

## TOPIC

## SIGNALING AND EPIGENETICS IN CANCER

### Electromagnetic pollution in the urban environment and risk of cancer

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#### Introduction

There is a risk of cancer related to excess exposure to magnetic fields. Regulatory bodies (ICNIRP and the Spanish State, RD 1066/2001) have established exposure limits. However, no control measures are carried out and the exposure of citizens in urban environments is increasing since last decade. There are no electromagnetic pollution maps of cities in Spain.

Although multitude of articles have been published about the effects produced by magnetic fields and the incidence and risk of cancer due to environmental exposures, it is still not clear if there really is a relationship between them. In addition, neither dose-response relationship nor mechanism of interaction between the magnetic field and living tissue have been described.

#### Objectives

The aim of this work is to study the relationship between exposure to magnetic fields in the urban environment and the risk of cancer. For this, it is essential to carry out a study of the levels of magnetic flux density in the urban environment and correlate them with the incidence of cancer.

#### Methods

A multiple bibliographic search has been carried out in databases such as Scopus and Pubmed, considering specialized building, biophysics and environmental journals, as well as specific data on cancer risk.

#### Results

Numerous epidemiological studies indicate that there is a correlation between exposure to magnetic fields and effects on human health, mainly cancer, and in particular childhood leukemia. Since 1993, excess mortality from leukemia has been detected in children living in homes exposed to low levels of magnetic fields, above 0.2  $\mu$ T. Other more recent studies conclude that daily exposure could increase the risk of cancer and other diseases. Almost all of these epidemiological studies have been carried out with exposure to magnetic fields inside residential and/or occupational buildings. However,

there are very few studies of exposure levels in the urban environment, outside buildings, which is currently known as electromagnetic pollution or electrosmog. In the urban area, this exposure is due to the electromagnetic fields emitted by the electrical conduits of all the city's wiring, both the electrical supply lines, electrical distribution, connections between transformers and domestic wiring, high voltage lines, electrical substations, transformers located in buildings, lighting, subways, tram, and mobile telephony.

We must not forget that all citizens are continually exposed to electromagnetic fields inside buildings, both in domestic and work environments. In fact, technological development contributes to an increase in urban equipment related to greater consumption and supply of electrical energy, and therefore higher levels of exposure.

Several studies have been published about electromagnetic exposure levels in urban environments in four cities in Extremadura and Göteborg, finding exposure levels above 0.4  $\mu\text{T}$ . These levels are associated with an increased risk of childhood leukemia in epidemiological studies. The growing social interest in this topic has led to other similar studies being carried out in 35 cities in Serbia, in the economic districts of 60 cities in Ontario and in the cities of Turin, Tehran, and Chongqing.

In Spain the exposure limit for 50 Hz is 100  $\mu\text{T}$ . Currently there are no electromagnetic pollution maps of our cities.

## **Conclusions**

Social, national and international interest in the health risks of exposure to electromagnetic fields in the urban environment is growing in our increasingly technological Society. In Spain, very few measurements have been made in cities, while in other countries such as Canada, exposure levels have been evaluated in more than 60 cities.

The International Agency for Research on Cancer (IARC) has classified low-frequency magnetic fields as "possibly carcinogenic" in humans.

It is important that Information Systems include data about urban exposure levels and their relationship with cancer incidence in order to minimize risks. To date, it is still not clear what is the molecular mechanism of interaction between magnetic field and biological tissue. There is evidence that magnetic fields could increase the production of reactive oxygen species, induce damage to the DNA molecule and alter signaling pathways that lead to carcinogenesis; although it is still not sufficiently demonstrated.