The Impacts of Electricity Lines on Mental Health – Literature Search

***

Effeithiau Llinellau Trydan ar Iechyd Meddwl – Chwiliad Llenyddiaeth

This literature search provides an outline of the current evidence base regarding the potential mental health impacts of electricity transmission lines. Overall, research in this area remains limited, and findings to date do not demonstrate a clear or consistent link between living near electricity lines and adverse mental health outcomes. While some studies have reported possible associations with electromagnetic field (EMF) exposure, these results are not conclusive and further research is needed to understand whether any such effects exist.

The evidence reviewed here draws primarily from peer-reviewed scientific and medical journals published within the last 10 - 15 years. Forty-two studies were identified, the majority focusing on overhead transmission lines, substations, or occupational exposure among electricity workers. A smaller number examined related health outcomes such as brain tumours or neurodegenerative conditions; these may provide broader context but are not direct measures of mental health impacts from residential exposure.

It is important to note that this is not an exhaustive review. Evidence published in languages other than English, animal studies, and many types of “grey literature” (such as reports and theses) were outside the scope of the search. Additionally, some international studies may not be directly comparable to the Welsh context due to differing working conditions, exposure levels, or regulatory frameworks.

This overview is intended to support informed discussion by presenting a high-level summary of what the current research base does - and does not – show. A more comprehensive assessment would benefit from wider searches, including older studies, psychosocial research, and non-journal sources.

***

Mae'r chwiliad llenyddiaeth hwn yn darparu amlinelliad o'r sylfaen dystiolaeth gyfredol ynghylch effeithiau posibl llinellau trosglwyddo trydan ar iechyd meddwl. Ar y cyfan, mae ymchwil yn y maes hwn yn parhau i fod yn gyfyngedig, ac nid yw'r canfyddiadau hyd yma yn dangos cysylltiad clir neu gyson rhwng byw ger llinellau trydan ac effeithiau andwyol ar iechyd meddwl. Er bod rhai astudiaethau wedi adrodd cysylltiadau posibl â maes electromagnetig (EMF), nid yw'r canlyniadau hyn yn gadarn ac mae angen ymchwil bellach i ddeall a yw effeithiau o'r fath yn bodoli.

Mae'r dystiolaeth a adolygwyd yma yn deillio yn bennaf o gyfnodolion gwyddonol a meddygol a adolygwyd gan gymheiriaid a gyhoeddwyd yn ystod y 10 - 15 mlynedd diwethaf. Nodwyd pedwar deg dau o astudiaethau, roedd y mwyafrif yn canolbwyntio ar linellau trydan uwchben, is-orsafoedd, neu amlygiad galwedigaethol ymhlith gweithwyr trydan. Archwiliodd nifer lai o astudiaethau ganlyniadau iechyd cysylltiedig fel tiwmorau'r ymennydd neu gyflyrau niwroddirywiol; gall y rhain ddarparu cyd-destun ehangach ond nid ydynt yn fesuriadau uniongyrchol o effeithiau ar iechyd meddwl preswylwyr o ganlyniad i ddod i gysylltiad â maes electromagnetig.

Mae'n bwysig nodi nad yw hwn yn adolygiad cynhwysfawr. Roedd tystiolaeth a gyhoeddwyd mewn ieithoedd heblaw Saesneg, astudiaethau anifeiliaid, a llawer o fathau o "lenyddiaeth lwyd" (fel adroddiadau a thraethodau) y tu hwnt i gwmpas y chwiliad. Yn ogystal, efallai na fydd rhai astudiaethau rhyngwladol yn cyfateb yn uniongyrchol i gyd-destun Cymru oherwydd amodau gwaith, lefelau meysydd electromagnetig, neu fframweithiau rheoleiddio gwahanol.

Bwriad y trosolwg hwn yw cefnogi trafodaeth wybodus trwy gyflwyno crynodeb lefel uchel o'r hyn y mae'r sylfaen ymchwil bresennol yn ei ddangos ynghyd â'r hyn nad yw'n ei ddangos. Byddai asesiad mwy cynhwysfawr yn elwa ar chwiliadau ehangach, gan gynnwys astudiaethau hŷn, ymchwil seicogymdeithasol, a ffynonellau nad ydynt yn gyfnodolion.

It should be noted that this literature search was returned to members of the Independent Advisory Group in the second half of March 2025. The group stopped considering new submissions at the end of March 2025 to work on the report and recommendations, and therefore members would have had very limited opportunity to consider any of the specific papers referenced in these results in their findings.

***

Dylid nodi bod y chwiliad llenyddiaeth hwn wedi'i ddychwelyd i aelodau'r Grŵp Cynghori Annibynnol yn ystod ail hanner mis Mawrth 2025. Rhoddodd y grŵp y gorau i ystyried darnau newydd ddiwedd mis Mawrth 2025 i weithio ar yr adroddiad a'r argymhellion, ac felly ychydig iawn o gyfle y byddai'r aelodau wedi eu cael i ystyried unrhyw un o'r papurau penodol y cyfeirir atynt yn y canlyniadau hyn yn eu canfyddiadau.

Results / Canlyniadau

Title	Citation	Year of publication	Link to abstract/full text (if available)
Progress in the study of the effects of electromagnetic radiation on the mood and rhythm [Review]	Zou, D.-F. et al. (2025) 'Progress in the study of the effects of electromagnetic radiation on the mood and rhythm', Electromagnetic Biology and Medicine, pp. 1–16. doi: 10.1080/15368378.2025.2460971.	2025	Abstract *"in conclusion, our understanding of EMR's role in body mood and rhythm is quite limited, and further research is needed to answer unanswered questions."*
Electric and magnetic field pollution in near substations and investigation of anxiety and depressive effects on adult individuals living in this area [Turkey?]	Sert, C., Başak, N. and Koruk, İ. (2024) 'Electric and magnetic field pollution in near substations and investigation of anxiety and depressive effects on adult individuals living in this area', Electromagnetic Biology and Medicine, 43(3), pp. 145–155. doi: 10.1080/15368378.2024.2348574.	2024	Abstract *"In conclusion, there is no statistically convincing evidence of a relationship between EMF exposure and anxiety-depression ($p > 0.05$). This result shows that there may be more meaningful results in places with higher EMF levels. We interpreted the fact that exposure to electromagnetic fields does not cause anxiety and depression in individuals, as the measured values are below the limit values."*
Residential distance from high-voltage overhead power lines and risk of Alzheimer's dementia and Parkinson's disease: a population-based case-control study in a metropolitan area of Northern Italy	Gervasi, F. et al (2019) 'Residential distance from high-voltage overhead power lines and risk of Alzheimer's dementia and Parkinson's disease: a population-based case-control study in a metropolitan area of Northern Italy', International Journal of Epidemiology, Volume 48, Issue 6, December 2019, Pages 1949–1957, https://doi.org/10.1093/ije/dyz139 **See also:** Comment by Su, Zhu and Chen, International Journal of Epidemiology, Volume 49, Issue 2, April 2020, Pages 700–701, Free Access Response to Su et al. International Journal of Epidemiology, Volume 49(2), April 2020, p 701-702 Free Access	2019	Open Access *"The finding of a weak association between exposure to the extremely low-frequency magnetic field and neurodegenerative diseases suggests the continuation of research on this topic. Moreover, the low consistency between the results of the already existing studies emphasises the importance of increasingly refined study designs."*
The potential for impact of man-made super low and extremely low frequency electromagnetic fields on sleep [Literature Review]	Ohayon, M.M. et al. (2019) 'The potential for impact of man-made super low and extremely low frequency electromagnetic fields on sleep', Sleep Medicine Reviews, 47, pp. 28–38. Available at: https://doi.org/10.1016/j.smrv.2019.06.001.	2019	Abstract *"While some of the earlier studies indicated that EM fields may have a suppressive effect on melatonin, the results cannot be generalized because of the large variability in exposure conditions and other factors that may influence melatonin. For instance, exposure to radiofrequency EM fields on sleep architecture show little or no effect. […]"*
"These Power Lines Make Me Ill": A Typology of Residents' Health Responses to a New High-Voltage Power Line [Netherlands?]	Porsius, J.T., Claassen, L., Woudenberg, F., Smid, T. and Timmermans, D.R.M. (2017), '"These Power Lines Make Me Ill": A Typology of Residents' Health Responses to a New High-Voltage Power Line' Risk Analysis, 37: 2276-2288. https://doi.org/10.1111/risa.12786	2017	Abstract *"Based on our findings we can conclude that there is a considerable heterogeneity in health responses to a new HVPL. Health risk perceptions appear to play an important role in this typology, which has implications for risk management."*
Biological effects of exposure to static electric fields in humans and vertebrates: a systematic review.	Petri, AK., Schmiedchen, K., Stunder, D. et al. (2017) 'Biological effects of exposure to static electric fields in humans and vertebrates: a systematic review' Environ Health 16, 41 (2017). https://doi.org/10.1186/s12940-017-0248-y	2017	Open Access *"The weight of the evidence from the literature reviewed did not indicate that static EF have adverse biological effects in humans or animals. The evidence strongly supported the role*

			of superficial sensory stimulation of hair and skin as the basis for perception of the field, as well as reported indirect behavioral and physiological responses."
Memory loss risk assessment for the students nearby high-voltage power lines—a case study [Iran]	Ghadamgahi, M., Monazzam, M.R. and Hosseini, M. (2016) 'Memory loss risk assessment for the students nearby high-voltage power lines—a case study', Environmental Monitoring and Assessment, 188(6). Available at: https://doi.org/10.1007/s10661-016-5358-4.	2016	Abstract *"The findings revealed a reverse correlation between magnetic flux density and working memory of students (R = −0.255). It is concluded that extremely low frequency magnetic field exposure may have a negative impact on the working memory of children, but further studies are necessary to reach a definitive conclusion."*
Association between Exposure to Electromagnetic Fields from High Voltage Transmission Lines and Neurobehavioral Function in Children	Huang J, Tang T, Hu G, Zheng J, Wang Y, et al. (2013) 'Association between Exposure to Electromagnetic Fields from High Voltage Transmission Lines and Neurobehavioral Function in Children.' PLOS ONE 8(7): e67284. https://doi.org/10.1371/journal.pone.0067284	2013	Open Access *"The results suggest long-term low-level exposure to EMF from HVT lines might have a negative impact on neurobehavioral function in children. However, because of differences in results only for two of four tests achieved statistical significance and potential limitations, more studies are needed to explore the effects of exposure to extremely low frequency EMF on neurobehavioral function and development in children."*
Residential Distance to High-voltage Power Lines and Risk of Neurodegenerative Diseases: a Danish Population-based Case-Control Study	Frei, P., et al (2013). 'Residential Distance to High-voltage Power Lines and Risk of Neurodegenerative Diseases: a Danish Population-based Case-Control Study' American Journal of Epidemiology, Volume 177, Issue 9, 1 May 2013, Pages 970–978, https://doi.org/10.1093/aje/kws334	2013	Open Access? *"The risk of Alzheimer's disease was not increased for ever living within 50 m of a power line (hazard ratio = 1.04, 95% confidence interval: 0.69, 1.56). No dose-response according to number of years of living within 50 m of a power line was observed, but there were weak indications of an increased risk for persons diagnosed by the age of 75 years. Overall, there was little support for an association between neurodegenerative disease and living close to power lines."*
Residence Near Power Lines and Mortality From Neurodegenerative Diseases: Longitudinal Study of the Swiss Population	Huss, A, Spoerri, A., Egger, M, Röösli, M (2009) 'Residence Near Power Lines and Mortality From Neurodegenerative Diseases: Longitudinal Study of the Swiss Population', American Journal of Epidemiology, Volume 169, Issue 2, 15 January 2009, Pages 167–175, https://doi.org/10.1093/aje/kwn297	2009	Open Access? *"Persons living at least 5 years within 50 m had an adjusted hazard ratio of 1.51 (95% CI: 0.91, 2.51), increasing to 1.78 (95% CI: 1.07, 2.96) with at least 10 years and to 2.00 (95% CI: 1.21, 3.33) with at least 15 years. The pattern was similar for senile dementia. There was little evidence for an increased risk of amyotrophic lateral sclerosis, Parkinson's disease, or multiple sclerosis."*
Association between high voltage overhead transmission lines and mental health: A cross-sectional study [Japan?]	Yamazaki, S., et al (2006), 'Association between high voltage overhead transmission lines and mental health: A cross-sectional study.' Bioelectromagnetics, 27: 473-478. https://doi.org/10.1002/bem.20227	2006	Abstract *"The prevalence of poor MH was 15%. Among the 223 subjects, 10 lived within 100 m of a HVOTL. The adjusted odds ratios (OR) for poor MH among those who lived 101–300 m or within 100 m from HVOTL were 1.29 (95% confidence interval (CI): 0.35–10.13) and 1.87 (95% CI: 0.35–10.13), respectively, against the reference category (300+ m). MH status was not significantly associated with the distance between the subject's residence and the closest HVOTL."*

Risk of Cognitive Impairment in Relation to Elevated Exposure to Electromagnetic Fields [Taiwan?]	Li, Chung-Yi PhD; Sung, Fung-Chang PhD; Wu, Shwu Chong PhD. (2002) 'Risk of Cognitive Impairment in Relation to Elevated Exposure to Electromagnetic Fields.' Journal of Occupational and Environmental Medicine 44(1):p 66-72, January 2002.	2002	Abstract "Compared with background exposure, the risk was equal or close to unity for participants with higher exposure from a previous occupation (odds ratio [OR], 1.3; 95% confidence interval [CI], 0.7 to 2.3), higher residential exposure (OR, 0.9; 95% CI, 0.3 to 2.6), or higher exposure in both occupation and residential environments (OR, 1.0; 95% CI, 0.2 to 4.6). Our findings provide little support for the link between PF-EMF and cognitive impairment. Nevertheless, the study results do not preclude the possible association between PF-EMF and any specific neurodegenerative disease previously investigated."
[Epidemiological studies on neurotic disturbances, anxiety and depression disorders in a population living near an overhead high voltage transmission line (400 kv)].. [In Polish]	Zyss T (1999). [Epidemiological studies on neurotic disturbances, anxiety and depression disorders in a population living near an overhead high voltage transmission line (400 kv)].. Psychiatria Polska, 33(4), 535-51. **See also:** Zyss T, et al (1997) '[Neurotic disturbances, depression and anxiety disorders in the population living in the vicinity of overhead high-voltage transmission line 400 kV. Epidemiological pilot study]. ' [In Polish] Med Pr. 1997;48(5):495-505. Polish. PMID: 9501332. Full Abstract via PubMed *"The measurements of the electric field levels taken at the front walls of investigated buildings averaged much higher than normal values of safety exposure. Our investigation showed the increased psychopathological values in all clinical tests. The difference between the group exposed to EMF and the control population was statistically significant. The results of our study did not support a possible cause-and-effect relationship between EMF and psychopathology observed. Some other factors (noise) can be responsible for the data obtained."*	1999	Abstract via PubMed *"The population resident in the closest neighborhood of the examined transmission-line manifested high level of psychopathology, significantly different than that in the control group. However, the obtained results do not allow us to state univocally whether the observed psychopathology remains in causal nexus with the exposure to electromagnetic field. Other factors, like noise, may also be responsible for these results. The hypothesis that electromagnetic fields generated by high-voltage transmission lines may evoke depressive disorders and depression requires further clinical and experimental studies."*
Magnetic Fields of Transmission Lines and Depression [Finland?]	Verkasalo, P.K, et al (1997) 'Magnetic Fields of Transmission Lines and Depression', American Journal of Epidemiology, Volume 146, Issue 12, 15 December 1997, Pages 1037–1045, https://doi.org/10.1093/oxfordjournals.aje.a009232	1997	Open Access? *"The adjusted mean Beck Depression Inventory scores did not differ by exposure, providing some assurance that proximity to high-voltage transmission lines is not associated with changes within the common range of depressive symptoms. However, the risk of severe depression was increased 4.7-fold (95% confidence interval 1.70–13.3) among subjects living within 100 m of a high-voltage power line. This finding was based on small numbers."*
Psychological effects of chronic exposure to 50 Hz magnetic fields in humans living near extra-high-voltage transmission lines	Beale, I.L., Pearce, N.E., Conroy, D.M., Henning, M.A. and Murrell, K.A. (1997), 'Psychological effects of chronic exposure to 50 Hz magnetic fields in humans living near extra-high-voltage transmission lines'. Bioelectromagnetics, 18: 584-594. https://doi.org/10.1002/(SICI)1521-186X(1997)18:8<584::AID-BEM7>3.0.CO;2-Z	1997	Abstract *"Performance on most memory and attention measures was unrelated to exposure, but significant linear dose-response relationships were found between exposure and some psychological and mental health variables. In particular, higher time-integrated exposure was associated with poorer coding-test performance and more adverse psychiatric symptomatology. These associations were found to be independent of*

			participants' beliefs about effects of electromagnetic fields."
Electric and magnetic fields (EMF): What do we know about the health effects?	Valberg, P.A. (1996) 'Electric and magnetic fields (EMF): What do we know about the health effects?' Int Arch Occup Environ Health 68, 448–454 (1996). https://doi.org/10.1007/BF00377868	1996	Abstract *"Due to the ubiquitous presence of electric power, the public health implications of this association are potentially very significant; however, good evidence for a causal relationship between exposure to EMF and any health effect has not been found."*
Symptom Prevalence and Worry about High Voltage Transmission Lines	Mcmahan, S. and Meyer, J. (1995) 'Symptom Prevalence and Worry about High Voltage Transmission Lines', Environmental Research, 70(2), pp. 114–118. Available at: https://doi.org/10.1006/enrs.1995.1055.	1995	Abstract [This may only be a published abstract e.g. a conference abstract?] *"For those who lived on the easement, the most worried respondents were more likely to report health problems. Disclosure of health problems may depend more on individuals' level of worry about rather than proximity to overhead transmission lines. Possible limitations of this study include personality variables such as hypo-chondriasis which were not assessed, recall bias, and social desirability. […]"*
Depressive Symptomatology in Women and Residential Proximity to High-Voltage Transmission Lines	McMahan, S., Ericson, J. and Meyer, J. (1994) 'Depressive Symptomatology in Women and Residential Proximity to High-Voltage Transmission Lines', American Journal of Epidemiology, 139(1), pp. 58–63. Available at: https://doi.org/10.1093/oxfordjournals.aje.a116935. See also: Clarke, K. and Leo, E (1995) 'RE: "Depressive symptomatology in women and residential proximity to high-voltage transmission lines", American Journal of Epidemiology, Volume 142, Issue 11, 1 December 1995, Pages 1248–1249, https://doi.org/10.1093/oxfordjournals.aje.a117588	1994	Abstract *"The results indicated that the average magnetic field level is 4.86 mG at the front door of homes adjacent to transmission lines and 0.68 mG at the front door of homes one block away. There was no significant difference in CES-D scores between the groups when demographic variables were controlled for. The homogeneity of the study population may limit the generalizability of findings."*
Depressive Symptoms and Headaches in Relation to Proximity of Residence to an Alternating-Current Transmission Line Right-of-way	Poole, C. et al. (1993) 'Depressive Symptoms and Headaches in Relation to Proximity of Residence to an Alternating-Current Transmission Line Right-of-way', 137(3), pp. 318–330. Available at: https://doi.org/10.1093/oxfordjournals.aje.a116679.	1993	Abstract *"Proximity to the line, defined as residing on a property abutting the right-of-way or being able to see the towers from one's house or yard, was positively associated with a measure of depressive symptoms. The association was not explained by demographic variables associated with depression or by attitudes about power lines or other environmental issues. The estimated prevalence odds ratio was 2.8 (95% confidence interval (CI) 1.6–5.1). The estimate did not change appreciably when the definitions of depressive symptoms or of proximity to the line were altered. Nonmigraine headaches had a weaker association with proximity to the line (odds ratio = 1.5, 95% CI 0.76–2.8), and self-reported migraine headaches exhibited no association (odds ratio = 0.99, 95% CI 0.29–3.4)."*

The effects of high voltage transmission lines on the health of adjacent resident populations.	R C Haupt, and J R Nolfi (1984) 'The effects of high voltage transmission lines on the health of adjacent resident populations.", American Journal of Public Health 74, no. 1 (January 1, 1984): pp. 76-78. https://doi.org/10.2105/AJPH.74.1.76	1984	Open Access? *"Results revealed no significant or consistent relationships between exposure to a high-voltage DC power line and the perceived health problems that were measured. The sample was not, however, large enough to draw statistically significant conclusions regarding possible health effects with a very low incidence."*
Environmental Power-frequency Magnetic Fields and Suicide	Perry, Stephen F.; Reichmanis, Maria; Marino, Andrew A.; Becker, Robert O.. (1981) 'Environmental Power-frequency Magnetic Fields and Suicide'. Health Physics 41(2):p 267-277, August 1981.	1981	Abstract *"We studied the relationship between power-frequency magnetic fields and locations of suicidal deaths in 1969–76 in the West Midlands, England. We found a significant correlation between suicide locations and the measured power-frequency magnetic field strength. Significantly more suicides occurred at locations of high magnetic field strength"*
Effect of extremely low frequency electromagnetic field exposure on sleep quality in high voltage substations. [Iran]	Barsam, T., M. R. Monazzam, A. A. Haghdoost, M. R. Ghotbi, and S. F. Dehghan. (2012) 'Effect of extremely low frequency electromagnetic field exposure on sleep quality in high voltage substations.' Iranian J. Environ. Health Sci. Eng. 9:1–7. doi:10.1186/1735-2746-9-15.	2012	Open Access *"Although there was a higher percentage for the case group with poor sleep quality than the control group, but no statistically significant difference was observed."*
Occupational and environmental risk factors of adult primary brain cancers: a systematic review	Gomes, J., Al Zayadi, A., & Guzman, A. (2011). 'Occupational and environmental risk factors of adult primary brain cancers: a systematic review.' The international journal of occupational and environmental medicine, 2 2, 82-111 .	2011	Abstract via PubMed *"On the basis of this review we suggest a concurrent evaluation of multiple risk factors both within and beyond occupational and environmental domains. The concurrent approach needs to consider better exposure assessment techniques, lifetime occupational exposures, genotypic and phenotypic characteristics and lifestyle and dietary habits. This approach needs to be interdisciplinary with contributions from neurologists, oncologists, epidemiologists and molecular biologists. Conclusive evidence that has eluded multitude of studies with single focus and single exposure needs to multifaceted and multidisciplinary."*
Elevated residential exposure to power frequency magnetic field associated with greater average age at diagnosis for patients with brain tumors.	Li, C.-Y., Lin, R.S. and Sung, F.-C. (2003), 'Elevated residential exposure to power frequency magnetic field associated with greater average age at diagnosis for patients with brain tumors.' Bioelectromagnetics, 24: 218-221. https://doi.org/10.1002/bem.10095	2003	Abstract *"Comparing with brain tumor cases with background magnetic field exposure (n = 506), brain tumor cases with elevated exposure (n = 71) were 6 years older on average at diagnosis (P = 0.01). The difference was greater for males (45.2 vs. 52.1 years, P = 0.01) than for females (44.3 vs. 48.2 years, P = 0.27). No such phenomena at a significant level was observed for leukemia, female breast cancer, or a random sample of general population. We noted an association between magnetic field exposure and a greater mean age at diagnosis for brain tumors."*

Childhood Brain Tumor Occurrence in Relation to Residential Power Line Configurations, Electric Heating Sources, and Electric Appliance Use	Gurney, J.G. et al (1996) 'Childhood Brain Tumor Occurrence in Relation to Residential Power Line Configurations, Electric Heating Sources, and Electric Appliance Use' American Journal of Epidemiology, Volume 143, Issue 2, 15 January 1996, Pages 120–128, https://doi.org/10.1093/oxfordjournals.aje.a008718	1996	Open Access? *"These data do not support the hypothesis that exposure to magnetic fields from high-current power lines, electric heating sources, or electric appliances is associated with the subsequent occurrence of brain tumors in children."*
A cohort study on adult hematological malignancies and brain tumors in relation to magnetic fields from indoor transformer stations [Finland]	Khan, M.W. et al. (2021) 'A cohort study on adult hematological malignancies and brain tumors in relation to magnetic fields from indoor transformer stations', International Journal of Hygiene and Environmental Health, 233, p. 113712. Available at: https://doi.org/10.1016/j.ijheh.2021.113712.	2021	Open Access "The HR [hazard risk] for meningioma was 0.46 (95% CI: 0.19–1.11), with no evidence of exposure-response gradient with increasing duration of exposure. The HR for glioma was 1.47 (95% CI: 0.84–2.57). The hypothesis of a positive association between ELF MFs and adult hematological malignancies was supported only for ALL. The results suggested decreased rather than increased risk of most hematological neoplasms."
Investigating the effects of exposure to extremely low frequency electromagnetic fields on job burnout syndrome and the severity of depression; the role of oxidative stress [Iran]	Bagheri Hosseinabadi, M. et al. (2020) 'Investigating the effects of exposure to extremely low frequency electromagnetic fields on job burnout syndrome and the severity of depression; the role of oxidative stress', Journal of Occupational Health, 62(1), p. e12136. Available at: https://doi.org/10.1002/1348-9585.12136.	2020	Open Access *"The thermal power plant workers exposed to ELF-EMFs are at risk of burnout syndrome and depression. These effects may be caused directly by exposure to magnetic fields or indirectly due to increased oxidative stress indices."*
The statistical evaluation of the environmental risk of electromagnetic fields on employees in an electrical distribution company [Turkey]	Yoran-Aktas, B; Coskun, O (2018) 'The statistical evaluation of the environmental risk of electromagnetic fields on employees in an electrical distribution company' FRESENIUS ENVIRONMENTAL BULLETIN, Volume 27, Issue 3, Page1953-1959	2018	Open Access? *"The results of the survey of the experimental and control groups among the diseases diagnosed, only there is a significant difference in terms of incidence of a migraine. (P<0,05) (X2 =7,951, P=0,004). No significant differences were found between the groups for diabetes, hyper-tension, kidney disease, lung disease, cancer, allergic disease, infertility and other disease types. (P> 0.05).*
Occupational exposure to steady magnetic fields and mental health of workers at the copper electrolysis unit [Iran]	Ghotbi, M. R., H. Mardi, N. Khanjani, and N. Parvaresh. (2015) 'Occupational exposure to steady magnetic fields and mental health of workers at the copper electrolysis unit' J. Saf. Stud 1:1–10. doi:10.5296/jss.v1i2.8485.	2015	Open Access *"In this study the mean intensity of the steady magnetic field in the exposed group was 2.5 mT. The mean rank of mental health in the exposed group was 102.04 and in the unexposed group was 78.96 and the difference was statistically significant (p=0.003). Also there were statistical differences between the two groups in anxiety and sleep disorder (p=0.001) and depression (p=0.007) dimensions."*
Health problems from radiation of high-voltage facilities	Rizi, H.A.Y; Dehghan, H (2013) 'Health problems from radiation of high-voltage facilities' International Journal of Environmental Health Engineering 2(1):p 1, Jan–Dec 2013. | DOI: 10.4103/2277-9183.106632	2013	Open Access *"This study indicates that increased symptoms among the exposed workers including depression, anxiety, hostility, paranoia, inter-sensitivity, and obsession-compulsion. Some of the self-reported symptoms were, headache (53.5%), fatigue (35.6%), difficulties in concentration (32.5%),*

			vertigo/dizziness (30.4%), attention disorders (28.8%), nervousness (28.1%), and palpitations (14.7%). A significant relationship was observed between the exposure to the electromagnetic field and psychological symptoms (P < 0.05).”
Depression in high voltage power line workers. [Brazil]	de Souza SF, Carvalho FM, de Araujo TM, Koifman S & Porto LA (2012). ‘Depression in high voltage power line workers.’ Revista Brasileira de Epidemiologia, 15(2), 235-45. https://dx.doi.org/10.1590/s1415-790x2012000200001 See also: Souza SF, Carvalho FM, Araujo TM & Porto LA (2010). ‘Psychosocial factors of work and mental disorders in electricians.’ Revista de Saude Publica, 44(4), 710-7. https://dx.doi.org/10.1590/s0034-89102010000400015 [Open Access]	2012	Open Access *“The group of low reward workers presented a depression prevalence rate 6.2 times greater than those in the high reward group. The depression prevalence rate was 3.3 greater in workers in the situation of imbalanced effort-reward than in those in effort-reward equilibrium. CONCLUSIONS: The prevalence of depression was strongly associated with psychosocial factors present in the work of electricity workers.”*
Long-term exposure to magnetic fields and the risks of Alzheimer’s disease and breast cancer: Further biological research.	Davanipour, Z., and E. Sobel. (2009) ‘Long-term exposure to magnetic fields and the risks of Alzheimer’s disease and breast cancer: Further biological research.’ Pathophysiology 16:149–56. doi:10.1016/j.pathophys.2009.01.005.	2009	Abstract *“The evidence indicates that long-term significant occupational exposure to ELF MF may certainly increase the risk of both Alzheimer's disease and breast cancer. There is now evidence that two relevant biological processes (increased production of amyloid beta and decreased production of melatonin) are influenced by high long-term ELF MF exposure that may lead to Alzheimer's disease.”*
Psychological effects of occupational exposure to electromagnetic fields [Iran]	Yousefi, H. A., and Nasiri, P 2(006) ‘Psychological effects of occupational exposure to electromagnetic fields’ *J. Res. Health Sci.* 6:18–21.	2006	Open Access? *“This study indicated increased symptoms including depression, anxiety, hostility, paranoia, interpersonal-sensitivity, and obsession-compulsion among exposed workers. A significant relationship was observed between the exposure of electromagnetic field and psychological symptoms”*
Exposure to electromagnetic fields and suicide among electric utility workers: a nested case-control study	Wijngaarden, E. van et al. (2000) ‘Exposure to electromagnetic fields and suicide among electric utility workers: a nested case-control study’, Occupational and Environmental Medicine, 57(4), pp. 258–263. Available at: https://doi.org/10.1136/oem.57.4.258.	2000	Abstract *“These data provide evidence for an association between occupational electromagnetic fields and suicide that warrants further evaluation. A plausible mechanism related to melatonin and depression provides a direction for additional laboratory research as well as epidemiological evaluation.”*
Electromagnetic hypersensitivity: Fact or fiction?	Genuis, S.J. and Lipp, C.T. (2012) ‘Electromagnetic hypersensitivity: Fact or fiction?’, Science of The Total Environment, 414, pp. 103–112. Available at: https://doi.org/10.1016/j.scitotenv.2011.11.008.	2012	Abstract *“Many people report symptoms when near devices emanating electromagnetic fields(EMF). ► Electromagnetic hypersensitivity (EHS) research has generated conflicting outcomes. ► Recent evidence suggests pathophysiological change in some individuals with EHS. ► EHS patients consistently report profound social and personal challenges. ► Clinicians need to be apprised of the EHS condition and potential interventions.”*

Consultations in primary care for symptoms attributed to electromagnetic fields – a survey among general practitioners [Switzerland]	Huss, A., Röösli, M. (2006) 'Consultations in primary care for symptoms attributed to electromagnetic fields – a survey among general practitioners'. BMC Public Health 6, 267 (2006). https://doi.org/10.1186/1471-2458-6-267	2006	Open Access *"In our survey, GPs often judged the association between the health problems and the suspected exposure to be plausible. This plausibility assessment seems to be based on grounds of preventive positions in a situation of scientific uncertainty. More research effort is needed to obtain more insight on a potential association between long term EMF exposure and unspecific symptoms."* [14% consultations related to power lines. Symptoms across the whole study included: sleeplessness, anxiety, nervousness / restlessness, difficulties concentrating].
The prevalence of symptoms attributed to electromagnetic field exposure: a cross-sectional representative survey in Switzerland.	Schreier, N., Huss, A. & Röösli, M. (2006) 'The prevalence of symptoms attributed to electromagnetic field exposure: a cross-sectional representative survey in Switzerland.' Soz.-Präventivmed. 51, 202–209 (2006). https://doi.org/10.1007/s00038-006-5061-2	2006	Abstract *"We found a prevalence of 5% (95% CI 4–6%) for electromagnetic hypersensitivity (EHS) in our study sample. The most common health complaints among EHS individuals were sleep disorders (43%) and headaches (34%), which were mostly attributed to power lines and mobile phone handsets."*
Symptoms of ill health ascribed to electromagnetic field exposure – a questionnaire survey [Switzerland]	Röösli, M. et al. (2004) 'Symptoms of ill health ascribed to electromagnetic field exposure – a questionnaire survey', International Journal of Hygiene and Environmental Health, 207(2), pp. 141–150. Available at: https://doi.org/10.1078/1438-4639-00269.	2004	Abstract [27% of complainants associated their symptoms with power lines. Over the whole study symptoms included: sleep disorders, nervousness or distress, concentration difficulties.]
Neurological effects of static and extremely-low frequency electromagnetic fields [Review]	Lai, H. (2022) 'Neurological effects of static and extremely-low frequency electromagnetic fields', Electromagnetic Biology and Medicine, 41(2), pp. 201–221. doi: 10.1080/15368378.2022.2064489.	2022	Abstract *"Results suggest that free radicals, both reactive oxygen species and reactive nitric species could be involved. Depending on the conditions of exposure, either harmful or beneficial effects could result. It is important to carry out further investigation to identify these conditions. However, Caution should be taken to extrapolate the experimental data to human exposure, since higher field intensites than environmental levels were used in most laboratory research."*
Human exposure to power frequency magnetic fields up to 7.6 mT: An integrated EEG/fMRI study.	Modolo, J., Thomas, A.W. and Legros, A. (2017), 'Human exposure to power frequency magnetic fields up to 7.6 mT: An integrated EEG/fMRI study.' Bioelectromagnetics, 38: 425-435. https://doi.org/10.1002/bem.22064	2017	Abstract *"Combined with previous findings in which effects were observed on the BOLD signal after 1 h exposure to 3 mT, 60 Hz MF, this suggests that MF exposure in the low mT range (<10 mT) might require prolonged durations of exposure to induce detectable effects."*
Limiting electric fields of HVDC overhead power lines.	Leitgeb, N. (2014) 'Limiting electric fields of HVDC overhead power lines.' Radiat Environ Biophys 53, 461–468 (2014). https://doi.org/10.1007/s00411-014-0520-2	2014	Abstract *"Based on theoretical and experimental data, in this article, static electric fields associated with adverse health effects are analysed and various criteria are derived for limiting static electric field strengths."*

No influence of short-term exposure to 50-hz magnetic fields on cognitive performance function in human	Kurokawa, Y., H. Nitta, H. Imai, and M. Kabuto. (2003) 'No influence of short-term exposure to 50-hz magnetic fields on cognitive performance function in human' Int. Arch. Occup. Environ. Health 76:437–42. doi:10.1007/s00420-003-0445-6.	2003	Abstract *"The results indicate that extremely low-frequency electromagnetic fields in the occupational environment are unlikely to interfere with human brain function so much as to lower working efficiency or accuracy."*