

Appendices

Appendix 1

The Powerwatch response to the October 2005 Health Protection Agency – Radiation Protection Division report on Electrical Sensitivity

Summary:

The HPA-RPD report "Definition, Epidemiology and Management of Electrical Hypersensitivity" unfortunately was limited to a carefully conducted review of the published literature - which for ES is extremely sparse. This HPA-RPD review gathers some useful information together but offers little of any practical use from a public health perspective.

This is a missed opportunity and GPs would have greatly benefited from some practical advice. At present they tend to blame the reported health effects on stress and so prescribe tranquilisers and other psychoactive medication.

We have to ask why, if they really do not have the expertise to recognise medical conditions, did the NRPB (now the HPA-RPD) commission this report in the first place? Who was it for? Who should do what now?

In the words of the review's foreword, the review "was commissioned by the NRPB to consider the definition, epidemiology and management of ES." To do this the review was largely defined by seven questions as follows:

1. Is there a characteristic set of symptoms associated with ES?
2. Are the triggers the same in all sufferers?
3. Is there a characteristic time course and prognosis for the condition?
4. Is the condition more common in certain groups in the population?
5. Is there a diagnostic test or pathophysiological marker characteristic of ES?
6. Are there management strategies that are known to be effective?
7. Is there an overlap with other syndromes such as multiple chemical sensitivity or other environmental illnesses?

Although there are overlaps, questions "1", "2" "5" and "7" can be seen as defining ES, "3" and "4" as the epidemiology of ES, and "6" as the management of ES.

Definition of ES

The review concluded that "It has not been possible to construct a meaningful definition of ES..." (Section 5.1 paragraph 1).

This conclusion is quite reasonable, due mainly to the wide range of symptoms experienced by ES sufferers and the wide range of sources that appear to cause these symptoms. The statement that "the review found no consistent evidence of objective clinical signs or sensitive/specific pathophysiological markers" (Section 5.1 paragraph 2) is similarly reasonable, though it could be taken as implying that the symptoms may not actually exist - which they do.

The final paragraph in the section is also acceptable, though it has an unnecessary final sentence that seems to have been inserted in order to weaken the section. Having noted that ES seems to share a number of its symptoms with other "functional somatic syndromes" and "idiopathic environmental intolerances" (the difference being that ES is normally attributed by the sufferer to a specific EMF source), the review finishes with "Other than noting the ongoing debate about this attribution, however, this review is unable to comment further". This is a real shame as the content of the review gave plenty of room to make further comments, and the lack of comment is therefore a deliberate decision, as opposed to there being a lack of data to comment on.

It could be argued that they are implying that there is not sufficient evidence to make a genuine association between ES symptoms and an EMF source except for the assertion of the sufferers, whereas some of the research cited in the review clearly suggests otherwise. For example, they cite a published questionnaire in section 4.5.5 (Rösli [2004](#)), where 394 people with self-attributed ES had to score the effectiveness of actions they took to reduce the problems they were experiencing from 1 (ineffective) to 6 (very effective), and we see these results as offering good evidence of the reality of ES. The actions taken and mean effectiveness score for reducing symptoms are displayed in the table below:

The 3 most effective actions to help ameliorate symptoms were

- **Disconnecting Electricity 4.5**
- **Removing indoor source 4.3**
- **Avoiding exposure 4.2**

With such a huge correlation between the removal of exposure and improvement of well-being, it is clear not only that this may well be useful in defining ES for (2) above, warranting further investigation, but it also provides a starting point for management of the condition (6). Recommendations of further work to be done to test these should have been made.

Epidemiology of ES

The review looked both at occupational studies and studies of general populations to estimate the prevalence of ES. The following is taken from section 4.6 of the review, and relates to the findings of the EC expert group who attempted to estimate the extent of ES within EU countries.

"The group reported that estimates of the total number of cases differed substantially between the answering groups, with self-aid group (SAG) estimates consistently around ten times higher than those of centres of occupational medicine (COM). Estimates ranged from less than a few cases per million of the population (COM estimates from UK, Italy and France) to a few tenths of a per cent of the population (SAG in Denmark, Ireland and Sweden)".

"The group concluded that the differences in prevalence were at least partly due to the differences in available information and media attention around ES that exist in different countries. Similar views have been expressed by other commentators".

EC Expert group (NIWL, Bergqvist et al) findings, Section 4.6 of "Definition, Epidemiology and Management of Electrical Sensitivity"

Report for the HPA-RPD by N Irvine, Regional Epidemiologist, CDSC N. Ireland

From this, it would seem that the real issue here is recognition of the syndrome. It is clear that the lack of recognition of Electrical Sensitivity as a condition is due largely to the lack of ability to clearly define it, either by symptoms or by cause, and that this is therefore going to have a direct

effect on the number of people estimated to suffer from it. The disparity in percentages may well be accounted for by the number of people with ES who are unable to continue their employment due to ill-health caused by EMF exposure at work and therefore drop out of occupational medicine statistics. They may then seek alternative sources of support such as self-help groups. It is therefore not possible to currently predict the prevalence of the condition either in the UK, or worldwide until there is a more formal method of defining who has the condition, especially when it seems to overlap with other sensitivity and intolerance responses. Powerwatch believes that around 3% of the UK population (about 2 million people) may experience some degree of electrical hypersensitivity.

Management of ES

The opening sentence of the "Policy/management options" section of the review (section 5.2) states "Given that the project did not specifically address the question of aetiology, it is unable to inform policy in terms of setting exposure guidelines". It then comments that there is not sufficient published evidence regarding evaluation of the symptoms and success of management strategies in dealing with the condition, though it does note that the "limited studies to date" show some success.

This section sums up what was really disappointing about the report: a lack of solid suggestions of how to move forward in an attempt to tackle the problem, perceived or otherwise, of Electrical Sensitivity. Aside from the comment that defining whether or not someone actually has ES is an exceptionally tricky prospect (aside from the fact the sufferer themselves thinks it is ES), the report has made some kind of recognition that a condition with apparent connections to EMF sources exists.

However, beyond that, very little support is offered to people who report that they have the syndrome. In fact, the final paragraph in section 5.4 reads "Thus, although symptoms attributed to RF EMF (such as mobile phones/base stations) and other exposures appear to be similar in type, the findings of this review cannot apply in full to these attributions", which is effectively stating once again that they are deliberately leaving open the chance that these symptoms are purely coincidental and are not related to EMF sources.

They conclude their "Future Research" section (5.5) by recommending that future research should control for the placebo effect, should engage with therapists and practitioners currently attempting to look at the condition to see if there are evaluations missed by this review and to conduct clinical trials on cognitive behavioural therapy (CBT). A study carried out by Kennedy (2007) showed that people undergoing CBT treatment demonstrated reduced metabolism in several prefrontal regions. As CBT has been shown to help some people with ES, this sort of study may help identify neurological changes that may point to a range of appropriate treatments for sufferers of ES.

Considering the results in the Actions/Effectiveness table (see above), it is infuriating that prevention has not been considered as a valid management tactic, focusing instead entirely on treatment. The results show quite clearly that the removal of the EMF source has the single strongest effect in ameliorating the symptoms. Surely it is worth recommending that studies are done properly to investigate the effectiveness of practical preventative measures.

If ES is as prevalent as we believe, it is responsible for both a considerable loss and cost to the country, with people living and working well below optimal health. We urgently need the HPA and the Department of Health to proactively take this issue forward.

Appendix 2

A study on ES. We report on the study's intent and findings and then add our comments on whether we think this study has moved the subject forward.

Are some people sensitive to mobile phone signals? Within participants double blind randomised provocation study.

James Rubin, et al; BMJ April 2006; 332; 886-891

Their objective was to test whether people who report being sensitive to mobile phone signals have more symptoms when exposed to a pulsing mobile signal than when exposed to a sham signal or a non-pulsing signal.

It was a double blind, randomised within participants provocation study carried out at a dedicated suite of offices at King's College London, September 2003 to June 2005.

The participants were 60 "sensitive" people who reported often getting headache-like symptoms within 20 minutes of using a global system for mobile communication (GSM) mobile phone and 60 "control" participants who did not report any such symptoms. Intervention Participants were exposed to three conditions: a 900 MHz GSM mobile phone signal, a non-pulsing carrier wave signal, and a sham condition with no signal present. Each exposure lasted for 50 minutes.

The principal outcome measure was headache severity assessed with a 0-100 visual analogue scale. Other outcomes included six other subjective symptoms and participants' ability to judge whether a signal was present.

Headache severity increased during exposure and decreased immediately afterwards. However, no strong evidence was found of any difference between the conditions in terms of symptom severity. Nor did evidence of any differential effect of condition between the two groups exist. The proportion of sensitive participants who believed a signal was present during GSM exposure (60%) was similar to the proportion who believed one was present during sham exposure (63%).

They concluded that no evidence was found to indicate that people with self reported sensitivity to mobile phone signals are able to detect such signals or that they react to them with increased symptom severity. As sham exposure was sufficient to trigger severe symptoms in some participants, psychological factors may have an important role in causing this condition.

Powerwatch Comments on Rubin et al study

There are a number of problems with this study that will contribute to the "no evidence" conclusions.

Firstly, a number of really ES people who volunteered to take part were too badly affected, did not complete the tests and so had to be excluded from the analysis. Indeed, to be included you had to be able to use a mobile phone.

Secondly, the background RF fields in the rooms were not controlled and the rooms were not screened so (a) there was a general level of RF pollution all the time and (b) any mobile phones in nearby rooms would have, at times, affected the ambient microwave fields.

Thirdly, and probably the most important problem was due to the design of the MTHR (UK Govt Mobile Telecommunications and Health Research) handset that was used in the tests. In order

that the handset should “warm up” the same in “sham” mode as it usually would in normal use, the MTHR specified that the microwave power should still operate and just be fed to a “dummy load” inside the handset. That works fine for the temperature control but also results in significant microwave fields around the handset when in the “sham” (= no exposure) mode. These are shown at: http://www.mcluk.org/MTHR_exposure_systems/SARplots.htm

What do we mean by “significant microwave fields”? Well, the TNO human volunteer study [a, below], which was well designed and carried out, found adverse effects on the well-being of sensitive people at microwave levels which caused SARs of less than 0.1 mW/kg. This was at a microwave field signal strength of 1 V/m. Various reports show adverse effects in the reported symptoms at levels above 0.05 V/m approximately (some of these are documented on the Powerwatch website at:

<http://www.powerwatch.org.uk/masts.asp>).

The MTHR handset when in the “sham” (=no exposure) mode has SARs up to about 5 mW/kg, fifty times the power level found by the TNO study as capable of inducing adverse effects on wellbeing and many more times the level at which sensitive people experience adverse effects when living near to mobile phone base stations.

http://www.mcluk.org/MTHR_exposure_systems/SARplots.htm

So, it is hardly surprising that the Rubin study did not find significant differences between the “sham” and “real” exposure conditions, as the “sham” exposure was exposing participants quite highly. It would have been so easy to have had a further test with the phone completely “turned off”.

It would also have been easy for the MTHR handset to be designed so that the direct battery voltage was used to heat the handset without generating and dissipating any microwave energy next to the volunteer’s head. This error in design will potentially invalidate a number of the MTHR research projects – especially any which involve testing sensitive people.

[a] See:

http://www.tno.nl/tno/actueel/tno_nieuws/2003/onderzoek_tno_naar_effect/tno_fel_report_03148.pdf

Appendix 3

The double blind provocation study by Essex University claims to have found that there is no significant difference between the subjective (self-assessed symptoms) and objective (measured symptoms - e.g heart rate) responses between sensitive and control participants, regardless of the system to which they were exposed.

We found some serious problems with the way that the results from this study were collected, analysed and presented.

Study Flaws

When addressing a subject such as this, where there is so much general public concern, there is bound to be a high level of nocebo effect amongst those that believe they may have a problem. This would give rise to a much higher proportion of self-assessed sensitive participants that were not in fact sensitive, and this would have the effect of "hiding" those that were actually

responding to the provocations. This is a potentially very serious confounder that has simply not been addressed in this study.

Anecdotal reports of sensitivity (useful when deciding how an experiment must be designed) show that many of the effects experienced only manifest themselves a few hours after exposure, and have often not fully subsided until the following day. This also seems to vary from person to person, but it is hard to evaluate what the reason for this would be. Both of these points are hard to properly incorporate into the design of the study.

Flaw counter-arguments

Nocebo responders are also very hard to sensibly deal with as a confounder, due to having no prior knowledge of who they are - this is especially true when cause is not established and it is a theoretical possibility that all fall into this category. However, there are certain steps that can be taken to separate out those with highly successful responses, perhaps with the aim of adding them to a "highest sensitivity pool". This gives the opportunity to test those that seem to be the most sensitive in a given study without the possible confounders of nocebo sufferers. This was not done here, but in fairness to the authors this would require another round of tests and may not have the required participation from the selected group (who may not want to go through another round of tests).

The problem of effects experienced after a few hours (but not immediately) was addressed by the study, which tested for symptoms very shortly after the end of the exposure and allowed the participants to fill in a questionnaire to return the following week. However, there is a good argument for it not being necessary as the sensitive group have reported much higher levels of perceived symptoms than the control group anyway. This gives reasonable support to the idea that the authors have designed it in a way that should find effect if there is one.

There is the added possible confounder that the sensitive group were suffering from stress responses based on the pressure of believing they might be exposed, and again this is something that it is not reasonable to expect the authors to eliminate. However, it is a very important issue in these double-blind provocation studies that cannot be ignored.

The problem of responses not subsiding until the following day has been very well catered for by the research team, as the tests were separated by a period of one week in each case.

Discussion

All in all, the Essex team have carried out one of the best designed and executed studies to date. They consulted widely during the planning stages and took notice of a wide variety of sources (including Powerwatch and some individuals who claim to be electrically sensitive). Their laboratory is well designed and uses non-toxic paints and DC lighting to help eliminate possible confounders.

Whilst there were distinct problems early on in the realism of the exposure system, by the time the actual provocation tests were performed it was the best we have seen in an experiment to date, including a well designed simulation of real network traffic. Measured background EMFs in the lab are negligible (the rooms were screened to a 60 dB reduction in field strength), and thus one of the biggest flaws of Rubin's work has been dealt with effectively.

As with all double-blind studies, there is no way in which the effects of chronic exposure can be addressed, so this is not a failing of the study but another point for consideration with regards to final conclusions.

Conclusion

Following this paper, it is becoming increasingly likely that there is a significant proportion of self-assessed Electrically Sensitive people whose response is entirely nocebo - whether induced by fear of harm or other reasons, the cause is not radiofrequency EMFs.

There are fundamental flaws in the idea of evaluating subjective responses in a double blind system that simply cannot be avoided regardless of the care taken on experiment design (such as the potentially large proportion of nocebo responses). There is also a chance that chronic exposure may give rise to genuine symptoms whereas acute exposure may not, but that cannot be addressed by this study.

Whilst a minority of people may be very sensitive, the results from this study suggest that the proportion of sensitive people is likely to be lower than the 3% - 35% that has been quoted. However, serious questions are now being raised about how the results from this study were analysed (Cohen [2008](#)).

Essex University study on Health Effects from TETRA radiation

This [study](#) was published in June 2010. A further one was published in [2011](#). As with previous Essex studies there were significant flaws which make their conclusion "*Our findings suggest that the adverse symptoms experienced by electrosensitive individuals are due to the belief of harm from TETRA base stations rather than to the low-level EMF exposure itself*" invalid.

We reproduce here the critique of the study reported in the ES-UK newsletter of September 2010, available on www.es-uk.info/index.asp.

1. There was no definition of what would count as 'sensitive'.
2. There was no fully objective screening of the self-proclaimed sensitives: theoretically they may all have not been sensitive or sensitive only to forms of electro-magnetic radiation or fields other than TETRA. Over 20% admitted that they were only "*a little bit*" sensitive and under 25% said that they were "*a great deal*" sensitive, so it was unlikely to produce a strongly positive result anyway, especially since 5% of the 'sensitives', presumably the most genuinely sensitive, had to withdraw because of ill health they attributed to initial TETRA exposure at Essex.
3. There was no fully objective screening of the control group: theoretically up to 30-50% may have some element of subconscious sensitivity and a very small number some degree of hyper-sensitivity. One study declared that "*EHS is not a prerequisite for the ability to consciously perceive weak EMF and vice-versa.*"
4. There was no allowance for the fact that a person sensitised to electro-magnetic radiation may not perceive a conscious symptom at every exposure but perhaps on only 10% of occasions or less.
5. There were no precise records of each electro-magnetic exposure for each of the supposed sensitive group over the preceding 48 hours, or however long each sensitised person remains affected by the cumulative nature of such irradiation.
6. Double-blind tests with sham following real are invalid for testing environmental pollution.
7. Humidity levels in different parts of the laboratory should be recorded and for sensitised people the levels should be adjusted to those appropriate to their level of sensitivity.

8. Geomagnetic levels and orientations should be recorded. These, like other ambient radiations from lights, daylight, metal structures in the building, reflective or absorbent surfaces and the person's own exposure to other humans who have been in a electro-magnetically polluted environment, can all influence a sensitised person.
9. ELF measurements should be recorded; many people are sensitised to specific synergies of electro-magnetic fields.
10. Since one mechanism by which electro-magnetic radiation affects human, animal and plant tissue is by induced currents, it is essential to test people moving at different speeds in relation to the field, especially for lower frequencies like the TETRA 'pulse'.
11. The deduction that no people are sensitive to TETRA is invalid: none of the 48 or the 132 'controls' may have been sensitive, based on these tests alone. There may, of course, be other people with TETRA sensitivity in the general population, or the people studied may be sensitive to TETRA under different synergies of radiation.
12. For idiopathic conditions it is essential to have and publish complete data for each individual and to test them in their own or idiopathic environment. Percentages are irrelevant since the condition is not a typical monomorphic disease but a multiform impairment unique in its extent and depth to the one individual alone.
13. From the sketch of the laboratory set-up, it was difficult to see how it replicated being in the middle of a TETRA line between masts with voice and data traffic in progress, or being in the direct line of radiation between a mix of handsets and towers. As listed in point 10, this should also allow movement towards, away from and across these stronger lines of radiation.
14. Even the title given to the study is not wholly appropriate: "Do TETRA (Airwave) base station signals have a short-term impact on health and well-being?" It is obvious that a person who says he/she is "*a little bit*" sensitive but cannot always state accurately when a TETRA mast is on or off should not decide definitely whether any short-term adverse health impacts exist from a TETRA base station's radiation. It would have been interesting, for instance, to replicate the radio and mobile phone mast studies which show cognitive and neurological effects in a dose-response relationship to the mast, some using blinded provocation by simply turning off the transmitter.

It is therefore evident that these Essex psychological tests are still flawed in many very basic areas. It would be better and more cost effective to test people using protocols developed by medical experts on electro-sensitivity in other countries. These include pathological reactions such as HRV, ECG, EEG, muscle stimulation, autonomic tests, skin histology, etc. In fact the 2010 Essex study did identify HV as a significant factor, but then, perhaps typically, appeared to assume, without any evidence, it was the result of a psychological state, such as anxiety, rather than the result of being sensitive to EMR, or becoming sensitised by EME, as many other studies have shown.