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Mobile Handset Output Power and Health

Örjan Hallberg and Olle Johansson

Experimental Dermatology Unit, Department of Neuroscience, Karolinska Institute, S-171 77 Stockholm, Sweden

The public health situation in Sweden has become drastically worse since the Autumn of 1997. A massive roll-out of GSM main transmitter towers and roof-mounted transmitters that became allowed after mid-1997 led to a booming sale of GSM handsets all over Sweden. The authorities in Sweden have issued a brochure on 'Radiation from Mobile Systems' [1] stating that good transmitter coverage leads to low handset output power that can vary from 2 W down to 0.001 W [2]. Thus, we examined health statistics data and GSM coverage in all counties in Sweden, Norway and Denmark. Here, we show that there is a very strong correlation between health degradation and weak GSM coverage, while there is no such relation noticed for the time period 1981–1991 when no handset power regulation was applied. The immediate implications from this study are the needs for: 1) a deeper analysis of handset power levels and health statistics and, 2) reconsideration of the planned massive roll-out of yet another mobile system (3G).

Key Words: GSM; Mobile; Base Station; Illness; Health

INTRODUCTION

The number of people in Sweden absent from work due to illness has increased from 118,530 people in August 1997 to 309,124 in February 2003 (see Fig. 1). The number of people that have been sick for more than one year has increased from 43,256 in July 1997 to 135,318 in February 2003 (Fig. 2).

Several investigations have tried to pin-point the reason and background for this trend that really took off during the Autumn in 1997. Basically,

Address correspondence to: Örjan Hallberg, Polkavagen 14B, 142 65, Trangsund, Sweden, E-mail: oerjan.hallberg@swipnet.se

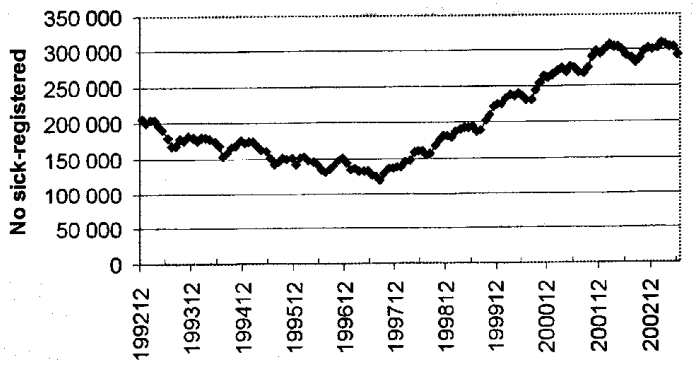

Figure 1: The total number of sick-registered persons in Sweden per month from December 1992 to June 2003.

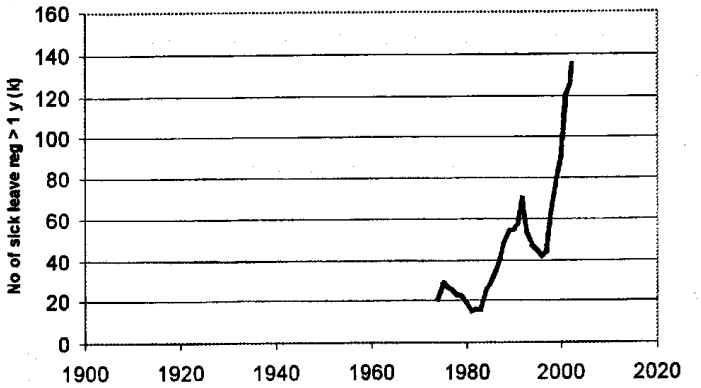

Figure 2: The number of people in Sweden that have been sick for more than one year.

all efforts so far have been devoted to reviewing the administration, the process for sick-leave acceptance, benefits, unemployment connections, early retirement procedures, degrading social morals, etc. It has been noticed that the northern parts of Sweden and also all areas that are sparsely populated have the highest increase of registered sick-leave days. So far, no plausible explanation has been presented that gives a basis for improvements and

corrective actions. One major change in the last few decades has been the introduction of mobile systems that started in 1981 with the analogue NMT system followed by GSM from 1994 onwards. The GSM system has the ability to adapt the output power to the distance from the base station. This is seen as an advantage for those who live in areas with good transmitter coverage since the handset output power might be as low as 1/2,000 of the maximum output power sometimes needed in less populated regions of Sweden.

In a comment on health aspects on mobile system radiation COST 281 [3] states the following: *If there is a health risk from mobile telecommunication systems (MTCS), it should first be seen in epidemiological studies of handset use* (2002). Thus, we decided to take a closer look at health progress and GSM coverage data in Sweden, Norway and Denmark.

METHODS

The basic idea was to compare the health degradation in different counties in Sweden to see if it in any sense correlates with corresponding GSM coverage data. We looked into the health statistics provided by Riksförsäkringsverket (RFV) [4] to characterise the change in average number of unhealthy days registered per inhabitant and year from measurements taken from 1981 to 2002. For details refer to [5], Table 1.

In order to get numbers representing the GSM coverage we contacted The National Post and Telecom Agency (Post- och Telestyrelsen (PTS)), in Sweden and asked for averaged coverage data per county. This request unfortunately was denied due to 'safety of the country' as we were told. This was later denied but still no data was provided, because it would have required excess work [6]. Instead, we used coverage map information web-published by the mobile operators, Telia Mobile, Vodafone and Comviq [7–9]. For each county and operator the percent of uncovered area was measured in the total area of the county. PTS provided information about the operators' respective shares of the subscribers (47%, 16%, and 36% respectively in 2001). Based on that material, average numbers for the GSM uncovered areas were calculated. See Table 1 in ref. [5].

We also retrieved data from Norway in order to make a similar analysis. Via the web page of Rikstrygdeverket [10] we got information about the average cost increase for health care that had incurred from 1993 to 2002. We used TeleNor's web information to download GSM coverage maps for all counties ("fylke") and estimated the geographical coverage per fylke.

Finally, we similarly examined all counties ("amt") in Denmark. The Social Security Council in Denmark has published data on health care costs in all counties for the years 1990 and 2000 [11]. Via web information, provided by Tele Denmark A/S [12], GSM coverage maps were retrieved and analysed.

RESULTS

The correlation between the percent uncovered area and the unhealth number in Sweden 2002 after deduction of sick days in 1981 (when no mobile system was present) was astonishingly strong, $R^2 = 0.781$ with $p < 0.00001$. For detailed information refer to [5], Table 1.

In 1981 the total span of sick days ranged from 16 to 23 days (difference = 7 days over the whole country) while in 2002 the span was from 18 to 30 days (difference = 12 days). In 1981 the densely populated regions had the highest sick numbers while in 2002 the sparsely populated regions had the highest sick numbers.

In order to investigate more recent trends we looked at the number of registered sick-days in 1997 and 2002, respectively. Again we found a very strong correlation between uncovered area and increase of sick-days in the Swedish counties (adjusted $R^2 = 0.73$). Fig. 3 shows the results of this analysis.

We repeated the analysis for the years 1981 to 1991 when no GSM phones were used. The older system (NMT) did not adapt the output power to the distance to the mobile transmitter tower. Fig. 3 shows that the correlation coefficient R^2 was only 0.0047 for data measured from 1981 to 1991. A similar analysis for the time period 1981–1993 gave a correlation coefficient of $R^2 = 0.0229$. According to Telia Mobile the first GSM subscribers were registered in 1994.

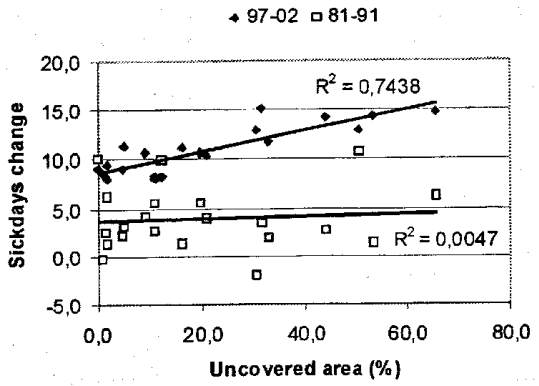

Figure 3: Sick days change in Swedish counties (1981–1991 and 1997–2002) vs. area not covered by GSM transmitters in 2002.

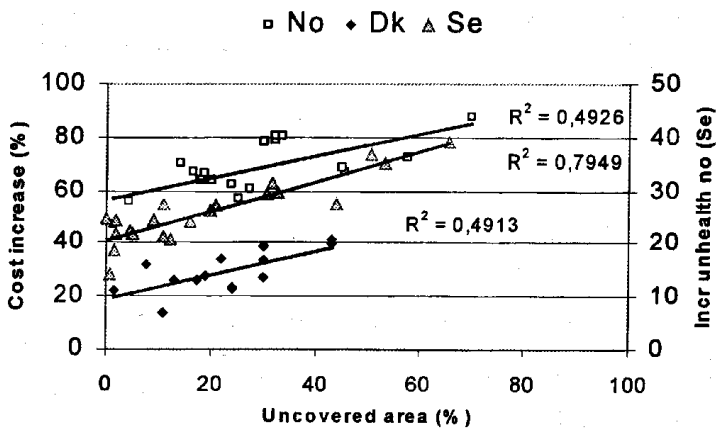

Figure 4: Health care cost increase in Norway and Denmark for 1993–2002 and 1990–2000, respectively, together with the difference in unhealthy number in Sweden [4] for 1981–2002 vs. the area of each county that is not fully covered by GSM transmitters.

The data from Norway is listed in ref. [5], Table 2 and is plotted in Figure 4. Here also we see a close correlation with adjusted $R^2 = 0.48$. Again, it is clear that counties having large uncovered areas have suffered most from health degradation, in this case since 1993.

The third country, Denmark, also showed a similar trend. Our results are presented in ref. [5], Table 3 and are also plotted in Fig. 4. It should be noticed that Denmark is a small country and the geographical circumstances are quite similar with generally good mobile coverage in contrast to Norway. Therefore, we defined the uncovered area as those places where GSM can not be used inside a car. The company Tdcmobile A/S provided this information on their website [12]. The adjusted correlation coefficient is $R^2 = 0.45$.

In Sweden 6 authorities have issued a brochure on radiation from mobile systems [1]. It states (authors' translation from Swedish): "The more transmitters that are used the less power is needed by the handsets and base stations for transmission. Thus, the radiation from base stations and handsets will become weaker."

In another pamphlet issued by the Swedish Radiation Protection Institute (SSI) [13] it is stated that: "The radiation from the base stations cannot be influenced by one self, but it is generally thousands times lower than the radiation from a handset". SSI also states that: "Any biological effect that is damaging health has not been possible to show."

In order to see if individual types of sickness also correlated with GSM coverage we collected data for the following diseases in all counties:

1. The average number of recreation days after breast cancer treatment.
2. The average number of recreation days after heart infarct treatment.
3. Mortality due to circulation problems.
4. Mortality due to nervous system problems.
5. Prostate mortality increase.
6. Multiple sclerosis incidence increase (2000 to 2001 only).

Figures 5–10 show the results including correlation coefficients.

We also took a look at the rehabilitation time after work-related injuries and illness in all counties of Sweden by support from the Swedish Work Environment Authority. Again, we can see a strong correlation between recovery time and GSM mobile system coverage (see Fig. 11).

DISCUSSION

Obviously, the total influence on population health measured in cost or unhealthy standard measure gives the strongest correlation with GSM coverage numbers. Looking at individual diseases we can also see similar trends. Rehabiliation times after either breast cancer surgery or heart infarcts clearly correlate to GSM coverage. We can see a similar trend for nervous

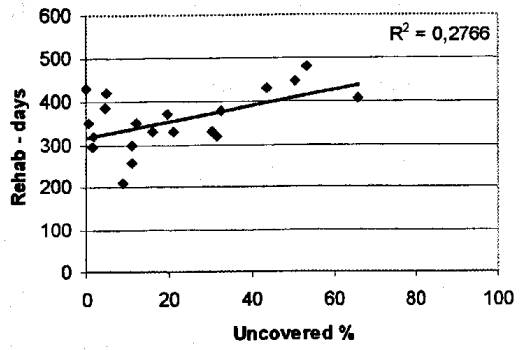

Figure 5: Days needed for rehabilitation of breast cancer treatment in the different Swedish counties vs. area not having maximum coverage.

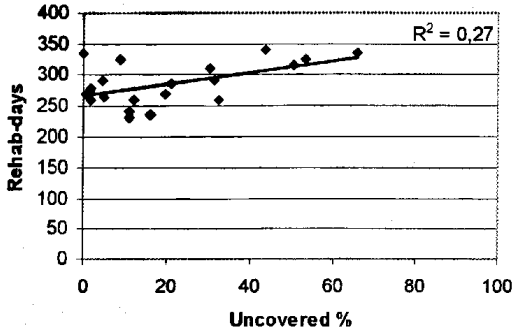

Figure 6: Days needed for rehabilitation after heart infarct treatment in the different Swedish counties vs. area not having maximum coverage.

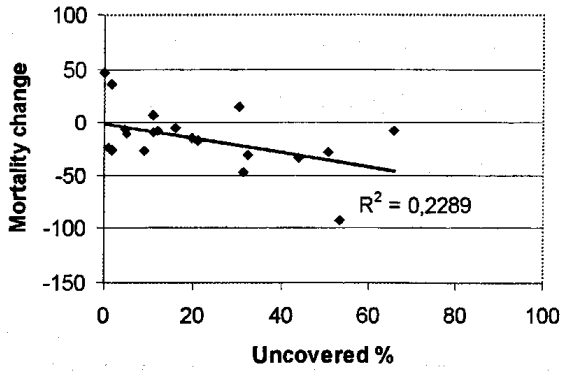

Figure 7: Change in mortality (1/100,000) between 1996–2000 due to heart disease in the different Swedish counties vs. area not having maximum coverage.

system diseases while prostate cancer and multiple sclerosis do not appear to correlate with coverage data. All diseases that are dependent on the efficiency of the immune defence system (IDS) are likely to increase in the population if IDS is being impaired by microwave radiation.

Circulation diseases like heart infarct are more related to blood transportation properties and not directly to the immune defence system. Interestingly, we noticed that the mortality due to circulation problems seems

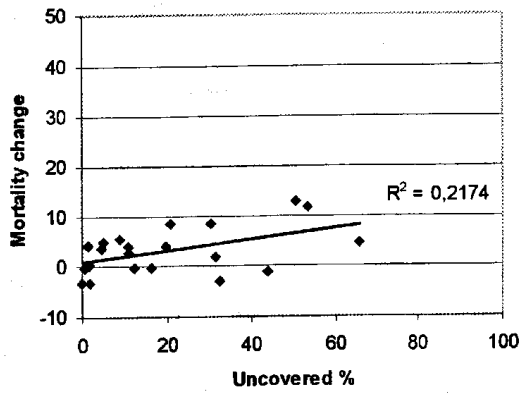

Figure 8: Change in mortality between 1996–2000 due to nervous system disease in the different Swedish counties vs. area not having maximum coverage.

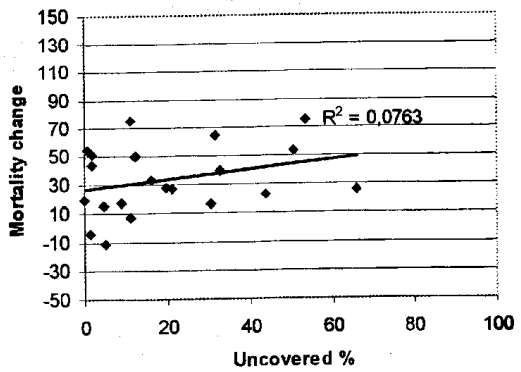

Figure 9: Change in mortality between 1996–2000 due to prostate cancer in the different Swedish counties vs. area not having maximum coverage.

to decrease with increasing levels of microwave radiation (Fig. 7). It has been noticed by the Swedish authorities that this type of disease has been improving for several years while no specific reason for the improvement has been presented.

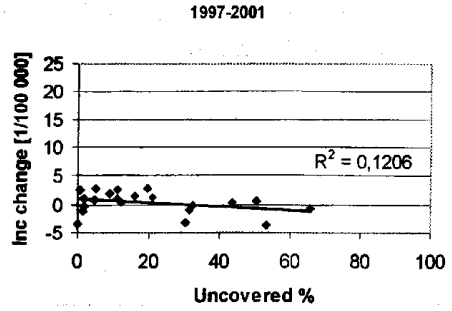

Figure 10: Change in incidence of multiple sclerosis between 1997–2001 in the Swedish different counties vs. area not having maximum coverage.

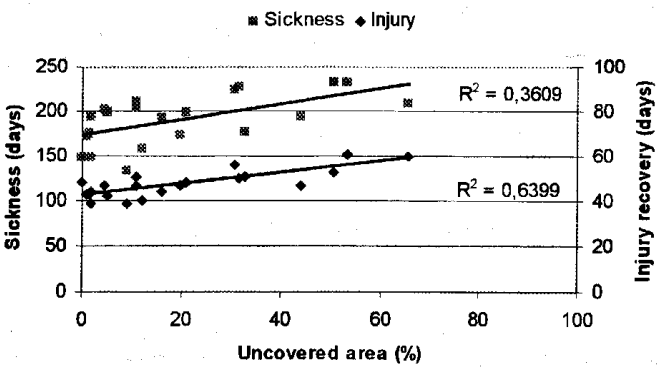

Figure 11: The recovery time after work-related injuries and sickness is related to the area of the Swedish counties that has not full GSM coverage (= uncovered).

The fact that recovery time after work-related injuries and sickness also has a strong correlation to the GSM coverage again underscores the importance of this research area.

Since we found these strong indications of a connection between mobile phone use and the national health status, we decided to look into the relationship between total amount of spoken mobile phone minutes over time and the development of long-term illness. Fig. 12 shows the result of that simple study, based on information from The National Post and Telecom

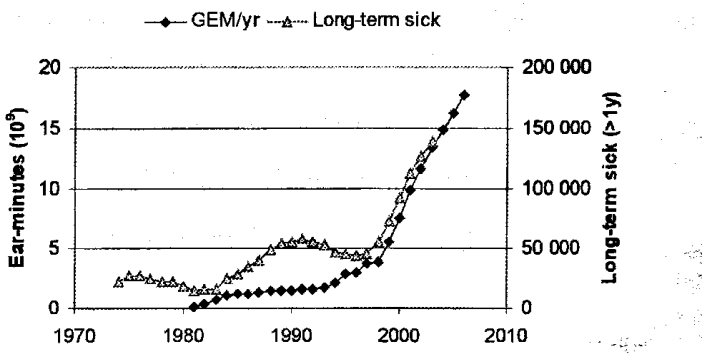

Figure 12: The initial down-going line of long-term sick people is halted around 1994 and turns upward as the number of ear-minutes per year accelerates. A similar trend shift was seen a few years after 1981 when the first mobile phone system (NMT) was rolled-out. GEM = Giga Ear-Minutes.

Agency, PTS. As can be seen, the result can not be used as an argument in support of mobile phone safety.

CONCLUSIONS

This brief report puts a question-mark on the health implication from mobile phones with high output-power radiation. We strongly recommend halting any further roll-out of the next generation mobile systems before we understand this strong correlation between GSM coverage and health degradation in Sweden, Norway and Denmark.

Our findings, despite the fact that PTS refused to provide Swedish data, show clearly that the health statistics in the Nordic countries indeed supports the statement by the authorities regarding the "positive" effects from a good coverage of base stations.

Cancer-related diseases and the recovery speed after surgery as well as after work-related injuries and sickness seem to be negatively influenced by high mobile output-power levels, while the risk for death due to circulation problems appears to be reduced by output power level. Other reports have pointed at the improved circulation health status, although the population continues to add weight and reduce its physical exercise.

Although 100% coverage (0% uncovered) is the best option it appears that the health status in such areas in Sweden has also degraded by around 11 sick days only since 1997. This represents a tremendous cost increase for society. A corresponding result was found in cost measures for Norway and Denmark.

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