
ALZHEIMER MORTALITY – WHY DOES IT INCREASE SO FAST IN SPARSELY POPULATED AREAS?

ÖRJAN HALLBERG¹, M.SC. E.E., AND OLLE JOHANSSON², ASSOC. PROFESSOR

- 1) Polkavägen 14B, 142 65 Trångsund, Sweden
2) Experimental Dermatology Unit, Department of Neuroscience, Karolinska Institute,
S-171 77 Stockholm, Sweden
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Reprint requests and correspondence to: Örjan Hallberg, e-mail: oerjan.hallberg@swipnet.se

Abstract

Purpose: To investigate the mortality in nervous system-related diseases in different parts of Sweden to see if it may have any correlation to mobile phone output power. **Methods:** The average output power from mobile phones was calculated based on power measurements and information on mobile system coverage over the country. Mortality data was obtained from the National Board of Health and Welfare in Sweden. **Results:** The main contribution to the increased mortality in nervous system-related diseases was deaths due to increasing mortality in Alzheimer's disease (AD). The correlation between mobile phone average output power and mortality has increased the last few years and is today significant. **Conclusions:** The mortality in Alzheimer's disease appears to be associated with mobile phone output power. The mortality is increasing fast and is expected to increase substantially within the next 10 years. Deeper studies in this complex area are necessary.

Introduction

Telia AB and Ericsson Research have demonstrated that the average output power from mobile phones varies between different parts of Sweden due to varying degrees of mobile system coverage [1]. This degree of coverage is well documented on the web pages issued by the main Swedish mobile system operators, Telia AB, Tele2 AB and Vodafone AB. It is also evident that the health care costs are the largest in counties having high average output pulse power from mobile phones [2].

Several scientific studies point at risks for decreased health, e.g. cochlea nerve cancer [3,4] after long term use of mobile phones. We thus decided to study if counties where the average output power from the mobile phones is high also have a high mortality in nervous system diseases.

Recent investigations of the effect from microwave radiation on the brain has risen the fear that it might accelerate Alzheimer's disease (AD). "What can be red from these results is that there is a suspected health risk in using a mobile phone. A disease like Alzheimer's disease might appear after ten years or so" [5].

Another nervous system disease is ALS, amyotrophical lateral sclerosis, that primarily attacks the spinal nerves and to a less extent the brain. No reports or suggestions have so far been put forward to connect ALS with the use of mobile phones. The hypothesis to test is thus that Alzheimer mortality should show a significant correlation with the output power from the mobile phones while no such correlation should be found for ALS.

Methods

The average output pulse power from mobile phones was calculated based on mobile phone coverage maps over all counties in Sweden together with real measurements of output power in several parts of Sweden. The measured output power [1] was used to 'calibrate' the coverage information by a simple model: $P(W) = 2-0,95T-0,55 T^2$ where T is the fraction of the county area that is claimed to have full coverage according to the operators. The coverage T represents the status around 1999 according to available coverage maps and can here be seen as some kind of average for the time period 1997 to 2001. The modelling thus did not consider the variation in coverage over time. Note that the output power represents an average value for all mobile phones in the county and not an individual level for one single phone. The output power from one individual phone may at a given time be as low as 2 mW while the lowest average value according to the model is 500 mW.

All data on the mortality in nervous system diseases was obtained from The National Board of Health and Welfare in Sweden. It became obvious that this mortality showed an increase from the late 1980's. All main groups according to the classification were then analysed for trend changes and we found that the single main contributor to the increasing mortality was that of Alzheimer's disease (AD). AD was then studied regarding its mortality over the time period 1969 to 2002, both regarding trends and correlation to mobile phone output power data. The mortality data was also reviewed for all different age groups and the changing number of deaths per age group. Another nervous disease, ALS, was also studied regarding its mortality and possible correlation to mobile phone output power in the Swedish counties.

Results

Figure 1 shows that the number of deaths in nervous system diseases started to increase from late 1980's and onwards. In the same graph is given the number of deaths in circulation-related diseases, where no such trend-break is seen. As a matter of fact, this trend is continuously improving.

A closer analysis of different diseases within the group "nervous system diseases" revealed that AD was the main contributor to the strong increase of deaths during the years since the late 1980's.

Figure 2 shows the crude mortality in AD according to The National Board of Health and Welfare in Sweden. In the same diagram the accumulated numbers of spoken mobile phone minutes since 1981 have been added.

Figure 2 made it logical to investigate if counties having high output power from mobile phones also have a high mortality in AD and other nervous system diseases. This is presented in Figure 3. Figure 4 shows that the mortality in AD has been increasing faster in the more sparsely populated counties of Sweden than in more densely populated counties.

In Figure 3 we noticed a significant correlation between average output power and the average mortality in AD during 2000 to 2002. It is worth mentioning that mobile phones and related transmitters first became available for public communication in 1981.

A similar analysis of the correlation between ALS mortality and output power from mobile phones was done. Figure 5 shows that in this case no correlation was found.

Figure 6 gives the age-specific mortality in AD in Sweden for the years 1969 to 2002 and Figure 7 gives the age-standardised mortality (ASR 1970) for the same years.

Figure 8 shows, finally, the extrapolated number of annual deaths in AD based on estimated future prevalence of AD in Sweden [6].

Discussion

This disease is typically affecting elderly people but hits occasionally also people under 50 years of age. Both men and women are victims. Before 1981 only a few deaths (<40) were registered as caused by AD. According to Kjell Asplund at the National Board of Health and Welfare in Sweden those were mostly younger victims. Older cases were not always registered as deaths due to Alzheimer, but more likely due to other reasons. However, as time passed deaths due to AD became more frequently noticed and the outcome can be seen in Figure 2. This also means that the earlier low numbers of Alzheimer deaths actually might have been somewhat larger if the underlying cause of death had been more carefully considered.

Over the time there have been changes in death-cause classification [7]. However, according to the National Board of Health and Welfare in Sweden there was not a substantial change in the classification of Alzheimer deaths in 1997, i.e. Alzheimer deaths after 1997 includes also pre-senile dementia deaths just as before. Figure 1 also shows that there was no stepwise increase of the number of deaths due to AD between 1996 and 1997 as clearly was the case for the deaths from other nervous diseases.

Figure 2 indicates a possible relationship between the use of mobile phones and deaths in AD. Such a connection has been indicated by animal studies [8, 9]. The fact that we can see a significant connection between the mortality of this disease and the average output pulse power from mobile phones also gives a strong argument to suspect a connection between the disease and the use of mobile phones.

Figure 6 shows that the mortality in age groups 62, 67 and 72 years have stabilised while age groups 77 to 85+ still are continuously increasing or possibly just about to settle (77). This could indicate that an environmental change suddenly started to affect elderly people. A similar pattern, effective from the age of puberty, seems to have developed since 1955 in Sweden regarding malignant melanoma of skin [10].

There are a some questions related to this study worth discussing:

1. Is there any risk of passive exposure?

Yes, but this is part of the general exposure picture from mobile phones. Either you talk in the phone yourself or a neighbour in the bus will expose you to 900 MHz/1800 MHz. This does not change the analysis at all in this case.

2. Is it enough with “one/few” exposure or is the cumulative exposure of importance for the development of the disease?

We have not shown that the disease is caused by using mobile phones, but that the cumulative exposure may accelerate the mortality among AD victims.

3. Is there a latency period between exposure and death? How long?

The accumulated risk of dying from AD is a strong function of age, or actually as it seems, exposure time from the date one has been diagnosed by AD. Figure 6 shows that 10-15 years after 70 years of age the mortality will today increase quite substantially.

4. Is there a plausible biological explanation?

It has been postulated [5] that mobile phone radiation might cause Alzheimer disease after approximately 10 years of use. The fear is based on experimental results from rat studies of the interaction between mobile phones and the brain, predominantly the blood-brain-barrier (BBB). This interaction has been demonstrated by different independent studies already in the 1970's.

5. Do persons with the disease use mobile phones more frequently than those without the disease?

This has not been studied, yet. The question refers to the relative rate of mobile phone use among Alzheimer patients and the normal population. Actually, it is more likely that Alzheimer patients do not use mobile phones as much as the normal population. If they have been using mobiles more frequently before they turned ill still needs to be determined.

Our main hypothesis is that already developed cases of Alzheimer's disease will accelerate and generate a higher death-rate due to the generally increasing exposure to radiation from their own mobile phones, neighbours in the bus and from mobile phone base stations.

6. Are the age, sex and geographical distributions of the outcome and the independent variables in agreement?

Yes, mortality is increasing for the oldest age-groups and is stable for younger groups according to Figure 6. There is not a noticeable difference between the sexes in mortality. The geographical distribution follows the coverage from the mobile phone system at a significant level ($p < 0.002$), see Figure 3. It also turns out that the mortality (Age Standardised Rate, ASR) has been increasing more in sparsely populated counties than it has in the more densely populated counties, see Figure 4.

7. Does the exposure cause the disease or is it a promoter for deaths among individuals with the disease?

At present the hypothesis is that exposure to mobile phone radiation promotes the disease to progress towards death. We still have to investigate the influence, if any, it may have on the initiation and onset of new cases of Alzheimer's disease. This is a quite separate study.

8. Could this be a coincidence?

Traditionally, the National Board of Health and Welfare in Sweden and the Swedish Radiation Protection Authority as well as textbooks point at the use of incidence rather than mortality for ecological studies. However, when we are going to look at the influence from a suddenly imposed environmental stress, such as the FM broadcasting in 1955, or the mobile phones, the mortality may be the first characteristic that reacts on the exposure. This is because there always are a number of patients, still alive, who suddenly gets an attack on their immune defence system. And who will first die from this type of attack, healthy people or already weakened cancer patients?

We can not state, based on the material presented here, that mobile phones cause AD, but we can raise a warning for a possible danger that mobile phone use may make the disease worse. The fact that older age-groups still show increasing mortality while younger groups are stable indicates that a sudden change to the environment has taken place, possibly from the midst of the 1980's.

Conclusions

1. The mortality in Alzheimer's disease is significantly higher in counties having higher output pulse power from mobile phones than in those having lower output power.
2. The mortality has increased by 106% from 1997 to 2002 in sparsely populated counties and by 71% in the more densely populated counties.
3. Simply by extrapolating the trends of annual deaths in AD we expect over 1600 deaths per year due to AD in Sweden by 2015.
4. ALS mortality does not seem to be associated with the mobile phone output power in different Swedish counties.
5. It is highly motivated to invest more effort into deeper studies of the relationships presented in this short report.

Acknowledgements

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References

1. Persson T, Törnevik C, Larsson L.E., Lovén J. 2002. GSM Mobile phone output power distribution by network analysis of all calls in some urban, rural and in-office networks, complemented by test phone measurements. Bioelectromagnetics Society Annual Meeting, Quebec, Canada, June 23-27, 2002.
2. Hallberg Ö, Johansson O. 2004. Mobile handset power and health. *Electromagn Biol Med*; 23: 229-239.
3. Hardell L, Mild KH, Carlberg M. 2003. Further aspects on cellular and cordless telephones and brain tumours. *Int J Oncology*; 22: 399-407.
4. Lönn S, Ahlbom A, Hall P, Feychting M. 2004. Mobile phone use and the risk of acoustic neuroma. *Epidemiology*; 15: 653-659.
5. Professor Bertil Persson interviewed by Aftonbladet, 2000-02-11; <http://www.aftonbladet.se/nyheter/0002/11/mobil.html>.
6. Sjöberg M. På väg mot en god demensvård – Samhällets insatser för personer med demenssjukdomar och deras anhöriga (Report in Swedish), Social Ministry, Ds 2003:47.
7. Måns Rosén, the National Board of Health and Welfare in Sweden, e-mail comment, 2004, <http://home.swipnet.se/Uncover/Letters/FrSOS040311.pdf>.
8. Salford LG, Brun A, Stureson K, Eberhardt JL, Persson BR. 1994. Permeability of the blood-brain barrier induced by 915 MHz electromagnetic radiation, continuous wave at 8, 16, 50 and 200 Hz. *Microsc Res Tech*; 27: 535-542.
9. Salford LG, Brun A, Stureson K, Eberhardt JL, Persson BR. 2003. Nerve cell damage in mammalian brain after exposure to microwaves from GSM mobile phones. *Environ Health Perspect*; 111: 881-883.
10. Hallberg Ö, Johansson O. 2005. FM broadcasting exposure time and malignant melanoma incidence. *Electromagn Biol Med*; 24: 1-8.

Figures

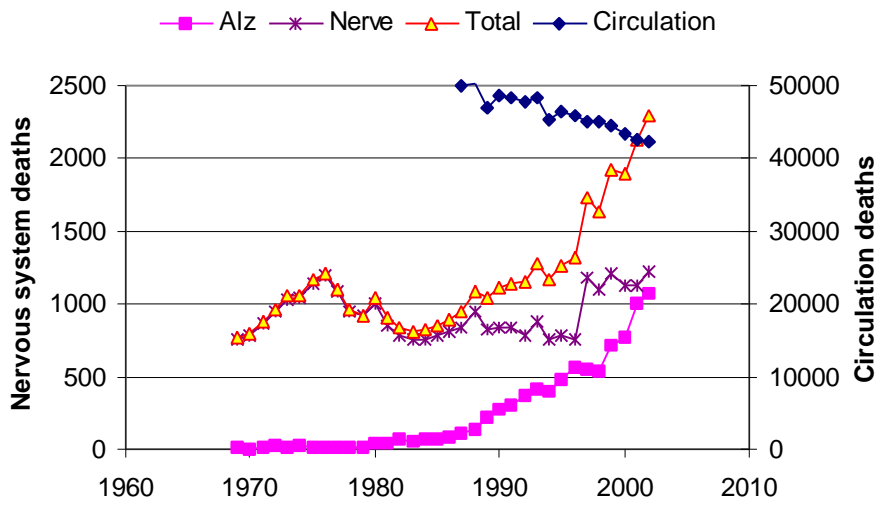


Figure 1. Number of deaths in Alzheimer's disease and other nervous system- and circulation-related diseases in Sweden.

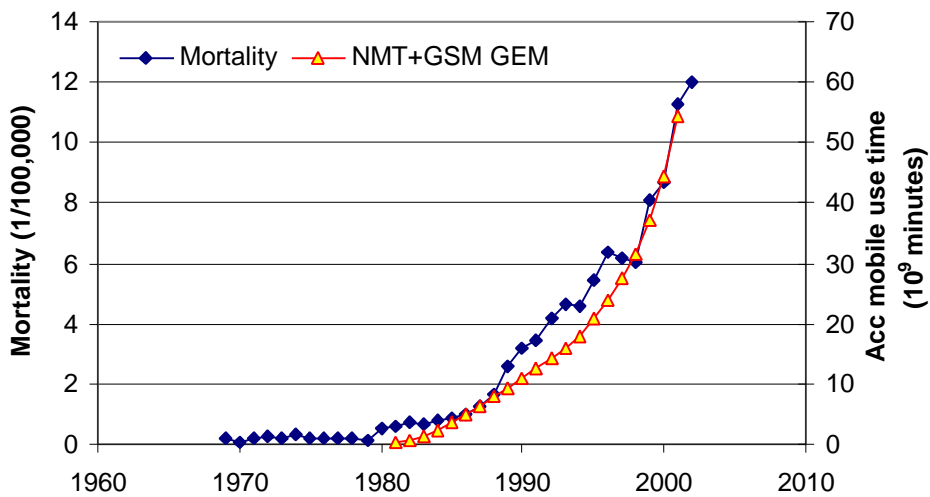


Figure 2. The crude mortality in Alzheimer's disease is accelerating and looks similar to the accumulated number of mobile phone minutes spoken since 1981. GEM = Giga Ear-heating Minutes.

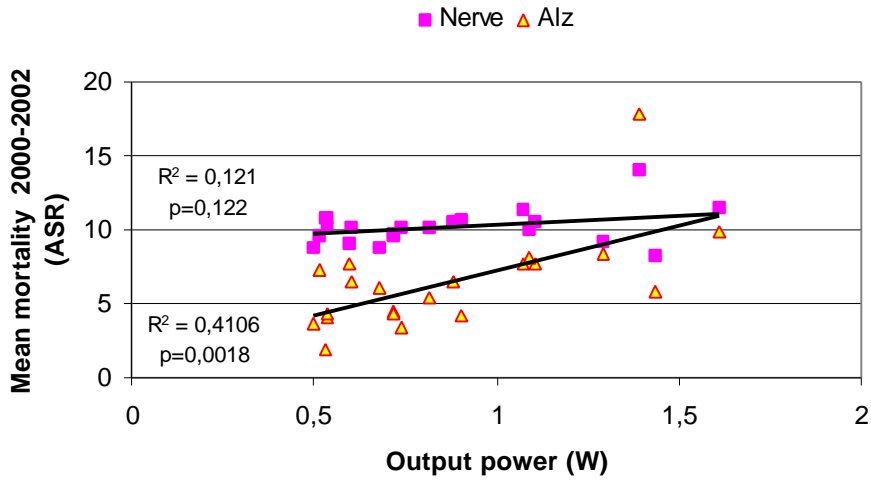


Figure 3. The graph gives the age-standardised mortality (ASR) in Alzheimer's disease and in other nervous diseases in all Swedish counties between 2000 and 2002 vs. the average estimated output mobile phone peak pulse power.

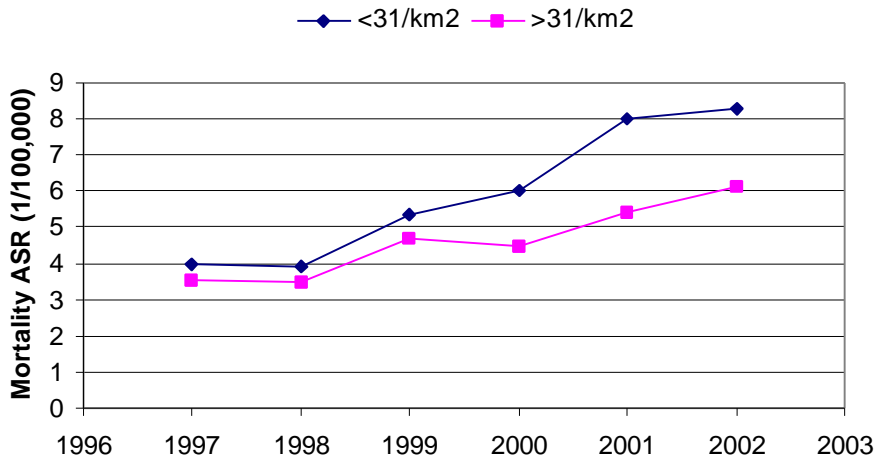


Figure 4. This graph shows the age-standardised mortality (ASR) due to Alzheimer's disease in sparsely and densely populated counties in Sweden from 1997 to 2002.

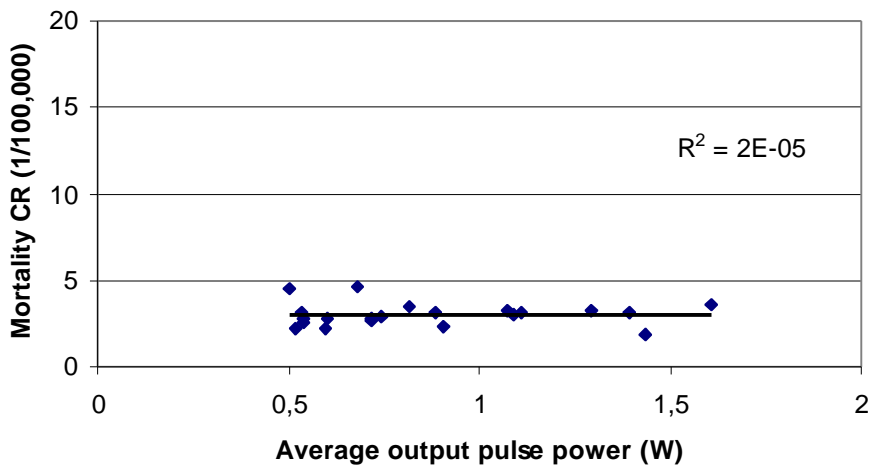


Figure 5. The crude rate mortality in ALS measured as average for the time period 1997-2001 is plotted against the average output peak pulse power from mobile phones in all Swedish counties.

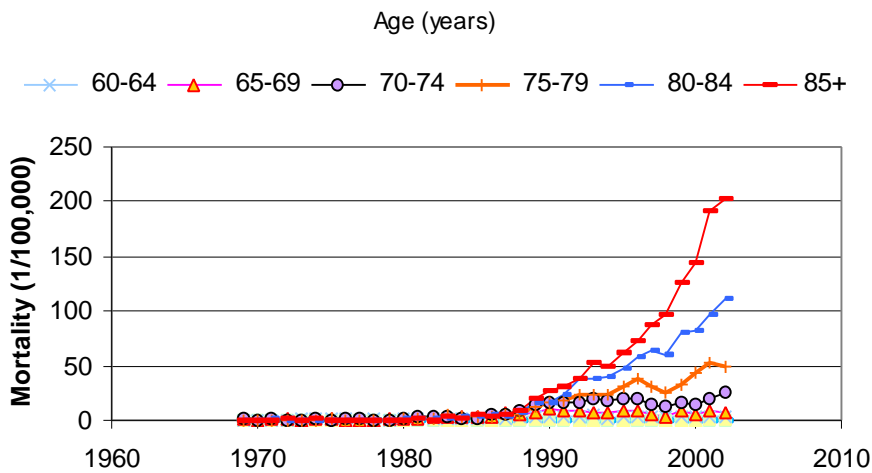


Figure 6. The age-specific mortality in Alzheimer's disease is continuously increasing among older age groups.

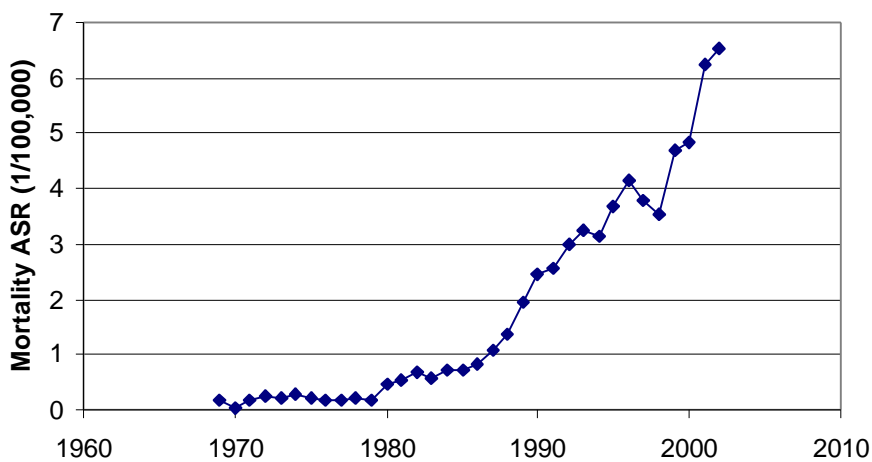


Figure 7. The age-standardised mortality (ASR) is increasing at an accelerating rate.

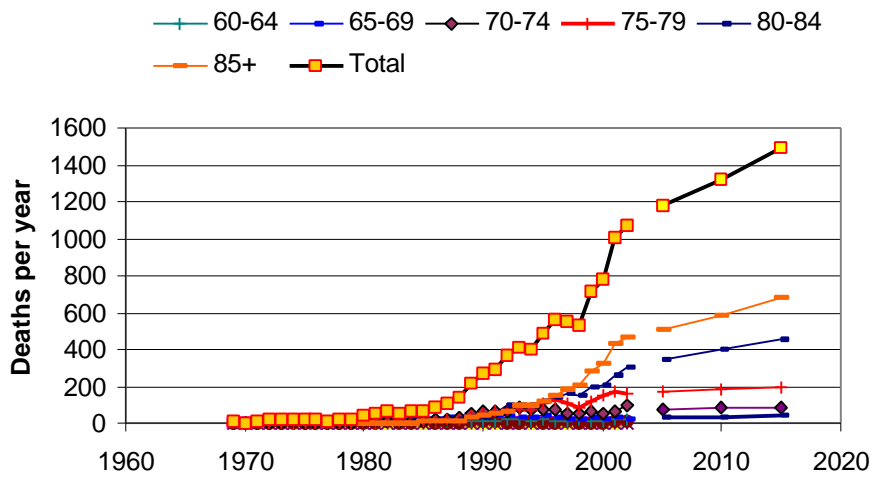


Figure 8. The annual number of deaths in AD has here been extrapolated up to year 2015.