specialists, must explain the risks of overexposure to light emitted by VDTs and the associated symptoms

Elaborating on the latter study, the prevalence of symptoms related to CVS in the study published by Reddy, *et al.* in 2013, was 89.9%, of which asthenopia was 16.4%. Studies from other countries have also reported on the frequency of asthenopia in VDT users, and these results are as follows: 31.9% from Italy (Mocci *et al.*, 1996), 46.3% from India (Bhandari *et al.*, 2008), 68.5% from Spain (Sánchez - Romano *et al.*, 1996). As can be seen, there is enormous variability in the results, which is attributed to aspects such as the composition of the sample, the geographical distribution and number of hours and the type of tasks

performed using VDTs.

As referred by Blehm *et al.*, CVS is a common problem, to such an extent that it was considered the most common health problem among VDT users. An increase in symptoms was reported: headache, eye strain, dryness, burning, feeling of grittiness, stiff shoulders, back pain and general fatigue as daily periods of VDT use increased (Acosta *et al.*, 1999;

Nakazawa *et al.*, 2006). Table 1 below contains a list of studies showing the frequency of the two most common symptoms reported by VDT users.

Table 1. Frequency of the two most common symptoms reported in computer users. Taken from Reddy, 2014.

Author and year	The two most common symptoms are:	
	First	Second
Shrestha <i>et al</i> (2011)	Headache (13.3%)	Tired eyes (21.5%)
Edema & Akwukwuma (2010)	Tired eyes (62.5%)	Blurry vision (59.4%)
Megwas & Daguboshim (2009)	Headache (41.7%)	Eye pain (31.5%)
Bali <i>et al</i> (2007)	Visual fatigue (97.8%)	Headache (82.1%)
Singh <i>et al</i> (2007)	Burning eyes (31%)	Tired eyes (25%)
Smith <i>et al</i> (1981)	Visual fatigue (91%)	Neck and shoulder pain or stiffness (81%)
Reddy <i>et al</i> (2014)	Headache (19.7%)	Visual fatigue (16.4%)

It is of particular interest to consider the time spent working in front of VDTs, since classical studies indicate that this is directly related to ocular symptoms; in addition, the longer the period of use, the greater the duration of symptoms, even after the work is finished (Bergqvist and Knave, 1994; Sanchez-Roman *et al.*, 1996).

There is a major controversy regarding the number of hours of use for symptoms to appear. Back in 1996 in the U.S.A. Mutti and Zadnik reported that 75% of VDT users who worked several hours in front of a screen complained of visual symptoms. In the study by Reddy *et al.* (2014), the continuous use of VDTs for more than two continuous hours was significantly associated with the appearance of CVS symptoms. However, Porcar-Izquierdo (2013) concluded that the presence of symptoms associated to CVS are usually mild and transient and decrease after a period of rest. In this sense, Mclean *et al.* (2001) suggest that taking small, regular breaks can relieve the accommodation process, thus preventing eye strain. Breaks during the use of VDTs was the most common preventive measure taken by users to relieve CVS symptoms, using the 20/20/20 rule, as Anshel (2005) suggests. The rule, which could still be recommended, is that the person stare at a distant object 20 feet away for 20 seconds after 20 minutes of VDT use.

Other noteworthy recommendations published to relieve symptoms include the best optical compensation for ametropies and visual problems using glasses or contact lenses to reduce visual fatigue (Sheedy *et al.*, 2000). Notably, in the last decade, contact lenses and eyeglass lenses have been designed, developed, and marketed whose ability to absorb short wavelengths decreases CVS symptoms and also protects the various ocular structures, including the retina, from the damage that this radiation may cause. Regarding the lighting level of both the screen and the room, as referenced in the article by Sheedy *et al.*, 2005, the level of lighting must be regulated, and the average luminance of the screen must not exceed three times the luminance of ambient lighting. In this regard, there have been important technological advances regarding screen backlighting in which LED light sources have been included (with a high ratio of violet and blue light) that significantly increases the energy emitted by the backlit screen. To counter CVS symptoms and possible damage to the macula or the acceleration of cataract formation, recently manufactured screen protectors are proposed which are applied to the surface of VDT screens to block the highest energy light spectrums by absorption without lowering color resolution (see www.reticare.com; www.certificadocsr.com).

Conclusion

The impact of abusing sight in front of the screens of electronic device is scientifically proven. Damage may be mild and reversible, or even serious and irreversible. The increase in conjunctivitis, blepharitis, keratitis, cataracts, and retinopathy is a major public health problem. Preventive medicine can and must address the problems arising from any habit that affects people's health. In this sense, children, adolescents, particularly sensitive people, and the elderly are the populations at greatest risk.

Health professionals, and especially vision professionals, must inform the public about the risks of overexposure to light emitted by VDTs and symptoms associated with the use of these devices. Furthermore, vision specialists must suggest CVS prevention strategies to users, such as lighting changes, positioning knowledge, use of artificial tears, and the existence of new prevention products such as specially treated contact lenses and glasses, and screen protectors.

Other tips such as staring at distant objects, taking breaks, and positioning the screen below eye level can help reduce the symptoms. Furthermore, it is important to use short-wavelength filters to protect the eyes from the highest-energy radiation emitted by VDTs.

The prevention of (reversible) CVS and possible (irreversible) retinal damage must be included in primary healthcare plans, as it is a universal habit whose damage may be exacerbated by increased life expectancy, among other factors. Public awareness of the risks associated with the use of backlit VDT screens must be increased since it is a new event of significant impact.

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Obesity, Physical Activity and Lower Back Pain: a genetically informative analysis

Health Promotion

Low back pain is one of the leading causes of disability. In Spain it affects 20.5 percent of the population over 15 years and is responsible for 12.5 percent of sick leave. In addition to the discomfort and suffering caused to millions of people, its economic cost is estimated at 160 million euros. This study, conducted on a sample of 1631 individuals registered as twins, seeks to establish the relationship between the variables of physical activity, Body Mass Index (BMI) and physical inactivity with the risk of having suffered back pain at some point, as well as determine whether such a relationship is maintained as genetic and environmental factors are shared.



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Lower back pain is one of the main causes of disability worldwide^[1] and has an important impact on the physical, social, psychological and economic spheres of people's lives^[2]. This impact also extends to their environment and society as a whole. Based on a 2011-2012 National Health Survey, in Spain 20.5 percent of people older than 15 admit to have suffered lower back pain during the last twelve months^[3], a proportion that seems to have stabilized in recent years^[4]. Between the years 2000 and 2004, this problem represented 12.5 percent of all lost work days and its average estimated cost per lost work day during this period was more than 160 million Euros per year^[5]. On the other hand, although the rate of recovery is 75 percent after 6 weeks, frequent relapses occur (where 33 percent result in lost work days)^[6, 7]. As a whole, given the magnitude and the extent of its implications, the identification of the causes of this problem as well as the preventive and effective rehabilitation strategies become especially relevant. However, the risk factors involved in lower back pain are not fully defined^[8] and currently, no decisive evidence exists regarding the efficiency of the preventive measures^[9].

Both obesity and low levels of physical activity have been

Obesity as well as physical activity have been considered possible factors affecting lower back pain, so the presence of obesity as well as lower physical activity have been associated, although not conclusively, to an increased risk of

linked, although inconclusively, with an increase in the risk of experiencing lumbar pain

developing this condition^[10-13]. In turn, Body Mass Index (BMI) and physical activity are clearly related^[14-18] and in fact, a relationship has been suggested between the genetic ability to lose weight by exercising and the adherence to regular exercise^[19] or an interaction between low physical activity and the FTO gene to increase the risk of obesity^[20]. Since obesity and physical activity are

modifiable factors, the nature of their association with lower back pain is especially of interest due to their role as possible preventive alternatives^[21] (references).

Several recent publications report the significant heritability of the phenotype, and state that genetic makeup accounts for between 30% and 67% of the individual differences observed in lumbar pain

Obesity is considered a pandemic^[22] and is a growing public health problem^[23], and also seems to be associated with different musculoskeletal disorders such as lower back pain^[10]. However, its association with this problem continues to be controversial^[8, 24, 25]. For example, while some studies have demonstrated that obesity increases the prevalence of chronic^[11, 26] and recurrent^[26] lower back pain and a relationship has been identified between BMI and lower back pain^[10, 11], other studies have not been able to observe an association between them^[27-29]. On the other hand, in a study of twins with controls^[26], the positive association between BMI and lower back pain that was found in the general

cohort analysis disappeared when identical or monozygotic twins with different body weights were studied, which suggests that genetics could influence and confuse this relationship. Therefore the relationship between obesity and lower back pain is still not clear^[25, 30].

In turn, different studies have analyzed the relationship between physical activity and lower back pain with contradictory results^[12, 13, 21] and there is still no evidence regarding up to what point different types of physical activity may cause or prevent this problem^[31]. For example, while some studies associate intense physical activity with a low prevalence of lower back pain^[21, 32]; others have found that sedentary behavior as well as highly intense physical activity increases the risk^[33].

Studies on twins, in which the genetic factor can be controlled, can explain the real influence of modifiable environmental factors on lumbar pain

One of the possible explanations to this disparity in the results when associating obesity and physical exercise with lower back pain may be found in the impact of the genetic factors in these relationships. In reality, environmental as well as genetic factors seem to be associated with the occurrence of lower back pain^[24]. Several recent publications note a significant heritability in this phenotype^[24, 34-37]. In accordance with these studies, the variations in our different genetic constitution would explain between 30 percent and 67 percent of the individual

differences observed in lower back pain, where the effect of the genetic factor is greater in chronic and incapacitating pathologies than in acute episodes^[24]. Likewise, we have observed that the genetic factors that affect this problem are common to other related phenotypes such as the degeneration of the lumbar disc^[34]. A large number of studies have been conducted from a genetically informative point of view, which have researched further into the association of lower back pain with socio-demographic factors, occupational workload, being dissatisfied with life and personality variables^[36, 38-41].

In the same way, obesity as well as physical activity demonstrate genetic influences in the occurrence of lower back pain. Studies of twins have consistently found a significant contribution of genetic factors in the changes in BMI and related traits, in both sexes and in all ages. Currently a mean heritability of BMI near 70 percent is estimated with a range based on the sample between 50 percent and 90 percent^[42-44]. This distribution remains constant in different countries and cultures^[43, 45, 46]. Likewise, exercising also seems to have genetic influences^[19, 47, 48] and in fact, a recently conducted genome-wide association study (GWAS) concluded that physical exercise is probably influenced by multiple genes^[47].

Given the relevant contribution of genetic factors to the variance observed for lower back pain as well as obesity or physical activity, the use of designs that allow controlling the effect of said factors is especially interesting. Studies using twins where the genetic effect can be controlled may contribute to clarifying the relationships between these variables and determine the real impact of modifiable environmental factors regarding lower back pain.

In this study, our aim was to study the relationship between BMI and different levels of physical activity with lower back pain in a sample using twins. Particularly, the objective consisted in conducting a case-control study using twins with differences regarding the studied condition. In other words, pairs where only one of the members is experiencing lower back pain. Given the perfect pairing by gender, age and family environment, to which we add the control of the genetic factors in the case of monozygotic twins, this type of study provides evident advantages for controlling confusing variables^[49] and determining the effect of the studied variables.

Material and method

Design, subjects and procedures

A cross-sectional study using a co-twin case-control design was carried out. The subjects were taken from the Registro de Gemelos de Murcia / Murcia Twin Registry (RGM is the Spanish acronym). This is a population-based registry of twins comprised of adults born from multiple births between 1940 and 1966, and residing in the Region of Murcia. The RGM is a joint initiative lead by the University of Murcia and the Health Department of the Autonomous Community. Information about the characteristics of the RGM and its development are described in another publication.^[50] Participation in the Registry is voluntary and subject to consent. The Registry procedures have been approved by the Ethics Committee of the University of Murcia.

The data used in this study was obtained in 2013 through telephone interviews. The sample for this study includes a total of 1,613 individuals participating in the registry, which were grouped in different zygosity categories (Table 1). Women represented 55.1% percent of the participants and the average age of the sample was 56.7 (SD: 7.1) years, without any significant differences noted between genders.

Table 1. Characteristics of the sample, prevalence of lower back pain and BMI; by gender and total

	Men	Women	Total		
General sample					
n (percent)	725 (44.9)	888(55.1)	1,613 (100)		
Age [mean, (DE)]	56.4 (6.9)	56.9 (7.3)	56.7 (7.1)		
Zygoty (Subjects) [n, (percent)]					
MZ	225 (31.0)	341 (38.4)	566 (35.0)		
DZ (Same gender)	261 (36.0)	309 (34.8)	570 (35.4)		
DZ-OG	239 (33.0)	238 (26.8)	477 (29.6)		
Prevalence of lower back pain [n, (percent)]	211 (29.1)	323 (36.4)	534 (33.1)		
BMI [media, (SD)]	27.8 (3.9)	26.6 (4.6)	27.2 (4.3)		
Case-control					
Discordant pairs for lower back pain					
	MZM	DZM	MZF	DZF	DZ-OG
n (percent)	38 (36.5)	49 (41.9)	49 (31.9)	63 (45.0)	99 (46.9)
Age [mean, (SD)]	54.0 (6.0)	56.3 (7.6)	55.6 (6.8)	58.1 (7.6)	57.5 (6.2)

BMI: Body Mass Index; **SD:** Standard Deviation; **MZ:** Monozygotic; **DZ:** Dizygotic; **MZF:** Monozygotic female; **MZM:** Monozygotic male; **DZF:** Dizygotic female; **DZM:** Dizygotic male; **DZ-OG:** Dizygotic opposite gender.

Determining the zygosity

The zygosity was assessed by means of a 12-point questionnaire focused on specific anthropometric characteristics and the physical similarity of the pair. This questionnaire was previously validated and its results properly correspond to the zygosity determined by the DNA analysis, reaching a concordance above 95 percent^[50].

Instruments and measurements

The interview was based on an epidemiological type questionnaire that among other things included aspects related with back pain, anthropometric data and physical activity. The prevalence of lower back pain was assessed by means of two questions taken from the National Health Survey^[51] asking if they have ever experienced lower back pain in their lives and if they required medical attention. It was defined as presence of lower back pain at some time when a positive response was given to both questions. On the other hand, the height and weight were provided by the subjects and the BMI was calculated by dividing the body weight of the individuals in kilograms by the square of their height in meters. Regarding physical activity, a questionnaire was used that was based on the International Physical Activity Questionnaire (IPAQ)^[52] which included measuring the frequency with which mild physical activity is practiced (i.e., walking for at least 10 continuous minutes), moderate (i.e., moderate physical activity for at least 10 minutes such as a relaxing swim or playing golf) and intense physical activity (i.e., physical activity that causes rapid breathing or gasping for at least 10 minutes) as well as time dedicated weekly to each one of these activities. Additionally, a sedentary lifestyle measurement was considered, implemented as time spent sitting down during a workday. Measuring of the frequency of physical activity was recorded as the number of times per week. The duration measurements were recorded in minutes and subsequently, given their concentration around specific points corresponding to hours, they were transformed into 11 time groups (from less than 1 hour up to more than 10 hours). In the case of sedentary lifestyle, the duration is grouped into four levels (less than 3 hours; between 3-6 hours; between 6-10 hours; more than 10 hours).

Statistical analysis

The analysis was carried out in two stages: analysis of the general sample and cases and controls study. All the variables, except gender, were used as continuous variables. To analyze the general sample we studied the association between BMI and the physical activity measurements (in other words, weekly frequency and duration of mild, moderate and intense physical activity and sedentary lifestyle) and the prevalence of lower back pain, including all participants regardless of the type of pair; if the pair was complete or incomplete, or the similarity of the lower back pain. Gender was included as a possible confusion factor. The effects of the predictor variables were calculated using Generalized Estimation Equations using a rough estimator. This method takes into account the structure that is dependent on family data so that all the members of each family can be included in the study. Gender was considered a factor while all the rest of the predictors were included as covariates.

The sample on which the study

Subsequently, for the purpose of controlling the possible confusing effect of the genetic factors and the family or shared environment, a case and controls study

was conducted included 1,613 individuals of different categories of zygosity, 55.1% of whom were female and the average age of whom was 56.7 years

was conducted using only pairs of twins of the same gender, complete and discordant for lower back pain (both twins had answered the questionnaire and only one of them mentioned having experienced lower back pain on some occasion), using the same statistical procedure. Gender and age were not taken into account since there was a perfect pairing in both variables. Additionally, separate studies were conducted for monozygotic (MZ) and dizygotic (DZ) pairs of twins. In these types of designs, when the magnitude of the association between two variables (for example BMI and lower back pain) sequentially

decreases between the analysis of the general sample (not adjusted for genetic factors or early shared environment) and the case and control studies of DZ pairs (adjusted for early shared environment) and MZ pairs (adjusted for genetic factors and shared environment), the relationship between the two variables would be indirect and mediated by confusion factors. By the contrary, the maintaining of the association in the case-control studies would be a solid indicator of a possible direct causal pathway^[49]. The data analysis was carried out using statistical software SPSS v.19.

Results

Characteristics of the sample

Detailed information about the characteristics of the sample are listed in Table 1. The prevalence of lower back pain in the total sample was 33.1 percent, with a greater presence in women (36.4 percent) than in men (29.1 percent). No significant differences in the prevalence by zygosity was found ($p < .05$).

The mean BMI of the sample was 27.2 (SD: 4.3), being significantly higher in males (F: 26.4; $p < .001$). In this case, no significant differences were observed by zygosity between individuals of the same gender.

The physical activity that is carried out is listed in Table 2. The average frequency of the mild activity was 3.7 times per week and was practiced an average of 6.5 hours per week. The frequency of the moderate activity did not reach once per week although those that practiced it, did so for 8.5 hours a week. Regarding intense physical activity, the frequency was also less than once per week with an average duration of less than 7 hours. On a normal workday, the participants in the study spent an average of 4.5 hours sitting down. In all cases except the frequency of engaging in mild physical activity, which did not show any differences by gender, males presented significantly higher values of frequency [Moderate (F: 33.3; $p < .001$); Intense (F: 110.1; $p < .001$)] as well as duration [Mild (F: 6.4; $p < .01$); Moderate (F: 26.6; $p < .001$); Intense (F: 9.8; $p < .01$)]. Likewise, males spent more hours sitting down during a workday (F: 61.7; $p < .001$). Also in this case we did not observe any significant differences by zygosity in individuals of the same gender except for a tendency in males of mixed pairs to spend more time sitting down (F: 4.8; $p < .01$).

Table 2. Frequency and duration of mild, moderate and intense physical activity and time sitting down during a normal work day. Total and by gender

	Men		Women		Total	
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)
Walking (Times/week)	716	3.7 (4.3)	883	3.7 (3.6)	1,599	3.7 (3.9)
Walking (Hours/week)	471	7.2 (9.5)	553	5.9 (5.1)	1,024	6.5 (7.5)
Moderate activity (Times/week)	699	0.7 (1.8)	883	0.3 (1.2)	1,582	0.5 (1.5)
Moderate activity (Hours/week)	109	11.5 (12.0)	70	3.7 (5.1)	179	8.5 (10.6)
Intense activity (Times/week)	708	1.2 (2.2)	882	0.3 (1.1)	1,590	0.7 (1.7)
Intense activity (Hours/week)	218	7.6 (9.2)	84	4.2 (5.9)	302	6.7 (8.6)
Time spent sitting down (Hours/day)	710	5.2 (3.3)	871	4.0 (2.5)	1,581	4.5 (2.9)

Analysis of the general sample

Differentiated analyses by gender showed that the risk of experiencing lumbar pain was greater at a lower age in men, while the opposite was true for women

Table 3 lists the results obtained in the analysis of the general sample as it relates to the object being studied. As was expected, gender showed a relevant association with lower back pain. Age on the other hand did not have any effect on this condition in the total sample. Therefore, the analyses conducted afterwards were adjusted by gender. In the case of the total sample, a high BMI, low frequencies of moderate and intense physical activity and a sedentary lifestyle showed to be significantly associated to a higher risk of suffering lower back pain. The duration of the activity did not have any effect on lower back

pain regardless of the type of activity that was carried out.

Table 3. Analysis of the general sample (Total and by gender). Estimate of the effect on lower back pain and confidence interval 95 percent for demographic, anthropometric (BMI) and physical activity variables.

n	B	CI 95 percent	p
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Gender				
General sample	1,605	0.367	0.148, 0.585	0.001
Age				
General sample	1,605	0	-0.02, 0.02	0.990
Men	722	-0.037	-0.06, -0.01	0.002
Women	888	0.023	0.01, 0.04	0.021
BMI				
General sample	1,482	0.030	0.00, 0.06	0.027
Men	705	0.008	-0.03, 0.05	0.707
Women	777	0.038	0.01, 0.07	0.037
Walking (Times/week)				
General sample	1,593	-0.018	-0.05, 0.01	0.203
Men	713	-0.018	-0.06, 0.02	0.400
Women	880	-0.019	-0.06, 0.02	0.370
Walking (Minutes/week)				
General sample	1,019	-0.023	-0.07, 0.02	0.296
Men	468	-0.042	-0.11, 0.02	0.185
Women	551	0.006	-0.05, 0.07	0.850
Moderate activity (Times/week)				
General sample	1,576	-0.078	-0.15, -0.01	0.045
Men	696	-0.085	-0.19, 0.02	0.114
Women	880	-0.062	-0.17, 0.05	0.268
Moderate activity (Minutes/week)				
General sample	179	-0.036	-0.15, 0.08	0.525
Men	109	-0.049	-0.19, 0.09	0.491
Women	70	-0.157	-0.47, 0.16	0.330
Intense activity (Times/week)				
General sample	1,584	-0.073	-0.14, -0.01	0.044
Men	705	-0.065	-0.15, 0.02	0.122
Women	879	-0.083	-0.22, 0.06	0.239
Intense activity (Minutes/week)				
General sample	301	-0.021	-0.10, 0.06	0.625
Men	217	-0.013	-0.09, 0.11	0.800
Women	84	-0.010	-0.01, 0.01	0.255
Time spent sitting down (Per day)				
General sample	1,575	0.160	0.02, 0.30	0.026
Men	707	0.230	0.04, 0.42	0.016
Women	868	0.051	-0.15, 0.26	0.628

Note: The models of the total sample are adjusted by gender. The models for the samples of men and women are adjusted by age.

Given the important effect of gender, we decided to carry out this same analysis independently for men and women. In this case, age showed to have a significant effect, although in the opposite direction for each gender. Thus, a younger age increased the risk of suffering lower back pain in males while for women, the risk increases, as they get older. For this reason the rest of the predictor variables were adjusted for age. The subsequent analyses limited the effect of a sedentary lifestyle in men and BMI in women.

Case and control study

A total of 199 complete and discordant pairs of twins were studied in the case and control studies. As would be expected, the discordance occurred with less frequency in MZ pairs of twins (Table 1). The conducted analyses showed that none of the variables that had shown to have an effect on the general sample had a significant effect when the sample was analyzed as a pair (Table 4). Regardless of the sub-sample that was used, the BMI as well as the variables of physical activity or sedentary lifestyle lost their statistical significance.

Table 4. Case-control study. Main effects of the covariates with a significant influence in the analysis of the general sample

	Waldx ²	gl	p
Discordant pairs (n = 199)			
BMI	0.027	1	0.870
Moderate activity (Times/Week)	0.533	1	0.466
Intense activity (Times/Week)	0.007	1	0.932
Time spent sitting down (Per day)	0.308	1	0.579
Discordant Dz pairs (n = 112)			
BMI	0.563	1	0.453
Moderate activity (Times/Week)	0.103	1	0.749
Intense activity (Times/Week)	0.081	1	0.776
Time spent sitting down (Per day)	0.183	1	0.669
Discordant MZ pairs (n = 87)			
BMI	1.71	1	0.191
Moderate activity (Times/Week)	0.612	1	0.434
Intense activity (Times/Week)	0.200	1	0.655
Time spent sitting down (Per day)	1.63	1	0.202
Male Discordant pairs (n = 87)			
Time spent sitting down (Per day)	0.018	1	0.892
Male DZ discordant pairs (n = 49)			
Time spent sitting down (Per day)	0.019	1	0.892
Male MZ discordant pairs (n = 39)			
Time spent sitting down (Per day)	0.101	1	0.750
Female discordant pairs (n = 112)			
BMI	0.014	1	0.906
Female discordant DZ pairs (n = 63)			
BMI	0.535	1	0.464
Female discordant MZ pairs (n = 49)			
BMI	1.19	1	0.273

Discussion

The object of this study was to analyze, in a genetically informative model, the possible relationship between anthropometric variables (BMI), physical activity (mild, moderate and intense) and a sedentary lifestyle, with the risk of having suffered lower back pain on some occasion. This way we expected to determine if an association existed between these variables and if said association was maintained after the genetic and shared environmental factors were controlled.

The results indicated that relationships exist between the considered predictor variables and the risk of suffering lower back pain. Thus, a higher BMI, spending hours sitting down and engaging in moderate or intense physical activity with less frequency are related with a greater risk of suffering lower back pain. On the other hand, the analyses also suggest that all these relationships are mitigated by genetic and shared environmental factors. None of the associations found in the analysis of the general sample maintained the significance in the case-control study, where the pairing of twins controls the effect of said factors. These results are in consonance with a prior study which also found a positive association between BMI and lower back pain in the general cohort analysis; this association disappeared when the case-control study was

conducted using MZ twins, which suggests that genetic factors could affect and confuse this relationship^[26] Similarly, the inconsistency of the results found with respect to the association that exists between a sedentary lifestyle and physical activity (moderate as well as intense) with lower back pain suggest that this association is not direct; instead, it is affected by other factors.

The fact that lumbar pain is influenced by genetic factors suggests that individual characteristics should be considered in research and interventions in order to resolve it

This study also provides other results worth mentioning. This way we have found a higher prevalence of lower back pain in women than in males, which is normal in the literature^[40, 53-56] but also, we have found a different pattern as far as the influences of predictor variables by gender. This way while in women the BMI was related with the risk of suffering lower back pain, in males this risk was associated with a sedentary lifestyle and a very low frequency of engaging in physical activity. Moreover, age also seemed to have a differentiated impact. While older age entailed an increased risk in women, in males it had the opposite effect. Until now, different explanations have been offered for this

higher prevalence of lower back pain in women but the reason for this is still not clear. Some authors have suggested that women may be more prone to report feeling pain^[40], feeling pain for longer periods^[40], seeking medical attention more often^[57], or are more prone to suffering pain^[58, 59] than males. Our data suggests another possible explanation. It is possible that males and females represent specific sub-groups of patients with lower back pain and which, due to their body constitution and lifestyles, require a differentiated analysis, at least in this age group. For example, the distribution of body fat is different in adult women and men, where being overweight could cause a greater impact in some people than in others. On the other hand, the type of job and the intensity with which a sport is practiced also differ by genders, which could explain part of the differences that are found.

Men and women can represent specific subgroups of lumbar pain patients that require different analyses due to their physical characteristics and lifestyles

Another relevant question is one related with the effect that physical activity and a sedentary lifestyle have on lower back pain. In our study, although a protective effect seemed to exist between the frequency of moderate and intense physical activity and lower back pain, this association was not strong enough for it to be maintained in the analysis by gender. As mentioned above, it did not have a significant effect in the case-control study. On the other hand, the number of hours per week engaged in physical activity was irrelevant. In the case of a sedentary lifestyle, the risk of suffering lower back pain increased as

the person spent more hours sitting down during the day but only in males. This condition implies a complex and possibly reciprocal relationship between physical activity and lower back pain with non-generalized effects and important changes based on the characteristics of the subject. This would also explain the results found by other authors. For example, De la Cruz *et al.*^[21], found that the total amount of normal physical activity does not seem to have an effect on back pain. However, subjects that had experienced back pain during the past 12 months, had more frequently engaged in a low or moderate activity pattern. Other authors found that intense physical activity had a preventive effect^[32], while others found that a sedentary lifestyle as well as intense activity were associated with the risk of developing lower back pain^[33]. In other words, the literature provides contradictory evidence regarding what type and degree of physical activity may cause or prevent lower back pain^[31], which is consistent with the noted explanatory model, according to which different types and degrees of activity would have different effects based on the characteristics of the individual. Worth adding to this is that the discrepancies can also be a result of the different definitions and categories used for lower back pain as well as for physical activity.

This study presents certain limitations that must be taken into account when interpreting the results. First of all, the definition used for lower back pain is basic and does not include information about the different degrees, frequencies of appearance, origin of the episode or functional impact, which could contribute to grouping cases with different characteristics in the same category. On the other hand, the information obtained regarding lower back pain as well as the predictors that were taken into account were self-reported. It is known that the frequency as well as the duration of the physical activity as well as the weight and height can be over-estimated (e.g. height) or under-estimated (e.g. weight)^[33, 60]. Additionally, our study uses a cross-sectional model that limits the possibility of identifying the causal relationships between variables^[33]. This design prevents accurately determining if for example, the sedentary lifestyle is what causes a higher risk for suffering lower back pain or if it is the presence of this pain what generates a higher possibility of spending more time sitting down. Any of these interpretations would be plausible in light of the current literature^[61-63]. However, we believe that our study provides valuable information for understanding the individual differences regarding the prevalence of lower back pain, with important practical implications for preventing and rehabilitating this condition.

In summary, while the literature provides many different strategies for handling cases after an episode of lower back pain^[64, 65], it offers a limited evidence regarding the strategies for preventing these episodes from occurring. Given the important impact of lower back pain on the individual and on their environment, its functional effects and the consequences it has on peoples jobs and income, having information available on preventive strategies and rehabilitation is especially relevant. The current lack of clear evidence regarding the effectiveness of these type of interventions may be attributed to a certain lack of knowledge on the causal factors that are responsible for lower back pain^[66]. The conclusions of this study, although far from answering the questions that exist, may contribute to gaining a more in depth knowledge of these aspects. Thus, our results suggest a greater relevance of the frequency of physical activity than the duration of the activity, provides information on the role of moderate or intense physical activity and points to the avoidance of a

sedentary lifestyle and excess weight as areas that should be further explored due to their potential for preventing lower back pain. Also, our study suggests the need to take the individual (e.g. age) as well as group (e.g. gender) characteristics into account instead of assuming that any strategy and with any intensity should have the same preventive or rehabilitating impact on all persons. Finally, our study also suggests that we should take into account the role played by genetic factors on the analyzed associations. The fact that lower back pain as well as BMI or engaging in physical activity are influenced by these types of factors leads us to consider the weight of individual characteristics and the interest in conducting further research on personalized interventions.

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