Aircraft noise and annoyance in the populations living near the Ciampino airport in Rome

C. Ancona[1], F. Mataloni[1], C. Badaloni[1], F. Forastiere on behalf of the SERA Study Team[2]

[1] Department of Epidemiology, Lazio Regional Health Service, Via S. Costanza, 53, 00198 Rome, Italy, ancona@asplazio.it

[2] Members of the SERA study Team: Aiello C, Ancona C, Ancona L, Badaloni C, Fabozzi T, Fano V, Forastiere F, Imperatore A, Marciano C, Mataloni F, Messineo A, Perucci CA , Salatino C, Zirro E

INTRODUCTION

Airport traffic noise has been increasing in recent years in Ciampino (Rome) because of the large rise in low cost flights. Since 2000 passenger traffic has been rising from about 830,000 passengers in 2000 to about 5,300,000 passengers in 2007 (about 6,000 flights a month). This increase, mainly due to low-cost flights, has produced concerns in citizens and the health authorities were asked to evaluate the possible health effects due to residential proximity to the airport.

Several studies have shown that aircraft noise is associated with health effects (Babisch 2006; van Kempen et al. 2002), in particular with the increase in blood pressure and a higher frequency of cardiovascular disease, (Haralabidis et al. 2008; Rosenlund et al. 2001; Matsui et al. 2004; Eriksson et al. 2007). Evidence from the HYENA study (HYpertension and Exposure to Noise near Airports, (Jarup et al. 2008)), suggests that aircraft noise exposure increases the risk of hypertension and that night-time aircraft noise is associated with high blood pressure (Haralabidis et al. 2008). The HYENA results were confirmed by the SERA study (Studio sugli Effetti del Rumore Aeroportuale – Study on the Effect of Aircraft Noise), conducted among residents around the airport of Ciampino, which had indicated the presence of a strong association between exposure to aircraft noise and blood pressure (Ancona et al. 2010). Annoyance due to noise represents one of the most investigated outcomes in environmental epidemiology (Miedema & Vos 2003; Miedema 2004). The HYENA study analyzed annoyance during both day and night, considering 6 major European airports. The study showed clear exposure-response relationships between the noise level and the noise annoyance for both exposures (Babisch et al. 2009). In a recent study was demonstrated that annoyance of residents at a given aircraft noise exposure level increases over the years noise sensitivity influences general noise and aircraft noise annoyance (Schreckenberg et al. 2010), while background noise level is one of the important factors on the estimation of community annoyance from aircraft noise exposure (Lim et al. 2008).

The objective of this study was to evaluate the association between aircraft noise and annoyance in people living close to the Ciampino airport in Rome.

METHODS

We studied a randomly selected sample of 1,200 subjects aged 45-70 years who have lived in the study area for at least 5 years. Noise annoyance due to aircraft and road traffic noise were assessed via a face-to-face interview using the 11-point ICBEN scale. Aircraft noise maps were defined (three noise levels, $L_{aeq,24h}$ <60, 60-65, and 65-75 dB) using the Integrated Noise Model proposed by the USA Federal Aviation Administration. We linked each participant's address to the aircraft noise con-

tours using a Geographic Information System. As a proxy for road traffic noise, we calculated morning (outside the rush hour) traffic volume (number of vehicles per hour <100; 100-400; >400). Within the $L_{aeq,24h}$ <60 area we then divided residents in highly urbanized and in suburban based on the volume of traffic recorded. The effects of airport noise on annoyance were analyzed through regression models adjusted for personal characteristics and road traffic volume.

RESULTS

The SERA study participation rate was 50 %, resulting in a study population of 597 participants. Figure 1 shows the participants location on the study area in relation to the different levels of airport noise exposure.

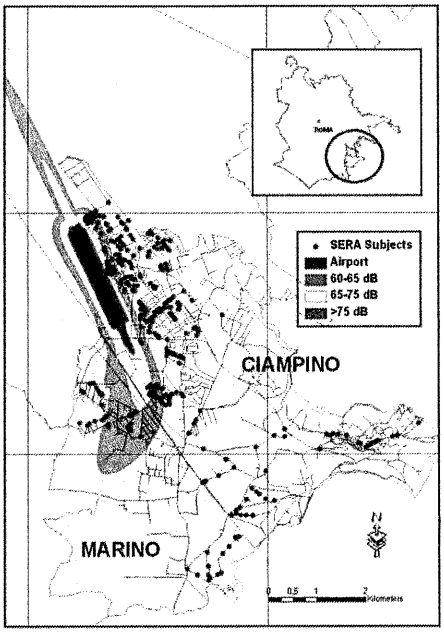

Figure 1: Location on the study area of the subjects in relation to the different levels of airport noise exposure

Table 1 shows the descriptive characteristics of the study population. The study sample (45 % females), had a mean age of 55.8 years (SD=7.3). About 13 % had a Body Mass Index defined by WHO as obesity, 26 % had a university degree, 53 % were currently employed (7 % has a job related to the airport). Regarding smoking habits, 25 % said they were current smokers while 39 % said they were ex-smokers. The most exposed group (53 persons resident close to the airport) was on average older than the reference group (216 persons resident far from the airport). People most exposed to noise were of normal weight (36 % vs 27 % of the reference), with university degree (26 % vs 20 %) and current smokers (28 % vs 21 %).

Table 1: Descriptive characteristics of the study SERA participants by airport noise impact

		Airport noise impact (dBA)				
		<60 Residential	<60 Urban	60-65	>65-75	TOT
		216	219	109	53	597
gender	males	51.9	59.8	50.5	56.6	54.9
	females	48.2	40.2	49.5	43.4	45.1
age groups	<50	25.0	24.2	29.4	22.6	25.3
	50-54	19.9	21.9	31.2	20.8	22.8
	55-59	21.3	19.6	20.2	15.1	19.9
	60-64	14.4	13.7	5.5	11.3	12.2
	65+	19.4	20.6	13.8	30.2	19.8
mean age (SD)		56.3 (7.5)	56.1 (7.0)	53.9 (6.8)	57.3 (7.9)	55.8 (7.3)
Body Mass Index	< 25 (underweight -normal weight)	27.0	34.7	35.2	35.9	32.1
	25-30 (overweight)	58.6	56.2	47.2	52.8	55.1
	>30 (obesity)	14.4	9.1	17.6	11.3	12.8
education (years)	<6	13.9	11.4	8.3	11.3	11.7
	6-9	22.7	17.8	19.3	32.1	21.1
	9-14	43.5	42.0	40.4	30.2	41.2
	>14	19.9	28.8	32.1	26.4	26.0
job	no/housewife	17.1	11.5	16.7	17.3	15.0
	retired	34.3	33.5	24.1	36.5	32.3
	yes	48.6	55.1	59.3	46.2	52.7
job related to Ciampino Airport	yes	5.1	6.4	11.0	5.7	6.7
smoke	never	42.1	36.5	33.9	49.1	39.2
	ex	36.6	38.8	37.6	22.6	36.4
	current	21.3	24.7	28.4	28.3	24.5

Prevalence rates of annoyance from aircraft noise were lower among residents in quite areas (24 and 18 % day and night) than among those primarily exposed to airport noise (64 % and 47 % day and night) (Table 2).

Table 2: Percentage of subjects highly annoyed by aircraft and traffic noise during day and night by airport noise impact

			Airport noise impact (dBA)				
			<60 Residential	<60 Urban	60-65	>65-75	TOT
			216	219	109	53	597
% highly annoyed	day	aircraft	24.1	27.9	55.1	64.2	34.7
		traffic	5.6	25.1	7.3	3.8	12.9
	night	aircraft	18.5	24.2	32.1	47.2	25.6
		traffic	6.0	12.8	2.8	1.9	7.5

Multivariate analysis results showed that the proportion of people very annoyed during the day increased with the level of airport noise exposure. After adjusting for sex, age, education, job and road traffic, and comparing with the reference group, we observed a RR of 1.35 in the exposed to <60 dBA, 2.19 in the exposed to 60-65 dBA, and 2.52 in the exposed 65-75 dBA. The same relationship was observed for people who said they were very annoyed by aircraft noise at night.

CONCLUSIONS

The SERA study results confirmed those of other studies conducted in populations living near airports in Europe, indicating the presence of a strong association between exposure to aircraft noise and annoyance. The association that we found is somehow stronger than what has been indicated in previous studies.

REFERENCES

Ancona C, Forestiere F, Mataloni F et al. (2010). Aircraft noise exposure and blood pressure among people living near Ciampino airport in Rome. Riv ItalAcust 34: 11-13.

Babisch W (2006). Transportation noise and cardiovascular risk: updated review and synthesis of epidemiological studies indicate that the evidence has increased. Noise & Health 8: 1-29.

Babisch W, Houthuijs D, Pershagen G et al. (2009). Annoyance due to aircraft noise has increased over the years--results of the HYENA study. Environ Int 35: 1169-1176.

Eriksson C, Rosenlund M, Pershagen G et al. (2007). Aircraft noise and incidence of hypertension. Epidemiology 18: 716-721.

Haralabidis AS, Dimakopoulou K, Vigna-Taglianti F et al. (2008). HYENA Consortium. Eur Heart J 29: 658-664.

Jarup L, Babisch W, Houthuijs D et al. (2008). HYENA study team. Hypertension and exposure to noise near airports: the HYENA study. Environ Health Perspect 116: 329-333.

Lim C, Kim J, Hong J (2008). Effect of background noise levels on community annoyance from aircraft noise. J Acoust Soc Am 123: 766-771.

Matsui T, Uehara T, Miyakita T et al. (2004). The Okinawa study: effects of chronic aircraft noise on blood pressure and some other physiological indices. J Sound Vibr 277: 469-470.

Miedema HM (2004). Relationship between exposure to multiple noise sources and noise annoyance. J Acoust Soc Am 116: 949-957.

Miedema HM, Vos H (2003). Noise sensitivity and reactions to noise and other environmental conditions. J Acoust Soc Am 113: 1492-1504.

Rosenlund M, Berglind N, Pershagen G et al. (2001). Increased prevalence of hypertension in a population exposed to aircraft noise. Occup Environ Med 58: 769–773.

Schreckenberg D, Griefahn B, Meis M (2011). The associations between noise sensitivity, reported physical and mental health, perceived environmental quality, and noise annoyance. Noise & Health 12: 7-16.

van Kempen EE, Kruize H, Boshuizen HC et al. (2002). The association between noise exposure and blood pressure and ischemic heart disease: a meta-analysis. J Anim Sci 80: 429-439.