



Electromagnetic emissions from mobile networks and potential effect on health

A preliminary study

*Chountala Chrysanthi, Baldini Gianmarco
European Commission, Joint Research Centre, Ispra, Italy*

*BEREC Workshop on how to best promote science based
EMF limits recommended by experts,*

21 September 2021

Objectives

- Overview of the Regulatory context
- Literature review with a focus on three areas:
 - Evaluation of RF emission levels from mobile base stations and phones
 - Experimental studies on health impact caused by RF EMF exposure
 - Correlation analysis between health data and deployment of wireless communication networks.
- Analysis of a possible link among brain cancer incidence and mobile phone usage based on data derived from publicly available databases (ECIS, ITU).

Short timeline (Assigned: 10/2020 – Delivered for comments: 12/2020)

Findings from Literature Review

RF emission levels

Exposure levels have been reported **significantly lower** than the EMF reference levels.

Downlink power from mobile base stations is the **most significant** contribution to the overall RF-EMF exposure.

Base stations on rooftops might generate **high levels** (but still much smaller than the ICNIRP's reference levels) of RF-EMF in living places close to them.

Impact of RF EMF exposure on health

Studies focusing on the impact of RF-EMF on cancer, sleep and cognitive functions **did not report** any significant health effects.

Some laboratory studies on animals and cells have found **negative metabolic activities in in-vitro cultures or mice** when exposed to prolonged high levels of RF-EMF, but **no conclusive negative effects** were observed in **humans**.

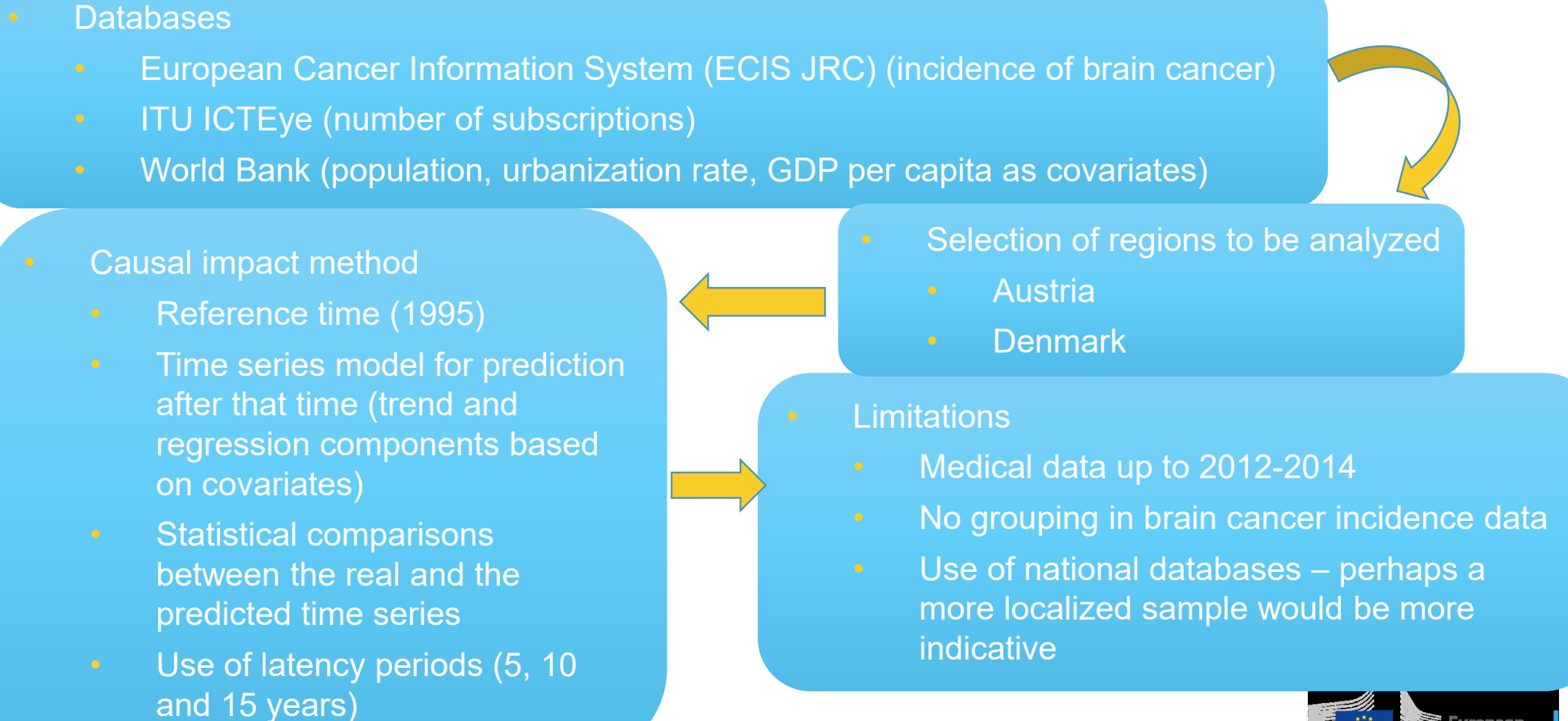
Other toxic stimuli (e.g., pollution) and their cumulative impact should be considered in conjunction with RF-EMFs.

Correlation analysis

No significant correlation between the emergence of cancers and mobile phone usage was reported by most of the reviewed studies

Many epidemiological studies reported a **lack of availability** of sufficient **medical data sets with a large time span** (cancer may appear only on a very long time span (e.g., 10 years)).

Data Analysis



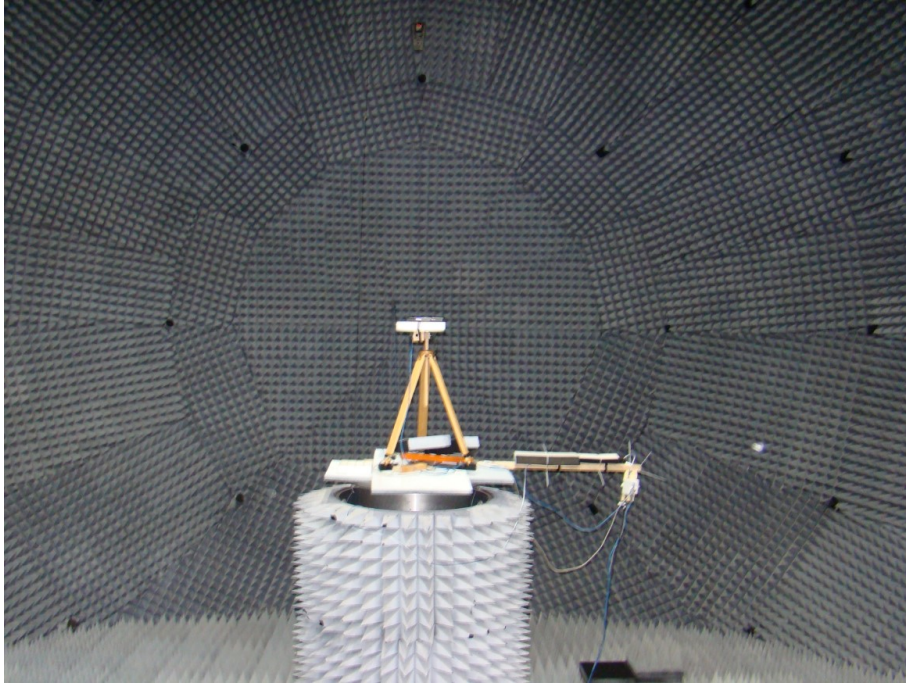
Findings (Data Analysis)

- The data analysis performed by the JRC found ***no evidence of an increase in the incidence of brain and other CNS cancers during the years that followed the evolution of cellular networks in the regions under study.***
- The above finding agrees with the conclusions of the literature review despite the identified limitations.

Potential future developments

- More research is needed in urban areas since **RF-EMF exposure** of current cellular networks is **depends on their density and communication traffic**.
- Definition of a **standardized protocol** when assessing EMF impact on biological functions for each specific technology.
- Research on the impact of **mmWave frequencies** that will be used by 5G networks and beyond.
- Further statistical analysis using **more suitable data sets** (i.e., covering a longer time span, particularly after 2012 when mobile phone use increased significantly with the introduction of 4G networks).

Experimental Facilities in the JRC for RF EMF Measurements



Thank you



© European Union 2020

Unless otherwise noted the reuse of this presentation is authorised under the [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/) license. For any use or reproduction of elements that are not owned by the EU, permission may need to be sought directly from the respective right holders.

Potential future developments:

Field RF-EMF exposure of users to cellular networks

- Exposure of current cellular networks is proportional:
 - to density of mobile users.
 - higher cellular network traffic.
- Studies conducted during major events with a large number of mobile users in urban environment could provide an indication on “worst case” scenario for field RF-EMF exposure.
- Studies on live RF-EMF exposure to 5G cellular networks is scarce.
- 5G cellular networks may have different configurations and architectures, which are scarcely taken in consideration in studies. Studies are often limited to simple cellular networks configurations.

Potential future developments:

Definition of a standardized protocol when assessing EMF impact on biological functions for each specific technology

- Lack of harmonization in the metrics of evaluation of the study.
- Different wireless network configurations, which are often not comparable among studies.
- Many findings are still based on the GSM wireless communication standard which is now more than 20 years old.
- Some studies recommend a review of the protocols for the RF-EMF exposure and the collection and recording of the measurements, which will be consistent to real-life situations.

Potential future developments:

Research on the impact of mmWave frequencies that will be used by 5G networks and beyond

- Very limited or no reported studies of mmWave in 5G networks.
- Local heating effects of the RF communications should be considered at such frequencies.
- Due to the strong directionality of mmWave frequency wireless communication, the variability in complex occupational environments that also include other co-exposures, retrospective estimation of exposure and an appropriate exposure metric remain central in studies of this nature.

Potential future developments:

Statistical analysis using more suitable data sets

- Many studies reported statistical inconsistencies in the existing data sets especially those based on reported mobile phone usage.
- Many studies reported the issue of the lack of availability of medical data sets with a large time span because the emergence of cancer may appear only on a very long time span (e.g., 10 years and more).
- More recent and more localized data sets that correspond to periods with higher mobile phone usage

Literature Review methodology

Search Key Words
“EMF”, “RF-EMF”, “health”, “radio frequency”, “cellular networks”, “mobile phone”, “mobile communication”, “cancer”, “tumor”, “tumour”

1 Step: Basic search criteria in scientific databases with search key words

Scientific Databases

- www.sciencedirect.com,
- PUBMED,
- IEEE Explore

2 Step: Additional studies identified by the analysis of the initial identified publications.

Radio Frequency (RF) emissions experimental studies where the RF emission power from consumer devices (mobile phones) or mobile base stations is measured.

Health impact due to RF emissions mostly on human but also examples from in vitro and animals.

Analysis of the statistical trends of the health diseases (e.g., tumours) in the human population in relation to the increase of presence of wireless communication networks or systems.

Disclaimer: The literature review is not meant to be exhaustive, but it is rather focused on the identification of the key research gaps and future research directions