# Power lines and health: neurodegenerative diseases

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# Executive summary

Health Council of the Netherlands

In the Netherlands, a precautionary policy is in place with regard to overhead power lines. The purpose of this policy is to avoid, as much as possible, creating new situations in which children are subjected to long-term exposure to magnetic fields with an annual average field strength above 0.4 microtesla that are generated by overhead power lines.
This precautionary policy is partly based on an earlier advisory report issued by the Health Council of the Netherlands. In 2000, the Council concluded that there are indications that children who live near such power lines are at a greater risk of developing leukaemia than other children. The cause is unknown, although the magnetic fields generated by the power lines may play a role.

**Three advisory reports**

The State Secretary for Infrastructure and the Environment (now Infrastructure and Water Management) asked the Health Council of the Netherlands to update the advisory report issued in 2000 and to focus not only on childhood leukaemia, but also on Alzheimer's disease and cancer in adults. The report on childhood leukaemia was published in 2018. In that report, the Health Council suggested considering an expansion of the precautionary policy to other sources of long-term exposure to magnetic fields generated by the electrical grid, such as underground power cables, transformer stations and transformer substations.
The current report relates to neurodegenerative diseases in adults, namely amyotrophic lateral sclerosis (ALS), Alzheimer's disease, Parkinson's disease and multiple sclerosis (MS). Cancer in adults is addressed in a separate report.

**Working method**

The Committee on Electromagnetic Fields of the Health Council has analysed the scientific data on a possible relationship between exposure to magnetic fields generated by power lines and other sources, such as transformers, and the occurrence of neurodegenerative diseases. It has mainly focused on epidemiological studies, taking into account studies on exposure in both residential areas and the workplace. In some occupational groups, the average level of exposure to magnetic fields is substantially higher than in residential areas. If magnetic fields can affect health, this will be more evident among such occupational groups. However, it should be noted that workers are a more homogeneous group than the general population, as the latter includes potentially more vulnerable groups such as children, the elderly and chronically ill people.

In most epidemiological studies, the level of exposure to magnetic fields is approximated. In residential studies, the assessment of the magnetic field strength in the home is usually based on calculations or measurements. Sometimes the distance between the home and an overhead power line is used as a proxy for the level of exposure. In occupational studies, the level of exposure is usually reconstructed based on the employees' job history.

Epidemiological studies can show that, at certain levels of exposure, a certain illness occurs more frequently than would otherwise be expected. Such an association does not necessarily mean that exposure causes the illness, although it can be an indication for possible causation. For more clarity on this matter, additional data from experimental research (including animal studies) and investigations into working mechanisms are required. To the extent that it was available, information from this kind of research has been incorporated into this advisory report.

**Conclusions**

With regard to Parkinson's disease, the committee considers a causal link between exposure to magnetic fields and the development of the disease to be unlikely. Residential studies did not show an association between the proximity of power lines and the risk of developing Parkinson's disease. The scale and the quality of the research may well be limited, but more extensive studies into substantially higher levels of exposure to magnetic fields in the workplace also found no associations.

For the other diseases, the picture is less clear. With regard to ALS and Alzheimer's disease, limited research into residential exposure did no show associations between the proximity of power lines and the risk of developing the diseases. However, for occupational groups with substantially higher levels of exposure to magnetic fields than in residential areas, the research did reveal associations between exposure and the risk of developing both illnesses, although these are less clear for Alzheimer's disease than for ALS. For this reason, the committee considers the results for the residential areas to be inadequate to infer a causal relationship between the proximity of power lines and the risk of developing either disease. The committee considers the associations identified by the occupational studies to be suggestive of a causal relationship. The few data available from experimental studies do not provide further support for a causal link.

For MS, no association was found in either the residential or occupational studies. However, in both environments, the number of studies was too limited to make definitive statements about whether or not there is a causal link between exposure to magnetic fields and development of the disease.

**Recommendations**

Based on the current state of knowledge, the committee does not consider it possible to

provide an unambiguous answer to the question of whether exposure to magnetic fields can cause neurodegenerative illnesses. At least, the residential studies did not give any indication that ALS, Alzheimer's disease, Parkinson's disease or MS are more prevalent in people who live closer to overhead power lines. Therefore, the committee does not believe that precautionary measures to limit exposure are currently necessary. Moreover, the current policy concerning overhead power lines is already based on precaution due to indications of a possible causal relationship between proximity to power lines and the risk of childhood leukaemia. Previously, the committee recommended considering an expansion of this policy to underground power cables and other sources of long-term exposure to magnetic fields generated by the electrical grid, such as transformer stations and transformer substations.

Within the occupational groups under investigation – which are subjected to significantly higher levels of exposure than found in the residential environment – the committee has found indications suggesting an increased risk of ALS and Alzheimer's disease. As a precaution, it therefore recommends restricting occupational exposure to magnetic fields to as low a level as is reasonably possible.

The committee does not expect that more epidemiological research will provide greater certainty in the short term regarding the effect of exposure to magnetic fields on the risk of neurodegenerative diseases. The committee believes more research into possible underlying biological mechanisms to be more effective.

Due to the energy transition, there has been a substantial increase in the use of wind turbines and solar panels as a primary source of energy. The use of electric cars and heat pumps is also on the rise. As a result of these changes in production and consumption, more electricity will need to be transported. Consequently, levels of exposure to magnetic fields in the vicinity of components of the electrical grid and in some workplaces may increase. For this reason, the committee recommends monitoring of the level of exposure to magnetic fields in residential areas and in the workplace.

The Health Council of the Netherlands, established in 1902, is an independent scientific advisory body. Its remit is “to advise the government and Parliament on the current level of knowledge with respect to public health issues and health (services) research...” (Section 22, Health Act).
The Health Council receives most requests for advice from the Ministers of Health, Welfare and Sport, Infrastructure and Water Management, Social Affairs and Employment, and Agriculture, Nature and Food Quality. The Council can publish advisory reports on its own initiative. It usually does this in order to ask attention for developments or trends that are thought to be relevant to government policy.
Most Health Council reports are prepared by multidisciplinary committees of Dutch or, sometimes, foreign experts, appointed in a personal capacity.
The reports are available to the public.

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