



# Noise and health

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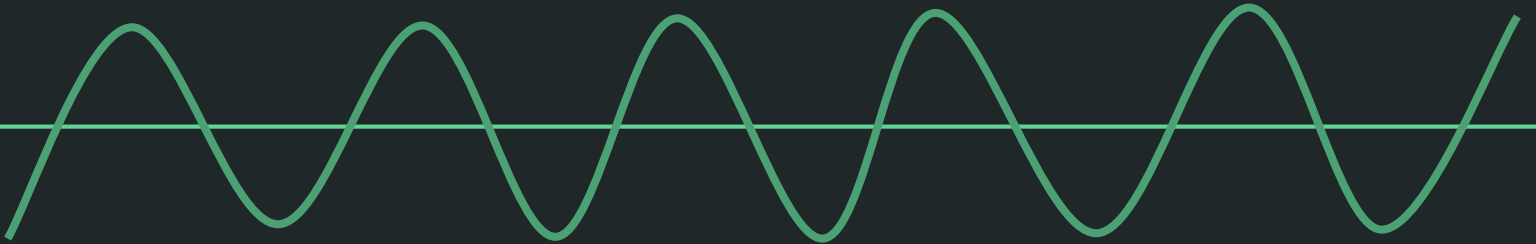
<sup>1</sup>CiiEM, IUEM

<sup>2</sup>CBAS, UP

<sup>3</sup>FCM, UNL

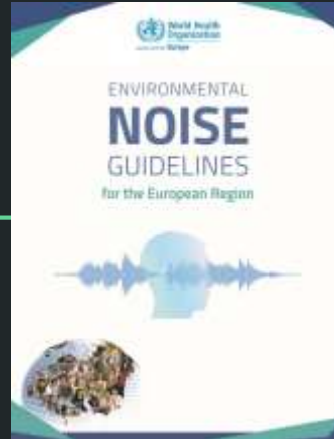
9th july 2019

sound = noise



# Environmental noise

In Europe, noise was estimated to be the third environmental risk factor with impact on public health



Noise pollution has adverse effects that go beyond the ear

The scientific evidence reviewed and summarized in these guidelines implies:

road traffic noise – incidence of IHD, annoyance and sleep disturbance, and potentially incidence of stroke and diabetes;

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aircraft noise – annoyance, reading and oral comprehension in children, sleep disturbance and potentially change in waist circumference and incidence of IHD.

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Several theoretical models for this association have been developed, focusing on the role of noise as a stressor and as a trigger of the neuroendocrine pathways

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Translational research

cardiovascular

metabolic (diabetes)

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# Cardiovascular

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# Cardiovascular

- Myocardial fibrosis in ventricles [1]
- Cx43 decrease in ventricles [2]
- Cardiomyocyte ultrastructural alterations [3]
- Coronary arteries perivascular fibrosis [4,5,6]
- Remodelling of large vessels [7]

- [1] Acta Cardiol 2013; 68(3): 241-5
- [2] Int J Clin Exp Pathol 2013; 6(9): 1874-9
- [3] Int J Clin Exp Pathol 2013; 6(11): 2333-41
- [4] Acta Cardiol 2013; 68(3): 285-9
- [5] Cardiovasc Pathol 2018; 37: 39-44
- [6] Int J Mol Sci 2015; 16(5): 10095-104
- [7] Eur J Anat 2002; 6(1): 17-21

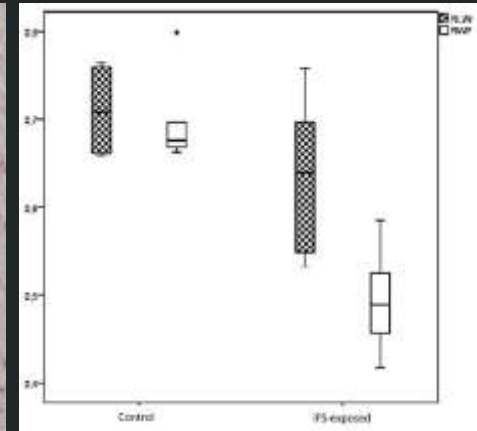
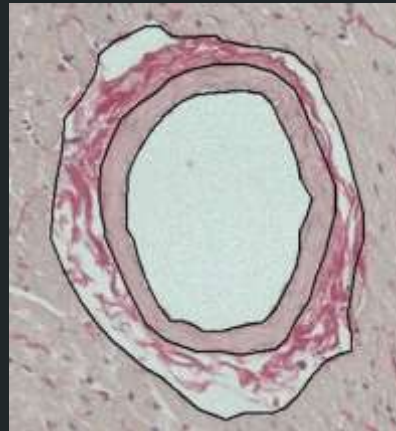
[2]

**Table 1.** Ratio Cx43/muscle in each anatomical region and *in totum* in LFN-exposed (n=10) and control (n=8) animals

Anatomical region	Group	Mean	Std. Deviation	Percent decrease with LFN exposure	p
LV	exposed	0.014	0.006	46.2%	0.008
	control	0.026	0.008		
IVS	exposed	0.014	0.006	22.2%	0.301
	control	0.018	0.008		
RV	exposed	0.016	0.012	55.6%	0.004
	control	0.036	0.012		
<i>In totum</i>	exposed	0.015	0.007	43.3%	0.009
	control	0.026	0.009		

LV = Left Ventricle; IVS = Interventricular Septum; RV = Right Ventricle; LFN = Low-Frequency Noise.

[5]





# Cardiovascular

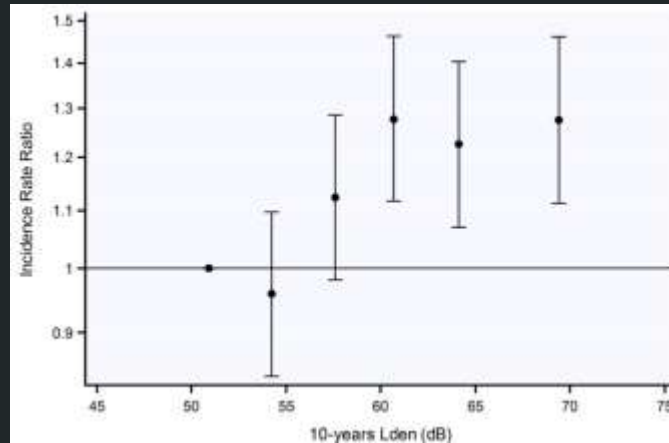
- Ventricular dysfunction
- Arrhythmogenic substrate
- Vascular compromise



Epidemiological evidence shows that noise exposure increases the risk of:

- ☐ Heart Failure [1,2]

[1]



[1] Environ Health Perspect 2017; 125(9): 097021

[2] Int J Hyg Environ Health 2016; 219(8): 749-58

# Cardiovascular

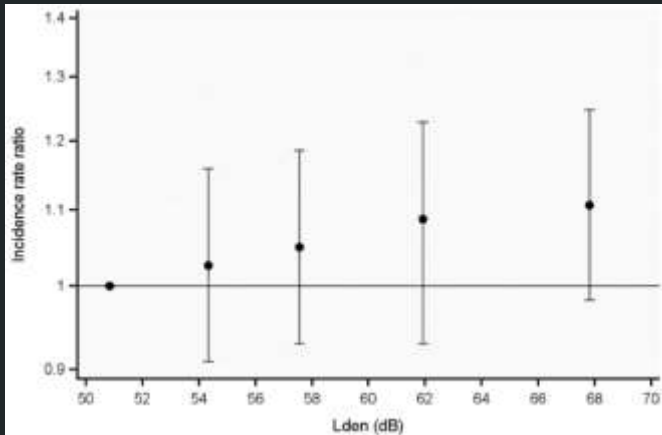
- Ventricular dysfunction
- Arrhythmogenic substrate
- Vascular compromise



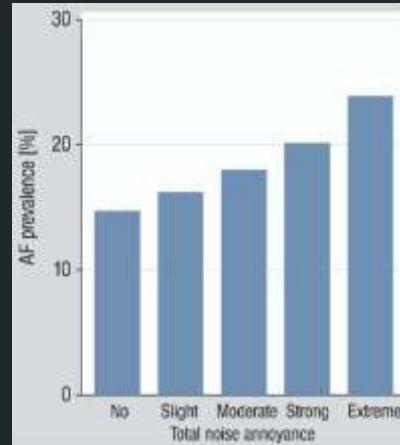
Epidemiological evidence shows that noise exposure increases the risk of:

- ☐ Heart Failure [1,2]
- ☐ Atrial Fibrillation [3,4]

[3]



[4]



- [1] Environ Health Perspect 2017; 125(9): 097021
- [2] Int J Hyg Environ Health 2016; 219(8): 749-58
- [3] Environ Int 2016; 92-93: 457-63
- [4] Int J Cardiol 2018; 264: 79-84

# Cardiovascular

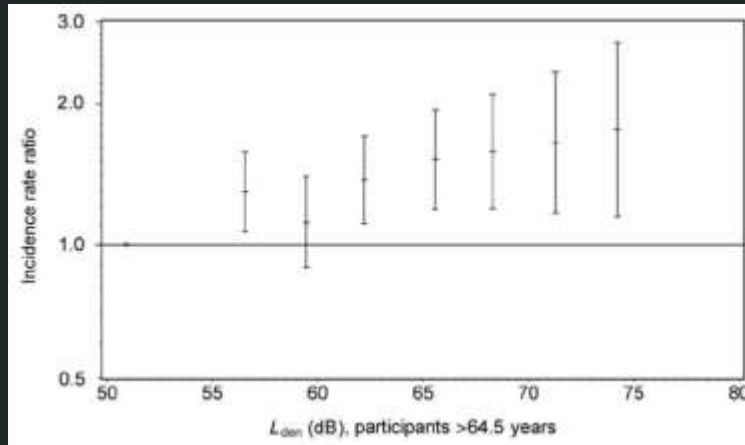
- Ventricular dysfunction
- Arrhythmogenic substrate
- Vascular compromise



Epidemiological evidence shows that noise exposure increases the risk of:

- ❑ Heart Failure [1,2]
- ❑ Atrial Fibrillation [3,4]
- ❑ Stroke and Myocardial infarction [5,6]

[5]



- [1] Environ Health Perspect 2017; 125(9): 097021
- [2] Int J Hyg Environ Health 2016; 219(8): 749-58
- [3] Environ Int 2016; 92-93: 457-63
- [4] Int J Cardiol 2018; 264: 79-84
- [5] Eur Heart J 2011; 32: 737-44
- [6] Am J Epidemiol 2012; 175: 898-906

# Cardiovascular (*work in progress...*)

Study the associations between noise exposure and increased risk of cardiovascular diseases in the Portuguese population

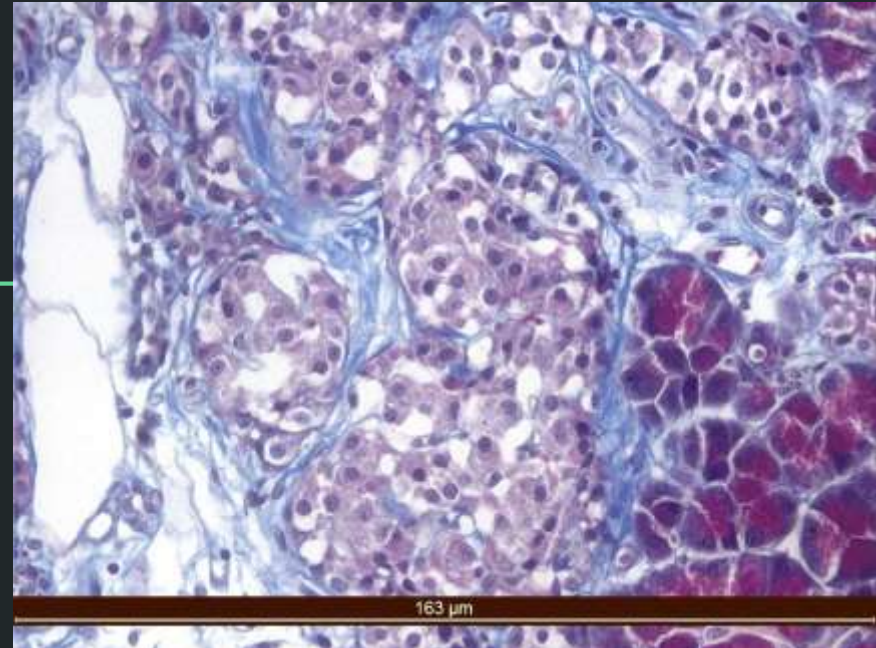
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Metabolic (diabetes)

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# Diabetes (pilot study)

- Absence of parenchymal distortion
- Vacuolization within pancreatic islets
- Pericapsular fibrosis in pancreatic islets
- Intracapsular fibrosis in pancreatic islets
- Perivascular fibrosis



# Diabetes (pilot study)

- Absence of parenchymal distortion
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Functional impact ?

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Epidemiological evidence shows that noise exposure increases the risk of type 2 diabetes mellitus [1-5]

[1] Environ Res 2018; 166: 647-657

[2] Noise Health 2015; 17(74): 23-33

[3] Environ Health Perspect 2017; 125(8): 087025

[4] Environ Res 2018; 160: 292-297

[5] Environ Health Perspect 2013; 121(2): 217-222

# Diabetes (*work in progress...*)

- Study the association between noise exposure and type 2 diabetes mellitus incidence in the Portuguese population
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- Study the effects of noise exposure on pancreatic, muscular and hepatic morphology and function in animal studies



# Noise and Health

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