



Protocol for a scoping review of systematic reviews on environmental effects of sunscreen ingredients

From the Panel on Food Additives, Flavourings, Processing Aids, Materials in Contact with Food, and Cosmetics of the Norwegian Scientific Committee for Food and Environment

Protocol for a scoping review of reviews on sunscreen and environmental effects

From the Norwegian Scientific Committee for Food and Environment (VKM) 2020
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The Panel on Food Additives, Flavourings, Processing Aids, Materials in Contact with Food, and Cosmetics of the Norwegian Scientific Committee for Food and Environment
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Competence of VKM experts

Persons working for VKM, either as appointed members of the Committee or as external experts, do this by virtue of their scientific expertise, not as representatives for their employers or third party interests. The Civil Services Act instructions on legal competence apply for all work prepared by VKM.

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Definitions

Definitions

Scoping review: A type of knowledge synthesis that follows a systematic approach to map evidence on a topic and identify main concepts, theories, sources, and knowledge gaps (Tricco et al., 2018).

Sunscreen (topical sunscreen): "Any preparation (such as creams, oils, gels, sprays) intended to be placed in contact with the human skin with a view exclusively or mainly to protecting [*sic*] it from UV radiation by absorbing, scattering or reflecting radiation" (Regulation (EC) No 1223/2009).

1 Introduction, aim and research questions

Concerns have been raised regarding potential effects of sunscreen ingredients on the environment. Consequently, an increasing number of countries are developing and passing legislation which may ban or limit the use of certain types of sunscreen ingredients (Narla and Lim, 2020). It is, therefore, timely to perform a scoping review to get an overview of the research on this broad and diverse topic. In a scoping review, the evidence on a topic is mapped in a systematic way and main concepts, theories, sources and knowledge gaps are identified (Tricco et al., 2018).

We will perform a scoping review of systematic reviews on environmental effects related to sunscreen ingredients. To report our findings, we will use the "Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist" (http://www.prisma-statement.org/documents/PRISMA-ScR-Fillable-Checklist_11Sept2019.pdf).

The aim of the scoping review is to systematically map the available literature to provide an overview of research on environmental effects related to sunscreen ingredients.

The research questions to be addressed are presented in Table 1-1.

Table 1-1. The research questions to be addressed in the scoping review of reviews.

	No	Research question
Environmental effects	1	For which sunscreen ingredients are environmental effects studied?
	2	What are the main hypotheses regarding environmental effects of sunscreen ingredients in reviews?
	3	What are the outcomes/endpoints addressed?
	4	What are the key findings that relate to the scoping review questions?

2 Literature search and eligibility criteria

Systematic reviews addressing sunscreen and/or sunscreen ingredients and any environmental effect (not including humans) will be included in the scoping review (Table 2-1).

Table 2-1. Eligibility criteria for environmental effects related to sunscreens.

Study design	Systematic reviews
Exposure	Sunscreens and/or sunscreen ingredients
Outcome of interest	Any environmental effect

2.1 Information sources

We aim to search the following electronic databases from MEDLINE (Ovid), Embase (Ovid), Cochrane Library (CDSR), Centre for Reviews and Dissemination (CRD) databases, (the Database of Abstracts of Reviews of Effects (DARE) and the Health Technology Assessment database (HTA)), Epistemonikos, Web of Science (including Zoological records and Biological abstracts), Scopus and the Aquatic Sciences and Fisheries Abstracts (ASFA) Bibliographic Database.

The search strategies will be drafted in cooperation with an experienced research librarian, who will then conduct the literature searches.

The electronic database searches will be supplemented by searching the web sites of organisations such as e.g. the World Health Organization.

2.2 Literature search

The search strategy for Ovid MEDLINE(R) is available in Appendix 1.

2.3 Selection of sources of evidence

The search result will be screened based on predefined eligibility criteria (Table 2-1). The identification of systematic reviews will be based on criteria developed by the Cochrane collaboration (Higgins and Green). In short, the publications will be considered as systematic reviews if they have described or presented 1) a specific research question and clear criteria for relevant studies to include, 2) a systematic literature search, and 3) quality assessment of the included studies.

Screening of titles and abstracts

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To ensure reviewer calibration, all reviewers will screen a sample of the retrieved titles and abstracts. Then the reviewers will meet to ensure a consistent application of the eligibility criteria. Following calibration, pairs of reviewers will screen titles and abstracts independently. A publication should be included, when there is doubt whether the publication meets the eligibility criteria.

Screening of full texts

A sample of the full text publications that have passed the initial screening (title and abstract), will be screened by all reviewers to ensure calibration of reviewers. Following calibration, pairs of reviewers will screen the full text publications independently. In case of disagreement, the two reviewers will discuss the paper to reach consensus. If the disagreement persists, the Panel will reach a final decision.

An overview of the results of the study selection will be presented in a flowchart.

3 Data charting process

The project group will jointly develop a data charting form. We will extract data on study characteristics of each systematic review and details of the primary studies included in the systematic review:

Characteristics of the systematic review

- Authors
- Title
- Journal
- Year of publication
- Funding
- Reported conflict of interest
- Main objective(s)
- Number of primary studies included
- Years of publication of the studies included (range)
- Quote hypotheses regarding our aim
- List main outcomes/endpoints considered
- List key findings that relate to the scoping review questions
- Quality assessment tool used

Characteristics of the primary studies included in the systematic review

- Countries where the studies were conducted
- Specify the type of studies included in the systematic review
- Specify the sunscreen ingredients included
- For laboratory studies, describe the control groups

All project group members will extract data from a sample of the included publications to ensure that the data extraction is consistently applied. Discrepancies will be resolved through discussions. If necessary, the data-charting form will be modified. Following calibration of the data extraction, one project group member will extract the data with a second project group member independently checking the data extraction forms for accuracy and completeness. In case of disagreement, the two project group members will discuss to reach consensus. If the disagreement persists, the Panel will reach a final decision.

4 Synthesis of results

The data collected will be summarized to provide information on the body of research on sunscreen ingredients and environmental effects. The hypotheses addressed and the body of evidence for different outcomes will be presented. The results will be presented for the included research questions (Table 2-1), and tables and charts will be used as appropriate.

5 References

Higgins J.P.T., Green S. Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011.

Narla S., Lim H.W. (2020) Sunscreen: FDA regulation, and environmental and health impact. *Photochemical & Photobiological Sciences* 19:66-70. DOI: 10.1039/c9pp00366e.

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Tricco A.C., Lillie E., Zarin W., O'Brien K.K., Colquhoun H., Levac D., Moher D., Peters M.D.J., Horsley T., Weeks L., Hempel S., Akl E.A., Chang C., McGowan J., Stewart L., Hartling L., Aldcroft A., Wilson M.G., Garritty C., Lewin S., Godfrey C.M., Macdonald M.T., Langlois E.V., Soares-Weiser K., Moriarty J., Clifford T., Tuncalp O., Straus S.E. (2018) PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Annals of Internal Medicine* 169:467-+. DOI: 10.7326/M18-0850.

Appendix 1

Search strategy for Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R) <1946 to April 17, 2020>

1	Sunscreening Agents/
2	(sunblock? or "sun block?" or "sun tan lotion?" or "suntan lotion?" or suntanlotion? or "sun lotion?" or sunlotion? or "sun screen?" or sunscreen? or "sunburn cream?" or "sun burn cream?" or sunburncream? or "sun cream?" or suncream? or "block out?" or blackout? or ((ultraviolet or ultra violet or UV or UVA or UVB or UVC) adj2 filter?)).tw,kf.
3	1 or 2
4	Environmental Pollutants/ or Water Pollutants/ or Water Pollutants, Chemical/ or Soil Pollutants/ or environmental microbiology/ or food microbiology/ or soil microbiology/ or water microbiology/ or waste water/
5	(Pollution or polluted or Pollutant or Pollutants or micropollutant* or environment* or effluent* or waste water* or wastewater* or food microbiology or soil microbiology or water microbiology).tw,kf.
6	exp Aquatic Organisms/ or exp Chlorophyta/ or Diatoms/ or Haptophyta/ or exp Dinoflagellida/
7	((((Aquatic or freshwater or "fresh water" or marine or abyssal or "cold seep" or "deep sea" or estuarine or "hydrothermal vent" or intertidal or pelagic or nektonic or neustonic or periphytic or Aphotic or bathyal or abyssal or hadal) adj (species or organism?)) or benthos* or (benthic adj (organism? or species or zone? or foraminifera)) or macrobenthos* or microphytobenthos* or nekton or neuston or Pleuston or periphyton? or plankton* or planktic* or bacterioplankton* or "marine bacterium" or holoplankton* or macroplankton* or meroplankton* or mesoplankton* or microplankton* or nanoplankton* or nannoplankton* or phytoplankton* or picoplankton* or zooplankton* or alga or algae or Chlorophyta* or Chlorophyceae* or Sphaeropleales or Scenedesmus* or Desmodesmus or diatom* or bacillariophyta* or Coscinodiscophyceae* or Thalassiosira* or Haptophyta* or coccolithophor* or prymnesi* or emiliania* or pavlova* or phaeocystis* or pleurochrysis* or Isochrysis* or Chlamydomonadales* or Volvocales* or Volvocida* or volvocine* or Dunaliella* or Skeletonema* or Chlorodendrophyceae* or Chlorodendrale* or Tetraselmis* or Chaetoceros* or Phaeodactylum or Dinoflagell* or Dinomastigot* or Dinophyceae or Dinophyta* or Mesokaryot* or Pyrrhophyceae or Pyrrhophyta* or Pyrrophyceae or Pyrrophyta* or Alexandrium or Microalga* or microphyte* or macroalga* or Seaweed or Kelp).tw,kf.
8	exp ecosystem/

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9	(ecosystem? or ecological or biodiversity or biological diversity or microflora? or Microbiota? or Mycobiome? or Microbial or agroecosystem? or biomass* or biome? or microbiome? or microorganism? or microbe? or microclimate or Ecotype or ecospecies or ecovar or ((Endangered or threatened) adj (Species or organism?)) or biosphere or biota or biocenose or biocenoses or fauna or macrofauna or macroinvertebrate? or meiofauna or Meiobenthos* or wildlife or flora or macrophyte? or biotope or ecotone or food chain? or food web? or habitat? or indicator organism? or indicator species or keystone organism? or keystone species or mesocosm? or metapopulation? or microcosm? or rhizosphere or microhabitat? or ((biological or biotic or organism or organismal or natural or animal or fungal or fungus or archaea or archaeal or bacteria or bacterial or plant or herb or shrub or tree or protistan or ciliate or flagellate or protozoan or climax) adj (community or communities)) or biocenoses or biocenosis or biocoenoses or biocoenosis or species dominance or species refuge* or species refugia or species refugium or trophic cascade* or forest? or rainforest? or taiga? or grassland? or savanna? or savannah? or pampas or prairie? or puszta? or steppe? or veldt? or Tundra? or Wetland? or estuary or Estuaries or coastal water? or ocean? or sea or seas or intertidal zone* or littoral* or pelagic zone* or lake? or river? or riparian* or limnetic or photic zone* or Aphotic zone* or bathyal zone* or abyssal zone* or hadal zone*).tw,kf.
10	Ecotoxicology/
11	("eco toxicity" or "eco toxicology" or ecotoxicity or ecotoxicology).tw,kf.
12	exp Invertebrates/
13	(invertebrate* or arthropod* or mandibulat* or Tetraconat* or Crustacea* or Branchiopod* or Cladocera* or "water flea*" or Daphnia* or "freshwater flea*" or Helminth* or aschelminth* or "parasitic worm*" or "parasite worm*" or "flat worm*" or flatworm* or platyhelminth* or Turbellaria* or Planaria* or Rhabditophora* or Triclad* or Dugesiiidae* or Dugesia* or hexapod* or insect* or Dicondylia* or Palaeoptera* or paleoptera* or Pterygot* or Neoptera* or Holometabola* or Endopterygot* or Antliophora* or Mecopteroidea* or Diptera* or flies or fly or Nematocera* or Culicomorpha* or Chironomid* or Chironomus* or midge or midges or Maxillopod* or Harpacticoid* or Tigriopus* or Malacostraca* or Peracarid* or Amphipod* or copepod* or calanoid* or Acartia* or echinoderm* or Echinoidea* or clypeasteroidea* or "sand dollar*" or Paracentrotus* or Anostraca* or "fairy shrimp*" or Artemia* or "brine shrimp*" or mollusc* or mollusk* or gastropod* or slug or slugs or Vetigastropod* or abalone* or Haliotidae* or Haliotis* or "Sulculus diversicolor*" or "Sulculus diversicolour*" or annelid* or "segmented worm*" or Polychaet* or "bristle worm*" or bristleworm* or "Elasmopus rapax*" or "Scrobicularia plana*" or "Hediste diversicolor*" or "Hediste diversicolour*" or "Corophium Volutator*" or Acropora or Anthozoa* or Acroporidae or Pocillopora or Pocilloporidae or Porites or Renilla or actinia* or coelenterat* or Cnidaria* or "Millepora complanata" or "Stylophora pistillata" or bivalv* or Lamellibranchiata or mussel* or clam or clams or Mytilidae or Mytilus or lugworm* or Arenicola or coral? or reef?).tw,kf.

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14	vertebrates/ or exp amphibians/ or exp birds/ or exp fishes/ or mammals/ or eutheria/ or exp artiodactyla/ or exp carnivora/ or exp cetacea/ or chiroptera/ or hyraxes/ or exp insectivora/ or exp lagomorpha/ or exp perissodactyla/ or primates/ or haplorhini/ or catarrhini/ or exp cercopithecidae/ or hominidae/ or gorilla gorilla/ or neanderthals/ or pan paniscus/ or pan troglodytes/ or exp pongo/ or exp hylobatidae/ or exp platyrrhini/ or exp tarsii/ or exp strepsirhini/ or exp rodentia/ or exp scandentia/ or exp sirenia/ or exp cingulata/ or exp marsupialia/ or exp monotremata/ or exp proboscidea mammal/ or exp reptiles/
15	(Vertebrate* or fish or fishes or bird? or seabird? or shorebird? or Amphibian* or mammal* or reptile* or tetrapod? or amniote? or amniota or reptilia* or sauropsid? or teleost* or Smegmamorpha* or gasterosteid* or gasterosteiform* or synbranchid* or Beloniforme* or belonidae* or needlefish* or Oryzias or oryziin* or medaka* or "japanese killifish*" or "japanese rice fish*" or "Danio rerio*" or zebrafish* or "zebra fish*" or "Brachydanio rerio*" or "Cyprinus rerio*" or "Danio frankei" or "zebra danio*" or "b rerio*" or "d rerio*" or Cyprinidae or cyprinid* or Cypriniformes or catostomus or catostomidae or catostomus or cobitidae or loach* or misgurnus or salmon* or Trout* or char or chars or salvelinus or oncorhynchus or "salmo gairdneri*" or steelhead* or "Salmo mykiss*" or "Pimephales promelas" or "fathead minnow*" or Pimephale* or "Paralichthys californicus" or halibut* or flounder* or Flatfish* or Pleuronectidae*).tw,kf.
16	or/4-15
17	3 and 16
18	limit 17 to "reviews (maximizes specificity)"
19	Meta-Analysis/ or (review* or metaanal* or "meta anal*").tw,kf,bt.
20	(17 and 19) or 18