

Homework assignment # 1

Please read the article, titled "Epidemiologic study of residential proximity to transmission lines and childhood cancer in California: description of design, epidemiologic methods and study population" (SO: Journal of Exposure Science and Environmental Epidemiology (2015) 25, 45–52) and answer the following questions.

1. What is the research objective of this study?

The research objective of this study was to assess the association between childhood cancer risk and exposure to high-voltage overhead transmission lines. Specifically, it replicated a study from the United Kingdom (Draper et al.) in California. The objective of this article, however, differed slightly from the study as a whole. Whereas the study aimed to quantify an association, this paper sought simply to describe the methods by which that association was measured.

2. What is the true primary exposure in this study?

The "true" primary exposure in this study is exposure to extremely low frequency magnetic fields (ELF MF).

3. What is (are) the exposure variable(s) used to measure the true primary exposure?

Since actually measuring children's exposure to extremely low frequency magnetic fields would be impractical and costly (or perhaps impossible), the researchers use a "proxy" variable which is closely correlated with the "true" exposure. That proxy variable is distance from the home address to nearby overhead transmission line.

4. What information did the authors use to develop the variable(s)?

The authors used a "three-tiered approach" to measuring the exposure:

1. distance according to the electric power companies' databases (lines within 2000m of a residence)
2. aerial imagery from Google Earth (lines within 200m of a residence)
3. site visits (for lines close enough to produce high MF levels)

5. Please discuss the limitations and strengths of the selected surrogate measures of exposure regarding dose (duration, frequency and intensity) and time of exposure?

Strengths:

1. The authors used multiple sources to validate their measurement of exposure, thereby reducing error.
2. The authors actually measured and assessed the correlation between two of their measures (Google Earth vs. utility), and were thereby able to demonstrably quantify the high value of their measurements.
3. The authors supplemented their data with actual visits (boots on the ground).

4. The authors' measures were able to achieve high specificity, which they note to be important for low prevalence diseases (since many false positives can make it difficult to distinguish the signal from the noise).
5. The authors' note that the conclusiveness of the cancer registry means that there is no participation or recall bias.
6. This study is part of a larger series of studies being done in Europe and Denmark, which means that potential associations (even with some inaccuracy in measurement) can be compared with similar studies elsewhere.

Weaknesses:

1. The authors only utilized actual site visits for some residences (those with a case and those who were very close to lines), which may have introduced bias to their data (more variability in and less accuracy in non-visited locations).
2. Proximity to high-voltage lines is most likely non-random. In other words, those who live near these lines are likely different from those who don't live near those lines in more ways than simply the exposure. This is known as "selection effect" and introduces non-randomness to exposure assignment (bias). The authors specifically mention this issue of "mobility."
3. Duration of dose was essentially not measurable: a child may have lived in the residence for 1 month or 1 year, and this difference was not known to the researchers.
4. Dosage itself was not measured fully, since children spend a significant portion of their time outside of the primary residence (and have different exposures there).
5. Again regarding dosage, the strength of a magnetic field varies widely based on voltage, and this issue was only tangentially addressed.
6. Frequency of exposure is also not fully knowable. The existence of a line does not necessarily mean the use of that line, and location of the child at the moment of the generation of ELF MF is entirely unknown.
7. Google Earth's aerial photographs are compiled from multiple sources, thereby introducing non-randomness to the accuracy of aerially-obtained measurements.
8. The authors correctly note that information on "viral infections, parental occupation and diet" was entirely unavailable.