Shortcomings of Review Paper, "Wi-Fi and Health: Review of Current Status of Research" by Kenneth R. Foster and John E. Moulder, May 9, 2013*

Michael Meszaros, M.Eng., P.Eng., November 4, 2013

INTRODUCTION

Foster and Moulder's (hereafter termed "Foster") paper is portrayed as "reviewing all literature". It proposes to invalidate only the studies which show harmful effects by claiming they are "not good enough". Upon analysis of their paper, it appears that many studies which show harmful effects were not reviewed, the exposure levels of radiation were downplayed, and warnings from Health Agencies were missed. When a review of Wi-Fi and Health is more complete, there is a completely opposite finding, namely that Wi-Fi is causing harmful biological effects.

Note that Foster's paper was funded by the Wi-Fi Alliance which certifies compliance of Wi-Fi networks.

I have received no financial compensation for this review and have no conflict of interest.

DEFICIENCIES

In terms of health and current research, there are a number of deficiencies in the Foster paper.

A. Firstly, there are incorrect statements.

1/
Their paper claims to "examine the current state of research on possible biological effects/health effects of RF energy emitted by Wi-Fi"; however, the paper is missing dozens and dozens of studies which show negative health effects from Wi-Fi radiation.

Literature listed in the BioInitiative Report and the Building Biology Survey are not mentioned as well as many other studies.

Consider the paper, "Non-Thermal Effects and Mechanisms of Interaction Between Electromagnetic Fields and Living Matter" by Magda Havas, PhD, et al, published for the National Institute for the Study and Control of Cancer and Environmental Diseases, Italy, 2010. It demonstrates that phones which radiate 2.4 GHz, the same frequency as Wi-Fi and at comparable power levels, cause heart rate variability.

So, a lot of critical research is not included.

2/
Page 561 states, "Health agencies have not expressed concern about possible health hazards from such exposures (e.g., WHO 2006)" (i.e., referring to exposure levels below ICNIRP 2009 and IEEE 2005 levels).

Contrary to this statement, in 2007, the the European Environment Agency warned that cell-phone technology "could lead to a health crisis similar to those caused by asbestos, smoking, and lead in petrol." In 2011, the WHO warned that, "IARC has classified radiofrequency electromagnetic fields as possibly carcinogenic to humans (Group 2B)." More recently, the BC Centre of Disease Control, 2013, noted that "most of the studies show harmful effects from low levels of radiation". Oct.15, 2013, the French Health Agency "recommends limiting the population's exposure to radiofrequencies – in particular from mobile phones – especially for children and intensive users, and controlling the overall exposure that results from relay antennas."

Considering that Foster's paper is about "Wi-Fi and Health", making such an incorrect statement about Health Agencies is substantial.

3/
On page 568, Foster claims that IARC's decision "has no relevance to possible health effects of Wi-Fi."

It is important to note that IARC consists of scientists who understand the difference between cell phones, Wi-Fi, and other radiation. Within this context, IARC did not limit the carcinogen warning to "cell phones", but rather classified "radiofrequency electromagnetic fields" as a possibly carcinogen. Wi-Fi is a "radiofrequency electromagnetic field", so IARC's statement is very relevant to Wi-Fi.

Further, on page 566, Foster shows that multiple Wi-Fi users is similar to cell phone usage.

Foster seems to have missed that all the studies that he references as showing no effects are short-term studies. Opposite to his statement, it is these short term studies that "have little relevance to Wi-Fi" because they were either measuring irrelevant parameters or the durations of exposure were too short. Wi-Fi produces millions of times longer exposure duration than the 6 minutes in ICNIRP and IEEE.

Dr. Hardell shows that one study which claimed "no effect" was measuring meningioma. Subsequent re-evaluation studies found that though it was correct that EMF doesn't cause meningioma, the studies found that it is glioma and acoustic neuroma that are caused.

The paper entitled, "Non-Thermal Effects and Mechanisms of Interaction Between Electromagnetic Fields and Living Matter" by Magda Havas et al shows that phones which radiate 2.4 GHz (the same frequency as Wi-Fi and at comparable power levels) cause heart rate variability. This demonstrates that Wi-Fi causes negative health effects.

4/
Foster's paper states "no basis to anticipate that Wi-Fi exposure will cause any biological effects" (p.571).

This contradicts ICNIRP's statement that "There are also data for chronic low level exposure that indicate that there may also be other health effects. It is, however, ICNIRP's view that in the absence of support from laboratory studies the epidemiological data are insufficient to allow an exposure guideline to be established." – "Use of ICNIRP EMF Guidelines", p. 294.

ICNIRP supports that low level exposure causes health effects. It is only their opinion to choose not to establish guidelines from it. In contrast, the Building Biology Survey and the BioInitiative Report 2012

chose to make guidelines from the data, and it is these guidelines that are helping people to maintain and improve their health.

Foster's incorrect claims of "no biological effects" are not supported by the organization that Foster is comparing his exposure results to.

5/
Foster provides a free-space propagation formula; however, the results he proposes in various examples are substantially lower than what the formula produces. Foster does not explain this discrepancy.

B. Secondly, the paper downplays the seriousness of health issues.

1/
The paper assumes 1 m distance from an antenna in the exposure models and considers a 3 cm distance as a "worst case".

When health is at stake, these are not the "worst case" scenarios. For example, when one approaches one's computer to plug something in, one can be immediately beside a Wi-Fi antenna. Similarly, one could be right next to a Wi-Fi antenna that may be in one's fridge or in one's car. Foster's paper is downplaying the real life exposure from Wi-Fi. This is inconsistent with an objective review about health.

2/
Foster tries to discredit studies which found health harm with the statement "Dose (SAR) in these studies ranged from 0.08 – 4.0 W/kg, all well above real-world Wi-Fi exposures. However, the studies had reasonably long exposure durations 1 – 2 h per day for 10 – 50 d)." (p.568)

Firstly, 2 h per day for 50 days is a small fraction of exposure that many people experience from Wi-Fi. For example, in schools with Wi-Fi, children and staff are exposed all day long, many returning to homes or other places such as sports complexes that also have Wi-Fi. Many people may be exposed to Wi-Fi day and night 365 days a year.

Secondly, on p.566, Foster states a "worse case" exposure condition of 0.817 W/kg. This dose is within the range of the studies that Foster tries to discredit above.

SAR is based on dead adult tissue. Studies have shown that a child absorbs twice as much as an adult. So, that would make it 1.634 W/kg.

Foster goes on to reduce the dose from 0.817 W/kg to 0.00817 W/kg because of "1% duty cycle"; however, Foster makes no mention of recovery time. As noted in his reference above on p.568, 0.817 W/kg (0.08-4.0 W/kg) has been shown in a number of studies to have negative effects on the immune system, brain development, etc. How long does it take for this damaged tissue to recover? If the recovery time of the tissue is longer than the time to the next pulse (as it very likely is because of the microseconds between pulses), "1% duty cycle" cannot be used to reduce the health effect on the tissue.

Further, the 1% duty cycle adds another frequency to the equation which studies have shown also harms cells.

As such, the paper is using the “average of exposures” rather than designing for the worst case. This is downplaying the impact on health effects.

3/
The review appears to be blinded by "inconsistent results" rather than exploring the differences that each study revealed. There is an assumption that "inconsistency" means falsehood and falsehood for the harm studies only (rather than considering that it could mean falsehood for the "Wi-Fi safe" studies). The paper does not explore the fact that "inconsistency" reveals a complexity in biological systems. In fact, it is more logical that any study showing harmful effects should be more serious to explore than studies which couldn’t find any effects.

4/
Foster notes that the IEEE 802.11 standard was first approved in 1997.

Compare this 1997 date to Hallberg and Oberfeld’s report which records an increase in electrohypersensitivity (EHS) from below 2% prior to 1997 to approximately 10% by 2004. Further, EHS is expected to affect 50% of the population by 2017.

5/
The Standard of Building Biology Testing Methods (Standard SBM-2008) lists severe health concern above 10 $\mu W/m^2$ and no health concern below 0.1 $\mu W/m^2$(i.e., 0.00001 $\mu W/cm^2$, or 0.002 V/m).

Compare this to Foster’s maximum time-averaged values (which are much lower than the peaks which hit the biological cells) from a laptop a distance of 0.5 m away (which is not the worst case for people using their laptop on their lap or beside them on their bed, as shown in the laptop advertisements). Foster says this equals 220 $\mu W/m^2$ (page 565). Even at this “downplayed” exposure value, this exposure is still 22 times higher than “severe health concern” levels. It’s no wonder people report that laptops give them pain in their abdomen, make them lose energy, or cause lumps on their legs.

6/
There is no comment or review of the fact that different parts of the body have different sensitivities to radiation. The eye, for example, is more sensitive than other parts of the body because it is exposed and has less of a blood supply than other parts of the body.

The Royal Society of Canada recommended in 1999 that a lower exposure limit be established for the eye.

7/
Foster compares Wi-Fi to microwave ovens, Bluetooth, cordless telephones, Smart Meters, and other household devices. The tone of the paper is portrayed as if to say, “because these are common, it must be safe”. The paper, however, omits to mention that each of these other devices are causing health problems in people too and have scientific studies to show this. Thus, aligning Wi-Fi with these devices is actually a demonstration of negative health affects from Wi-Fi just like all the other devices

are causing.

As an example, on page 566, Foster compares a roomful of schoolchildren uploading to a single WLAN to the power radiated by a single mobile phone handset (100 mW). Is Foster suggesting that a single mobile phone handset is safe? Compare this to IARC's statement that mobile phone handsets have been documented to cause cancer.

A recent supreme court ruling in Italy directed that a worker's compensation be awarded in a case where a man claimed that his cell phone caused his facial tumour.

Like cell phones, Wi-Fi is unsafe.

C. Other Deficiencies

1/
The authors make unscientific hypotheses to discredit papers and then criticizes those other papers for not being scientific.

On page 570, Foster states, "it is not clear how many people actually use laptops on the laps". From a quick survey of laptop users, many of them use them on their laps (or can no longer use them on their laps because of the negative health effects). There is nothing in the design of a laptop that would prevent or discourage a user from putting it on one's lap (in fact, they are marketed as "lap" "tops"). Since putting them on one's lap is part of the design, for a review paper to propose otherwise raises questions if the authors are is really interested in health.

2/
The paper references IEEE 2005 and ICNRP as "major international limits" and the "reference standard". About 40 countries are currently following ICNIRP because of their organizational structures; however, this is commenting on "status quo" not on "current health research". Countries which are responding to "current health research" have provided lower protection levels than ICNIRP. Countries such as Finland, France, Japan, Russia, Israel, India, and the U.K. are considered "major" countries, and they have lower exposure limits and warnings for children.

On page 563, Foster notes that the European Union limits are one tenth the Canadian/US limits. ICNIRP is based in Germany. So for the European Union to have maximum. limits one tenth the power of ICNIRP, emphasizes that IEEE 2005 and ICNIRP are not the "current health research".

CONCLUSION

Foster's paper does not heed the warnings of the "public outcries" and tries to discredit studies on opinionated grounds rather than exploring the serious impacts of their findings.

A review of Wi-Fi and Health should document the negative effects that are being reported world-wide and the reasons for the Health Agencies warnings. It should include the dozens and dozens of papers which show negative health effects from Wi-Fi.

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* Foster, Kenneth R, and John E Moulder. 2013. “Wi-fi and Health: Review of Current Status of Research.” *Health Physics* 105 (6) (December): 561–575.