MAKING SENSE OF RADIATION: A GUIDE TO RADIATION AND ITS HEALTH EFFECTS

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ABSTRACT:

Long absence of national research body and national policy for research in Sudan are responsible for inefficient research system. This shaped and determined the main features of health research. Most of health research is done for academic purposes. It is fragmented and done in isolation within each research institution. There are no means of communication or coordination between numerous research and academic institutions involved in health research. Publication and dissemination of research findings is not well observed. Any national authority does not govern health research and even policies or regulations do not exit. Despite the early mentioned research activities, there is no obvious impact of research in health development in the country. A meticulous literature review and extensive consultations were made to build a comprehensive approach to conduct this work. This study was performed in Khartoum state and it focuses in mobile phone mast, Pylon's cable, Electrosensitivity and EM radiation in 2008. The study investigated Public discussion about radiation is a frustrating mixture of truths, half-truths and conjectures. As a result, some people are being made to worry unnecessarily about electric fields from pylons and radiation from mobile phones and computers. The results of this paper were an increased incidence of leukaemia among children living next to pylons and other more recent studies have found a similar association. Psychologists have long known that worry and anxiety can lead to strong physical changes in the body and that seems to be what is happening to 'electrosensitives'.

KEYWORDS: Radiation health effects, Mobile phone effects, Pylon's cable, mobile phone masts, Electrosensitivity and EM Radiation.

INTRODUCTION

Public discussion about radiation is a frustrating mixture of truths, half-truths and conjectures. As a result, some people are being made to worry unnecessarily about electric fields from pylons and radiation from mobile phones and computers [1-3]. Discussion about nuclear power often confuses radioactive materials and radiation. There are frequent references in newspapers and on websites to 'electrosmog' polluting us, causing illnesses and even hanging around in our bodies. Proposed EU regulations affecting MRI have added to confusion about the kinds of radiation used in medical scans and their associated risks[5-7]. The fact that research is carried out on a precautionary basis to establish whether risks exist has been presented by some commentators as evidence of danger, and a growing range of 'protective' products make implausible claims about how electromagnetic radiation behaves.

This paper drafted in scientists working in the field – including medical physicists, radiologists, oncologists, radiotherapy technologists, pathologists, hospital doctors, psychologists and electrical and mechanical engineers – to explain the different kinds of radiation, their impact on health, and why some claims in news, commentary and advertising are wrong. Their main concern is that people can't tell which claims are well-founded [9-12]. The consequences are far reaching; people sometimes don't consider the real risks of exposure to radiation, for example through non-urgent medical procedures such as 'MOT' body scans. Parents, teachers, counselors and others have become incredibly anxious about exposure to non-ionizing forms of radiation, and some schools have now removed Wi-Fi from the classroom. Such anxiety helps no-one but sellers of anti-radiation products. What's more, the scientists say, policy and public discussion can't advance without a clearer picture of the science involved. This paper has worked with scientists to identify tools and insights that might help others. For example: that there are different types of radiation; that 'cancer clusters' are unusual; and that when you picture what radiation is really like you can see that the 'electrosmog' pollution metaphor is misleading. We are grateful to the volunteers who have helped us to understand a complicated subject. This briefing doesn't cover everything. But we hope it equips people with tools and questions that deliver a clearer picture of what radiation is, what it does and what it can't do[13].

METHOD:

This paper was prepared based on thorough literature review and extensive consultation process. Consultations involved many experts in the field, interested organizations and individuals, a wide range of researchers and colleagues. The thought began in October 2008. All ideas gained from the discussion and literature gathered together and summarized. Finally one achieved to propose a National Health Safety for better health and sustainable health development.

Radiation is the emission or transfer of energy, either as electromagnetic waves or alpha and beta particles. Radiation mostly exists as waves, known as electromagnetic radiation (EM radiation). There are different types of

EM radiation, which can be grouped into ionizing and non-ionizing. This briefing talks a lot about radio frequency radiation (RF radiation) used by mobile phones. Electromagnetic Fields (EM field or EMF) are generated whenever EM radiation is present, for example when you use a mobile phone. It is possible to have a separate electric or magnetic field, for example the earth has a magnetic field. 'EMF Radiation' isn't a term used in science and muddles together EM fields and EM radiation.

The radiation discussed in this briefing is represented in the electromagnetic spectrum (below), which groups radiation according to the amount of energy it has. At one end the radiation is ionizing and needs to be carefully controlled to produce benefits, such as x-rays. At the other end it is non-ionizing and includes visible light and radio waves. Ionizing and non-ionizing radiation have very different effects. Exposure to high levels of ionizing Radiation can be dangerous and is known to increase the risk of cancer. Non-ionizing radiation can cause harm if sufficiently intense, the heat from an electric fire can cause burns for example, but it has not been shown to have longer-term ill effects. Knowing what type of radiation you might be exposed to helps you to decide whether or not it's necessary to be protected from it. The effect of non-ionizing radiation is like throwing a ping-pong ball at the coconut. It does not have sufficient energy to knock it over or make it wobble. Increasing the power of the radiation is like throwing more ping-pong balls every second – they still won't knock the coconut over – so the cell remains undamaged. Electrosmog is a poor description of electromagnetic radiation around us. There is no such thing as 'electrosmog' but it has become a popular term to describe the amount of radio frequency (RF) radiation around us. By evoking the London smog of the 1950s, which killed many people, it suggests that RF radiation is harmful when there is no evidence that it is. It also implies that radio waves somehow linger in the environment when they are actually constantly moving and are not something that can or need to be eliminated, by airing a room for example.

Radiation from mobile phones does not cause harmful effects. After talking on a mobile for a while both your phone and ear feel hot. Concerns have been raised that this heating can cause long-term harm. We know that at very high levels radio frequency (RF) radiation causes heating effects – this is how microwave ovens cook food – but mobile phones emit far less power and consequently don't cause damaging heating effects in people. The warmth we feel comes mostly from the electrical components in the phone and not the RF radiation. There are no known biological effects from mobile phone's RF radiation. A concern often raised by campaign groups is that mobile phones can have biological effects (affect our cells) despite being too weak to cause significant heating. Because non-thermal effects cover everything except heating it is a very broad term – it can refer both to cancer and insomnia – but there is no evidence that RF radiation causes harmful non-thermal effects. Corona ions aren't harmful to health. Some campaigners suggest that charged ions or particles (corona ions) – caused by the

electric field which surrounds a pylon's cable – can attach themselves to pollutants in the environment making them more likely to accumulate in the body. Research by the World Health Organization (WHO) and the National Radiological Protection Board (NRPB) concluded that this effect is small and does not cause harm.

There is no evidence that 'Pulsing' is dangerous. 'Pulsing' is used by anti-EMF campaigners to mean the rate at which a signal from an EM radiation source is turned off and on. They say low frequency 'pulsing' might be dangerous since one research paper found that human's cell functions might be affected at a frequency of 16 Hz. TETRA handsets (not masts), the mobiles used by the emergency services, 'pulse' at 17.6 Hz so possible effects were investigated but further research did not support the original finding. It is likely that the initial result was an artifact probably due to experimental error.

Debates about mobile phones, pylons and Wi-Fi radiation: Mobile phones, Wi-Fi and masts use radio frequency (RF) radiation and are in the non-ionizing end of the electromagnetic spectrum. Some people are concerned that such radiation may cause long-term health problems, such as cancer, in the same way that ionizing radiation can. Although RF radiation at high levels can cause burns (microwave ovens operate using RF radiation) no biological mechanism has been found to show they can cause cancer.

The International Agency for Research on Cancer (IARC) is coordinating epidemiological research in 13 countries. The project – INTERPHONE – is assessing whether RF radiation from mobile phones is associated with an increased risk of brain cancer. The final report has not yet been published but most of the countries have found no causal relationship between mobile phone use and brain tumors. Some data from the Nordic countries and the UK suggested an increased risk of developing certain kinds of brain tumor (gliomas and benign acoustic neuroma) in people who have used a mobile phone for over ten years. However, there are serious concerns about the interpretation of these results and the IARC warns that the data do not show a causal link between mobile phone use and brain tumors. There have been many media reports of cancer clusters around mobile phone masts, which on investigation turn out not to be clusters at all – the presence in the same place of people with cancer is not necessarily a cluster. Masts can be very visible and people are concerned that being near one exposes them to high doses of RF radiation. However, the exposure from a mast doesn't happen quite as people think. When a mast is put on a building, especially a school, there are often concerns that people in the building will be greatly exposed to radiation from it. The antenna, though, is at the top of the mast and the signal goes out almost horizontally, so in a radius of about 50m around the base of the mast its signal is barely detectable. The Stewart Report suggested that schools should not be in the 'beam of greatest intensity' from a mast, which corresponds to the region between 50m and 200m from the base of the mast. Even within this 'beam of greatest intensity' the RF radiation will be

hundreds of times less than the recommended limit.

A study published in 1979 reported an increased incidence of leukemia among children living next to pylons and other more recent studies have found a similar association. The most recent, the Draper study published in 2005, found a relationship between the chances of developing leukemia and the distance a person lived from power lines in the UK, which would account for no more than five cases in England and Wales (of the c.400 that occur annually). About 3% of the UK population believes that mobile phones, masts and Wi-Fi affect their health, reporting a range of symptoms within minutes of being near a mobile phone or mast emitting a radio frequency. The media coined the term 'electrosensitives' to describe them and they have been the subject of several large-scale scientific investigations.

DISCUSSION:

As with other medical treatments, radiotherapy can have side effects and occasionally mistakes are made. These are rare and therefore highly publicized in the media. To put things into perspective: over 100,000 courses of radiotherapy are given to cancer patients in Britain each year; errors with serious clinical consequences occur in around 0.003% of these treatments. The risk of death as a direct result of a treatment error is around one in 200,000 (there were only two such cases in the UK in the ten-year period 1995-2005). Most suspected cancer clusters turn out to not be clusters at all when investigated. A cluster is more likely to be a true cluster, if it involves one specific type of cancer, particularly a rare type, or if the age group affected is not usually prone to that type of cancer. A few true cancer clusters have been documented, but they have mostly occurred in groups of people exposed to high levels of occupational carcinogens. Classic examples of clusters include the scrotal cancer in chimney sweeps exposed to soot and coal, and mesothelioma and lung cancer in workers exposed to asbestos. It has been said that children are more vulnerable to non-ionizing radiation because they have thinner skulls, the implication being that radiation can penetrate more deeply. Whilst it's true that children's skulls are thinner, the inner ear is embedded in the densest part of the skull and the auditory nerve, on which an acoustic neuroma (a type of slow growing tumor) may develop, is embedded deep in the bone and well protected. The National Radiological Protection Board (NRPB) standards have been set to limit the intensity of microwave radiation and the recognized heating of human cells which it can cause. Nevertheless many scientists are concerned that NRPB limits for exposure are up to 1,000 times higher than in some other countries. Concern has also been expressed that increases in the growth of incipient cancers, and cataract problems experienced by mast riggers exposed to high intensity radiation, may also become apparent in people exposed to extremely low intensity radiation for very prolonged periods e.g. by living very close to a phone mast for months or years, for many scientists now believe that there are also non thermal effects of microwave radiation, particularly when pulsed at low frequencies, close to those used by the brain itself (brainwaves). It is believed that children may be

particularly at risk because of the larger absorption of microwaves by their heads, and the fact that the electrical activity of their brains is still developing. Because every human being is unique, however, each person may respond to radiation in a different way, but the following are commonly reported examples of human reaction to this form of radiation: Some people living near masts report headaches, impairment of short term memory, sleeping disruption (and with it chronic fatigue syndrome). Mast riggers report health problems including short term memory loss. A study has shown an impairment of learning skills in exposed children. Certain prescribed drugs are known to make some people especially sensitive to microwave radiation. Some parents across UK have reported that their children are apparently suffering epileptic type seizures at schools which are close to mobile phone masts. When the children are at home the fits do not occur and none of these children had a previous history of epilepsy. One girl, already known to be epileptic, who, prior to the erection of a mast near her home, was having an average of 2 fits per month, is now having 8 per day with the mast in place. When, unbeknown to her or her family, the mast is turned off, her condition improves dramatically. A health check questionnaire at a London school resulted in 30 reports from parents whose children were suffering headaches and violent nosebleeds during term time, which cleared up in school holidays. Adults living near the mast, sited at the school, reported headaches and dizziness. People who have pacemakers have been advised that mobile phone masts may cause the pacemaker to race - or stop. We know of one mast which carries a notice warning people with pacemakers not to approach it.

Replication of experimental results is essential. An experiment is performed can affect the results. This usually becomes clear to researchers if an unusual pattern occurs that isn't supported by other data. This is why repeating an experiment is important in determining what a true result is and what an artifact of the study design is. Repeating experiments and getting the same results is important to verify scientific findings. One or two early studies linked mobile phones with adverse cognitive effects but several large-scale replication studies have since been done and have not found the same effects. In the case of mobile phones, a number of large studies have been carried out in different countries, and they do not show a consistent relationship between mobile phone use and the development of brain tumours. Despite people looking very hard, there is no biological rationale provided by laboratory or animal studies that would lead us to make the conclusion that mobile phones cause cancer. The weight of evidence therefore does not support a causal relationship between mobile phone use and brain tumours.

Some 70% of secondary and 50% of primary schools is Wi-Fi enabled. The effects of emissions from wireless devices have not been investigated as extensively as mobile phone emissions but the frequencies at which they operate (2.4GHz) are close to those from 3G mobile phones (2.1GHz). Wi-Fi devices only transmit when they are sending data (not continuously) and operate at very low power – 0.1 watts at most. Someone

sitting in a Wi-Fi 'hotspot' for a whole year, according to the Health Protection Agency would be exposed to the equivalent radiation dose of a 20-minute call on a mobile phone, which studies have shown does not cause harm.

Some products claim to protect the user by screening incoming electromagnetic radiation though most of the literature promoting the products fails to mention that visible light is also EM radiation. They may reduce some of the radiation within the screened space but their cost effectiveness is questionable and there is no established evidence that they produce any benefits. Some of the more remarkable (and expensive) devices claim to offer protection from 'bad' radiation and other invisible and immeasurable phenomena, while themselves generating beneficial 'energy fields' of a type unknown to science, which also cannot be measured or detected.

RECOMMENDATIONS:

- *Psychologists have long known that worry and anxiety can lead to strong physical changes in the body and that seems to be what is happening to 'electrosensitives'. Further research is needed but unless well-conducted double-blind studies do show effects of electromagnetic fields on health and well-being, it appears that the worry about mobile phone technology is more dangerous than the electromagnetic fields themselves.*

- *Any mast which is over 15 meters high or in a specially protected area, such as a Conservation Area, National Park or Area of Outstanding Natural Beauty, requires a full planning application to be submitted to the Local Planning Authority - normally the District or Borough Council. All of these applications must be advertised, and most BUT NOT ALL councils will consult local Councils and advice neighboring residents. Where a full planning application is required, the Planning Authority can refuse permission for any reason which would normally be allowed under planning law, and this includes potential public health risk, and the level of public concern. However, as with any planning application, the Council must consider each proposal and the appropriateness of any grounds of refusal, on a case-by case basis.*

- *If the mast is less than 15 meters high, and NOT in a specially protected area, mobile phone operators have been given what are called Permitted Development Rights (PDR) by the Government. This means that no full planning application is needed. If the mast is to be on a building or other existing structure, there is a complex formula setting out the height of masts allowed under PDR, depending on the height of the building. Under Permitted Development Rights, companies only have to tell the Council where they propose to site the mast and provide a written description of what it looks like. The Council then has EITHER 28 days to 'intervene' if the mast is on an existing building, OR 42 days if it is sited on the ground. If the Council does choose to intervene, the company has to go through a Prior Approval Procedure, giving the Council the opportunity to consider the detail of the proposal and, if appropriate, refuse it. Any refusal must be issued within the 28 or 42 day period. Despite Government guidance encouraging councils to consult local people, there is no legal requirement to do this and many Councils say they haven't time to do a meaningful public consultation exercise*

in 28 days...so they don't tell anybody. All the company has to do is to post a Site Notice (but only if it is a ground based mast) which can be one page of small print attached to the nearest lamppost...

- *'Protective' products; a range of products capitalize on public concerns about radiation, claiming to measure or protect us from non-ionizing radiation. These products perpetuate the idea that radio frequency radiation (referred to in marketing literature as EMFs) in particular should be avoided. Many of these products claim to work using mechanisms that don't exist and can't do what they promise to.*

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