Night noise and sleep in Spain

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ABSTRACT

Around 48 % of the complaints presented before the administration in Spain are related to noise produced by leisure activities at nighttime. In this paper the situation of night noise in Spain during the last 20 years is analyzed. Noise levels and social surveys from 100 towns of different size (with populations between 6,000 and several millions) have been reviewed from 1989 until 2010. In practically all the measurement points close to places with leisure activities, night noise levels were well above the 55 dBA recommended by local and national authorities, which should lead to sleep problems. Different studies show that between 20-60 % of the population affected by night noise have difficulties in falling asleep, awakenings during the night, etc. The most disturbing noise source at night is people in the streets, followed by the music emitted by discos and pubs.

INTRODUCTION

Night noise has become an increasingly important problem in Spain over the last 30 years. Several factors are involved in this process. First, the increase in night clubs, discos and bars in practically all the small, medium and large size towns, together with an increase in the number of people going out at night. Second, closing times were not enforced in most cases, making for an endless night that went right into the next morning. The night leisure industry has grown to become a powerful social agent lobbying for keeping their present status, even if they do not comply with local regulations. In the last years, another way of going out at night has become very popular in Spain, the gathering in the open air of thousands of people to drink and party. In the rural areas, there has been also an increase in the traditional dancing parties in the outside that take place during local festivities, with bands playing with powerful equipments, accompanied by the use of loud fireworks. All the open air activities used to be associated with warm weather and summer, but now they can take place during any time of the year, including nights of bad weather. Social tolerance has lead to the idea that this is something that cannot be fought with the present regulations, since people have the right to enjoy themselves without any restriction during the night time. This tolerance contrasts with the impact of these activities on the population: around 48 % of the complaints presented before the administration in Spain are related to noise produced by leisure activities at night time (Goyenechea & Ortiz 2010). Information about the social effect of night noise in Spain can be consulted in the website ("http://www.ruidos.org/").

In this paper the situation of outdoor night noise in Spain during the last 20 years is analyzed. First we shall review the acoustic data available. We shall differentiate between studies of a general type, in which there is no specification of any particular noise source; studies in which acoustic data from areas with night leisure activities are compared with data from areas for which the main noise source is traffic; and studies where data from noisy nights (generally weekend nights with numerous people going to discos and pubs) are compared to data from quiet nights (generally the rest of the weekend). Second, the impact of night noise on the population is

analyzed. We shall review the opinions of the people about the most disturbing night noise sources and the problems caused by noise on sleep, namely difficulties in falling asleep and awakenings during the night.

METHOD

We shall review the different strategies for analyzing night noise data.

Noise measurements and indexes

There is a wide choice of strategies to characterize night noise and its impact on the population. In most cases the recommended 55 dBA value for L_{Aeq} has been adopted by local regulations as the outdoors night noise limit. The duration of the measurements varies a great deal among studies, from 5 minutes to a whole night, or even several nights. The way to present the acoustic data can be roughly divided into two strategies: a) In studies where measurements took place in specific places (selected for having a particularly dominant noise source, such as night leisure activities or traffic), L_{Aeq} or even L_{Amax} are usually the choice indexes; b) In studies where measurement points were randomly selected (using grids, etc.) the percent of points with L_{Aeq} values above 55 dBA are presented. The first approach allows us to know the noise levels affecting people. The second approach is sometimes turned into a percent of people or a percent of town surface, and different levels are added (like percents over different noise levels, etc.). The method used to calculate the percent of people affected is unclear.

Social surveys

The methodologies used to assess the reaction of people are based on social surveys conducted in different ways. In some cases the interest is focused on which is the most disturbing source of night noise. The usual choices are music and people on the streets, but traffic should also be included, although it actually appears only in one study. Other studies try to find out the percent of people affected by night noise, although there is no specification of the way in which people are affected or disturbed. Only in a reduced set of studies the influence on sleep is considered, with data related to the difficulties in falling asleep or to awakenings during the night. Only in one study the percent of people receiving medical attention due to the problems caused by night noise is considered. The way people were selected for the social surveys is unclear in some cases, and the data produced is not easily comparable among all the studies.

RESULTS

Acoustic data (unspecified source)

Table 1 presents mean L_{Aeq} levels and the percent of points surpassing 55 dBA in studies which were not focused on the effect of a particular noise source. Each study is identified by its initials and the year of publication. In one case data correspond to range variations (i.e. GA89; Romero et al. 1989); in other cases the standard deviation is included (CV98; Garrigues & Garcia 1998; AN01a; AN01b; Arriaga et al. 2001). The case AN01a corresponds to the review of data from 18 towns of more than 50,000 inhabitants, while AN01b corresponds to the review of data from 44 towns with a population between 20,000-50,000 inhabitants.

Table 1: L_{Aeq} levels and the percent of points exceeding 55 dBA

	GA89	GA06	EIB92	CV98	AN01a	AN01b	HU08	VLL10	LE08
L_{Aeq} (dB)	67-70			60±8.6	60±1.7	60±2.4	58.5		
>55 dBA		60 %	100 %		77.9 %	80.5 %	72.7 %	14 %	26 %

Acoustic data of specific sources (night leisure activities and traffic)

Table 2 presents the ranges of L_{Aeq} and L_{Amax} values encountered in two studies dealing with the differences between areas where the predominant noise source is related to night leisure activities and areas where the predominant source is traffic.

Table 2: L_{Aeq} and L_{Amax} values in areas where the predominant noise source is related to night leisure activities and areas where the predominant source is traffic

	L_{Aeq}dBA		L_{AMax} dBA	
	Leisure	Traffic	Leisure	Traffic
VA96	53.1-62.8	67.5-71.7	72.6-77.3	85.1-96.4
AV99	65.9	46.9-60.3		

Acoustic data from specific days of the week (noisy and quiet nights)

Table 3 presents data obtained in the same points considering two different periods during the week: one with leisure activities working at full capacity (generally weekends, but in some places, like university towns, starting Wednesday or Thursday); and one with those activities closed (generally Mondays or some other day of the week). We shall henceforth call the first one "noisy night" and the second one "quiet night". The studies which were particularly focused on areas with night leisure activities are presented in boldface. The study VA94a presents average data from 8 small towns from Valencia together with 7 streets of the same city, while VA94b presents data only from those 7 streets (Gimenez et al. 1994). The study SC09 (Feijoo 2009) presents two different data in each box, the first one corresponding to data from an area with leisure activities but without traffic, and the second one corresponding to an area with both noise sources.

Table 3: L_{Aeq} levels and the percent of points exceeding 55 dBA during noisy and quiet nights

	L_{Aeq}dBA		>55 dBA	
	Quiet night	Noisy night	Quiet night	Noisy night
VA94a	**60**	**76**		
VA94b	**65**	**75**		
CO95			**70 %**	**87 %**
ALQ98	**58-72**	**69-78.4**		
MAD00			38.4 %	86.4 %
VLL03			52 %	85 %
BIL03			49 %	56 %
CLE03			22 %	31 %
SC09	**54±5 ; 60±2**	**62±5 ; 66±3**		
OR04	**55.6**	**61.2**		

Social surveys: effects on sleep

Table 4 shows the percent of people whose sleep was perturbed by night noise. This includes the percent of people having difficulties in falling asleep or being awoken during the night. Only in one study the percent of people receiving medical attention due to sleep problems caused by noise is considered. Again, the studies which were

particularly focused on areas with night leisure activities are presented in boldface. The study VA96 (Guijarro et al. 1996) is divided in two parts: data obtained in a place with traffic as the predominant noise source (VA96a), and data obtained in a place packed with leisure activities. The study SC09 is divided in three parts, the first one (SC09a) corresponding to a general survey of people living in areas packed with night leisure activities; the second and third one corresponding to answers given by people living in the particular homes where noise measurements were performed, either during quiet or noisy nights (referring to their sleep problems during that specific night).

Table 4: Percent of people with their sleep affected by night noise, including difficulties in falling asleep, awakenings during the night and those that had to receive medical attention.

	% Affected	% Difficulties	% Awakenings	% Medical Att.
GA89			28-36 %	
ZA91	50 %			
VA96a		33 %	22 %	
VA96b		**58 %**	**42 %**	
VLL03a	21-46 %	22-44 %		
BIL07	13.9 %	43.4 %		
SC09a		**85 %**		**31.2 %**
SC09(Quiet)		0 %	4 %	
SC09(Noisy)		**40 %**	**56 %**	

Social surveys: opinions of the people about the noise source

Table 5 shows the percent of people that consider a particular night noise source to be the most disturbing at night. The studies which were particularly focused on areas with night leisure activities are presented in boldface.

Table 5: Percent of people that consider a particular night noise source to be the most disturbing

	GA89	ZA91	**ALQ98**	**LE08**	CLE03	**SCQ09**
Music	32 %	18 %	**12 %**	**11 %**	20 %	**39 %**
People			**68 %**	**46.4 %**		**55 %**
Traffic						**6 %**

Evolution of the problem along the years

Despite all the studies carried out since 1989, in only one of them (concerning 18 towns of more than 50000 inhabitants, Arriaga et al. 2001) there is information about noise levels during different periods: during 1992-93, average L_{night} was 60.2±2 dBA, and during the period 1995-98 it was 60±1.7 dBA. Data from every town in that study show a similar trend, with little variations in levels between both periods. In other places where studies were carried out along several years (i.e. Leon, between 2000 & 2008; Cepeda et al. 2008) the use of different methodologies in each one of them prevents us from following the evolution in either levels or in the response of people before noise.

DISCUSSION

According to the acoustic data gathered over the years, night noise levels in Spain are usually above the 55 dBA recommended by local noise ordinances. Although it is not conclusive, the presence of night leisure activities means an increase in levels with respect to other areas, and certainly an increase in those same areas compared to nights with the activities closed. For these areas, an average increase between 4-15 dBA can be expected during noisy nights. It is difficult, though, to determine the percentage of people affected by those levels. The percent of measurement points with levels above 55 dBA ranges from 14 % to 100 % in studies with an unspecified noise source, while in places with night activities it ranges from 22 % to 70 % (quiet nights) and from 31 % to 87 % (noisy nights). There is an increase in the number of points with levels higher than 55 dBA during noisy nights, between 7 % and 48 %. This increase in noise levels affects not only the places with nightlife, but also other areas, probably through an increase in both traffic and in people walking in the streets going from one place to the other. Nevertheless, it is not easy to calculate the number of people affected using only the acoustic data, since the effect will depend on the floor where each dwelling is located, its situation with respect to the most exposed facade, the situation of the bedroom inside the house, the number of people inside, the acoustic insulation of the building, etc.

The sleep of between 14-50 % of the population of several cities (higher than 300,000 inhabitants) seems to be affected by night noise (unspecified source). In two of these cities the percent of people that have difficulties in falling asleep lies between 22-43 % (Guijarro et al. 1996; Martin et al. 2003). Data from a popular summer holiday resort show that 28 % of the population is awoken often or vey often by noise (Romero et al. 1989). The rest of the data comes from studies on the effect of nightlife activities and the percents given usually refer to people living in the specific area analyzed. Between 58-85 % of the people living in nightlife areas have difficulties in falling asleep during noisy nights, while in areas with traffic as the main source the percentage goes down to 33 %. In one of those studies a 30 % of the interviewed people declared to be receiving medical attention due to insomnia or nervous breakdown caused by noise (Feijoo 2009). The social surveys data show that the most disturbing noise source is people in the streets at night, followed by the music emitted by discos and pubs. It is unclear the effect of traffic, since only in one study it is included as a specific option for night noise. We can draw some conclusions, though, from studies VA96 and SC03. In the first one measured noise levels are higher in a place for which the main source is traffic than in a place where the main source is related to nightlife activities (Guijarro et al. 1996). The sleep of people is however affected in the opposite way: 33 % have difficulties in falling asleep (traffic) vs 58 % (night life); and 22 % are awoken by noise during the night (traffic) vs 42 % (night life). In the second one, people were interviewed in the next morning after measuring levels (Feijoo 2009). During quiet nights, with traffic as the main source, there was only a 4 % that manifested being awoken by noise and nobody had problems to get asleep. During noisy nights 40 % had troubles falling asleep and 56 % were awoken by noise.

CONCLUSIONS

Night noise is an important source of problems in Spain. Levels higher than 55 dBA in the outside are commonplace, with both traffic and nightlife activities as the main

sources. Nightlife activities contribute to aggravate the situation, weekend nights being particularly problematic, with increases in both noise levels and in the spread of those levels. As a result, sleep quality is seriously affected. Whenever data about sleep problems is available, it shows that a good percentage of the people affected by noise (roughly between 20-60 %) are likely to develop insomnia and some of them will probably have to receive medical attention.

REFERENCES

Arriaga JM, Flores P, Dominguez PF, Casado M (2001) Estudio de la contaminación ambiental acústica en Andalucia. In: Proceedings of Tecniacustica.

Cepeda J, Garcia E, Fuentes M et al. (2008). Evolucion de los niveles sonoros en zonas acústicamente saturadas (ZAS) del casco urbano de Leon (España). In: Proceedings of Tecniacustica.

Feijoo S (2009). Reactions to night noise due to leisure activities. In: Proceedings of EURONOISE.

Garrigues JV, Garcia A (1998). Analisis estadístico de los niveles de contaminación sonora medidos en diferentes zonas urbanas a lo largo de las 24 horas del dia. Revista de Acustica 29: 13-20.

Gimenez A, Sanchis A, Sancho S (1994). Ruido ambiental producido por actividades nocturnas de ocio en Valencia y en diferentes poblaciones de la provincia. In: Proceedings of Tecniacustica.

Goyenechea CM, Ortiz JMC (2010). Creencias ambientales y coste social del ruido de ocio. Revista de Acustica 36: 11-19.

Guijarro D, Llorens D, Rodrigo D et al. (1996). Efectos del ruido ambiental sobre el sueño de los residentes en zonas urbanas. In: Proceedings of Tecniacustica.

Martin MA, Tarrero AI, Rodriguez T et al. (2003). Estudio psicosocial de la molestia ocasionada por el ruido en la población de Valladolid. Analisis de los resultados. In: Proceedings of Tecniacustica.

Romero J, Garcia A, Garcia AM (1989). Noise survey in a holiday beach resort. In: Proceedings of the 8º Symposium FASE 89: 125-128.