

SR-9. Systematic review of the effects of exposure to radiofrequency radiation on biomarkers of oxidative stress

The World Health Organization's (WHO) Radiation Programme in the Department of Public Health, Environmental and Social Determinants of Health (Geneva, Switzerland) has an ongoing project to assess potential health effects of exposure to radiofrequency electromagnetic fields (RF EMF) in the general and working population. To prioritize potential adverse health outcomes, WHO conducted a broad international survey in 2018. Ten major topics were identified for which WHO will now commission systematic reviews to analyze and synthesize the available evidence.

One of the topics ranked as important was oxidative stress which is a disturbance in the balance between the production of reactive oxygen species (free radicals) and anti-oxidant defenses. Oxidative stress is assumed to be at the basis of aging and degenerative diseases, such as cancer and cardiovascular disease, even though the relationships are not fully elucidated. It has also been proposed that exposure to RF EMF might lead to an increase in oxidative stress and thus could be linked to an adverse outcome pathway leading to health outcomes, such as cancer or cardiovascular disease.

Through this Call, WHO invites eligible teams to indicate their interest in undertaking a systematic review of the effects of RF EMF exposure on biomarkers of oxidative stress in *in-vivo* and *in-vitro* studies.

Participating review teams will receive methodological support from the WHO Secretariat on the planning and conduct of the systematic reviews. The team's contribution of a systematic review will be acknowledged in the official WHO publication on radiofrequency fields. The systematic reviews will be submitted for open-access international peer-reviewed publication(s).

Scope of the research

The review team should conduct a systematic review of the effects of radiofrequency exposure on biomarkers of oxidative stress for the following PECO¹ question:

- What is the effect of exposure to RF EMF (E) on the most important and best validated biomarkers for oxidative stress (O) compared to no/lower exposure (C) in animals, humans or cells (P).

Systematic review approach

The systematic review should be conducted according to the quality requirements for systematic reviews as formulated in the [WHO Handbook of Guideline Development](#) and should be reported according to the [PRISMA standard](#). WHO will provide review teams with a detailed draft protocol stating the PECO question and methods for conducting the systematic review based on the state-of-the-art. The systematic review teams will be asked to finalize the protocol and to register them in

¹ PECO is an acronym for the four elements that should be considered in any question governing a systematic search of the evidence: (P) population, (E) exposure, (C) comparator and (O) health outcome.

the [PROSPERO](#) database. The systematic review will then be conducted according to the lines set out in the protocol. The final deliverable is a systematic review in scientific article format. A contribution towards the operating costs for the conduct of the systematic review will be available.

Requirements and process

The systematic review team will be selected from the submitted expressions of interest and based on the members' qualifications and skills (see specifications below). The team should be composed of at least two members to enable study selection, data extraction and risk of bias analysis in duplicate. Geographical diversity is encouraged.

The systematic review team leader must provide information regarding the composition of the team (proposed team members, their organizational affiliations and their relevant expertise and skills), description of similar assignments, examples of relevant reports or publications using the enclosed curriculum vitae for each team member. The team members will participate in their individual capacity rather than a representative of their employer. Each member will also need to complete the standard [WHO Declaration of Interest form](#), which will be assessed for conflict of interests.

Expressions of interest must be delivered electronically to the WHO Secretariat at emfproject@who.int with subject line: "**Expression of interest for SRT-9**" no later than 16:00 (CET) on **4 November 2019**.

The team leader can be asked to further elaborate the expression of interest in a video meeting with the WHO Secretariat. The final candidates will be selected through a competitive process in accordance with WHO's policies and procedures.

Expected deliverables and timelines

The systematic review should be completed within a 12-month timeframe. It is anticipated that the systematic review will begin as soon as practicable, but no later than **2 December 2019**.

1. Final version of protocol and registration in Prospero (+ 1 month from start)
2. Operational search strategies for all relevant databases as listed in the protocol (+ 1 month)
3. Risk of bias assessment tool(s) developed, including aspects related to exposure assessment (+ 1 months)
4. List of references to be checked as full-text studies (+ 1 month)
5. List of included and excluded studies (+ 1 months)
6. Tables on (i) characteristics of included studies, (ii) effects of exposure to radiofrequency radiation on oxidative stress, and (iii) risk of bias in included studies (+ 3 months)
7. Draft manuscript ready for peer review (+ 1 month)
8. Final manuscript for journal submission (+ 1 month after receipt of comments)

Qualifications and skills required

The successful teams would have to fulfil the following criteria:

- Expertise in radiofrequency exposure;
- Expertise in the field of oxidative stress;
- Expertise in experimental (human, animal and in-vitro) studies;
- Demonstrated experience in conducting systematic reviews in environmental health;
- Experience in scientific writing and communications on environmental health and/or epidemiology;
- Strong communication skills in English, both written and oral.