

Some Important Peer-Reviewed Journal Articles by Om P. Gandhi, et al.

1. O. P. Gandhi, G. Lazzi, and C. M. Furse, "Electromagnetic Absorption in the Human Head and Neck for Mobile Phones at 835 and 1900 MHz," *IEEE Trans. on Microwave Theory and Techniques*, Vol. 44 (10), pp. 1884-1897, 1996.
2. O. P. Gandhi and G. Kang, "Some Present Problems and a Proposed Experimental Phantom for SAR Compliance Testing of Cellular Telephones at 835 and 1900 MHz," *Physics in Medicine and Biology*, Vol. 47, pp. 1501-1518, 2002.

Peak 1-g body tissue SAR up to 56% higher at 1900 MHz and up to 20% higher at 835 MHz for models of children heads as compared to those for adults. For brain tissue, peak 1-g SAR up to 220% higher at 1900 MHz and up to 144% higher at 835 MHz, because of deeper penetration of absorbed energy for smaller heads of children.

This is due to thinner pinna (outer ear) and skull for the children's head models and the resulting closer placement of cell phones to the brain of children.

3. O. P. Gandhi and G. Kang, "Inaccuracies of a Plastic "Pinna" SAM\* for (FCC-Mandated) SAR Testing of Cellular Telephones Against IEEE and ICNIRP Safety Guidelines," *IEEE Trans. on Microwave Theory and Techniques*, Vol. 52 (8), pp. 2004-2012, 2004.

Due to the use of a 5-10 mm thick plastic "pinna," the SAR for the FCC-mandated SAM model of the adult head is reduced by a factor of 1.6-2.0 or more. As published in the peer-reviewed literature, the SAR diminishes by 12 to 15% for every one millimeter additional spacing of the cell phone from the head. This problem is further compounded by the fact that SARs are higher for children as compared to the adult-size model used for SAR compliance testing.

\*Specific anthropomorphic (SAM) plastic shell model obtained from the 90<sup>th</sup>-percentile anthropomorphic data of the adult male head.

Additional Publications Confirming Our Published Results of Greater Absorption of  
Electromagnetic Radiation (SAR) into Children's Heads

France

- J. Wiart, A. Hadjem, M. F. Wang, and I. Block, *Physics in Medicine & Biology*, Vol. 53, pp. 3681-3695, 2005. (1-g SAR of brain tissues of children is about two times higher than adults.)

Brazil

- A. A. deSalles, G. Bulla, and C. F. F. Rodriguez, *Electromagnetic Biology & Medicine*, Vol. 25, pp. 349-360, 2006. (The 1-g SAR for children is about 60% higher than for the adults.)

Spain

- M. Martinez-Burdalo, A. Martin, A. Sanchez, R. Villar, *Physics in Medicine & Biology*, Vol. 49, pp. 345-354, 2004. (As head size decreases, the percentage of energy absorbed in the brain increases; so higher SAR in children's brains can be expected.)

Japan

- J. Wang and O. Fujiwara, *IEEE Transactions on Microwave Theory & Techniques*, Vol. 51, pp. 966-970, 2003. (Compared to the peak local SAR in the adult head model, we found a "considerable increase in the children's heads" when we fixed the output power of radiation.)

Switzerland

- Niels Kuster, *et al.*, "Past, Present and Future Research on the Exposure of Children," ITIS Foundation, Unpublished report, 2009.

Spatial peak SAR of the CNS of children is "significantly larger (~2x) because the RF (microwave) source is closer and skin and bone layers are thinner;" "bone marrow exposure strongly varies with age and is significantly larger for children (~10x)."

## The Stewart Report\* (2001): Summary and Recommendations

“If there are currently unrecognized adverse health effects from the use of mobile phones, children may be more vulnerable because of their developing nervous system, the greater absorption of energy in the tissues of the head (paragraph 4.37), and a longer lifetime of exposure. In line with our precautionary approach, at this time, we believe that the widespread use of mobile phones by children for non-essential calls should be discouraged. We also recommend that the mobile phone industry should refrain from promoting the use of mobile phones by children (paragraphs 6.89 and 6.90).”

<sup>\*</sup>IEGMP (Independent Expert Group on Mobile Phones): Report of the Group (The Stewart Report), May 2000 (last updated October 16, 2001).

Chaired by Professor Sir William Stewart, FRS, FRSE.

Full report available at [www.iegmp.org.uk/index.htm](http://www.iegmp.org.uk/index.htm).