Power-Line EMFs: New Focus on Alzheimer's Disease

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It's not just childhood leukemia anymore. Alzheimer's Disease is poised to take center stage in the long-simmering EMF-health controversy.

A couple of weeks ago, a group led by Martin Röösli at Switzerland's University of Bern reported that people living within 50 meters of a high-voltage power line were more likely to die with Alzheimer's. The longer they lived near a 220-380 kV power line, the greater the risk: After 15 years, the odds of dying with Alzheimer's were double the expected rate. It is this striking dose-response —with the risk increasing over time— that makes the Swiss study compelling. Röösli told *Microwave News* that he himself found the consistency of this increase "surprising." Other members of the Röösli team are Anke Huss, Adrian Spoerri and Matthias Egger.

The new residential study adds to a growing body of work that links Alzheimer's to occupational EMF exposures. Last year, in a review for the *BioInitiative Report,* Zoreh Davanipour and Gene Sobel concluded that there is "strong epidemiological evidence" that magnetic fields are a risk factor for Alzheimer's Disease. Back in 1994, Davanipour and Sobel, who are husband and wife and are based in Chicago, were the first to make this association (see *MWN,* J/A94, p.4). Seamstresses who use industrial sewing machines appeared to be particularly vulnerable. "This new Swiss study strengthens my opinion that long-term EMF exposure likely leads to Alzheimer's," Sobel told *Microwave News.* "I think that the association is real."

In a meta-analysis published in the April issue of the *International Journal of Epidemiology*, Ana Garcia of the University of Valencia, Spain, reported that the combined data from 14 occupational studies showed that, in general, being exposed to EMFs on the job doubled the risk of developing Alzheimer's —about the same as Röösli found among those exposed from power lines at home. This

may well be a low estimate, according to Sobel. If the association is real, he said, then the true risk would be larger because Alzheimer's is often incorrectly specified as the cause of death on death certificates. As Röösli pointed out in his new paper, when diagnoses are based on clinical examinations rather than on death certificates, rates of Alzheimer's Disease can be as much two to eight times higher.

As in all epidemiological studies, occupational or residential, estimating exposures is at best approximate. Röösli said that exposures above 1 μT (10 mG) from power lines are rare in Switzerland. "I think that 0.3-0.4 μT (3-4 mG) would be a plausible value," he said, estimating the magnetic fields in homes next to the high-voltage lines. This is the same level as has been implicated in studies linking childhood leukemia to power-line EMFs.

The case favoring a link between EMFs and Alzheimer's has only become persuasive quite recently. An earlier meta-analysis, published in *Occupational and Environmental Medicine* last November, found that the association was inconsistent and unconvincing. This paper, also from Spain (Garcia worked on this one too), appeared just five months before the Valencia study. Why the sudden shift in outlook? The *OEM* analysis only included studies published through June 2003, while the cutoff for the *IJE* paper was April 2006. During those three years four new studies came out: three from Sweden (Feychting, Håkansson and Qiu) and one from Turkey (Harmanci). All four pointed to an Alzheimer's risk. (In an interview, Garcia explained that her two papers appeared so close together because of the journals' publication schedules.)

Then last year, after Garcia's second cut-off date, two more epidemiological studies were published: One by Röösli and the other by Sobel and Davanipour. Once again, both supported a link. "It is hard to believe that these associations are entirely due to bias," Röösli wrote in an invited commentary that accompanied the second Garcia meta-analysis.

Röösli closes his new paper on residential exposures on a note of uncertainty. "Despite the large sample size covering the whole Swiss population, these findings must be interpreted with caution, because of the lack of known biologic mechanisms," he wrote. Sobel and Davanipour have tried to fill this gap: As far back as 1996, they put forward a hypothesis that showed how EMFs could cause Alzheimer's. The process begins, they proposed, when magnetic fields increase the flow of calcium ions into cells. This, in turn, leads to the build-up of amyloid beta, a known neurotoxin, in the blood stream. Amyloid beta eventually makes its way into the brain by crossing the blood-brain barrier, where, in ways not yet fully understood, it aggregates into plaques that are hallmarks of Alzheimer's.

[If cell phone radiation can increase the permeability of the blood-brain barrier —another hot-button and unsettled issue— then it might amplify the action of EMFs by helping amyloid beta cross from the blood stream into the brain.]

"The new Röösli study is consistent with our 1996 hypothesis," Sobel said, explaining that the higher risk of Alzheimer's among those with the longest exposure fits with the idea of accumulation of amyloid beta over time. "It wouldn't take a lot of effort to find out whether magnetic fields can lead to an increase of amyloid beta in the blood," he said. In fact, Curtis Noonan and John Reif did measure a small increase of amyloid beta in the blood of electric utility workers, but, as they pointed out in a paper published in 2002, the study was limited because the workers' exposures were quite low. "To my knowledge, this was the first attempt to use amyloid beta as a biomarker for exposure to EMFs," Reif said in a telephone interview from his office at Colorado State University. "It has yet to be replicated."

Everyone agrees —Garcia, Röösli and Sobel— that more work on biological mechanisms need to be done. But as Sobel points out, "It's next to impossible to get money to do these studies."

Martin Röösli, Anke Huss, Ana Garcia, Alzheimer's disease, Zoreh Davanipour, Gene Sobel, Maria Feychting, John Reif, Curtis Noonan,

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