

EWG Science Review**Cell Phone Radiation Damages Sperm, Studies Show****Phones Carried on Belt or in Pants Pocket May Harm Reproductive Health****June 2012****Olga Naidenko, PhD**

Although most scientific and public attention on the issue of the safety of cell phone radiation has focused on evidence suggesting an increased risk of brain tumors (Baan 2011), a little-noticed but growing body of research points to a new concern – sperm damage (La Vignera 2012).

In a comprehensive review of the published scientific literature, the Environmental Working Group found 10 human studies that have identified a startling variety of changes in sperm exposed to cell phone radiation. In the most striking findings, men who carried their phones in a pocket or on the belt were more likely to have lower sperm counts and/or more inactive or less mobile sperm. These findings accord with similar results in laboratory animals.

Collectively, the research indicates that exposure to cell phone radiation may lead to decreases in sperm count, sperm motility and vitality, as well as increases in indicators of sperm damage such as higher levels of reactive oxygen species (chemically reactive molecules containing oxygen), oxidative stress, DNA damage and changes in sperm morphology (see summary below).

Many men who talk on a cell phone using a Bluetooth device or other headset keep the phone in a pants pocket or clipped to a holster. This exposes their reproductive organs to cell phone radiation, and several studies have found lower sperm count and/or poorer sperm quality in men who use their phones this way than in those who do not.

Scientists have yet to identify a mechanism by which cell phone use might cause such effects (Makker 2009). However, the research appears to rule out the possibility that the changes are caused by simple heating, which is considered to be a possible source of some radiofrequency radiation-related health problems (De Iuliis 2009; Volkow 2011).

The findings are particularly significant in light of the fact that infertility affects approximately 15 percent of couples of reproductive age, and nearly half of these cases are linked to male fertility (Sharlip 2002). The number and consistency of the findings raise the possibility that cell phone radiation could be contributing to this significant public health problem and demand further investigation.

Studies linking cell phone exposure to harmful effects on sperm have been done in the United States, Australia, Austria, Hungary, Poland, Turkey and South Africa, using diverse methodologies. In some, scientists compared sperm counts and sperm health in men who wore cell phones on the hip with those who carried them elsewhere on the body or did not use cell phones at all. In others, researchers exposed sperm to

cell phone radiation under laboratory conditions. In still others, scientists examined whether there was a correlation between sperm health and the intensity of cell phone use among men undergoing evaluation for infertility.

Among the findings:

- Men who carried a phone in a hip pocket or on the belt had 11 percent fewer mobile sperm than men who kept a phone elsewhere on the body (Kilgallon 2005).
- Men who carried a cell phone on the belt and used it intensively during a five-day test period had a 19 percent drop in highly motile sperm from their previous levels (Davoudi 2002).
- Men who talked on the phone for more than an hour a day had 17 percent fewer highly motile sperm than men who talked less than 15 minutes a day (Fejes 2005).

Laboratory studies on the effects of cell phone radiation on rats, rabbits and other animals have found similar effects on reproductive health (Kesari 2011; Mailankot 2009).

All these studies found statistically significant correlations between cell phone radiation and sperm health, and many found that the adverse changes increased with the amount of radiation exposure. Opinions differ as to the possible mechanism by which cell phone radiation might produce these changes (Falzone 2010).

A number of research papers include unambiguous statements on the potential of cell phone radiation to affect men's reproductive health:

- *“Keeping the cell phone in a trouser pocket in talk mode may negatively affect spermatozoa and impair male fertility” (Agarwal 2009).*
- *“Use of cell phones decreases the semen quality in men by decreasing the sperm count, motility, viability and normal morphology. The decrease in sperm parameters was dependent on the duration of daily exposure to cell phones and independent of the initial semen quality” (Agarwal 2008).*
- *“These findings have clear implications for the safety of extensive mobile phone use by males of reproductive age, potentially affecting both their fertility and the health and wellbeing of their offspring” (De Iuliis 2009).*
- *“Overall, these findings raise a number of related health policy and patient management issues that deserve our immediate attention. Specifically, we recommend that men of reproductive age who engage in high levels of mobile phone use do not keep their phones in receiving mode below waist level” (De Iuliis 2009).*
- *“Our results showed that cell phone use negatively affects sperm quality in men... Men with poor sperm quality planning for pregnancy should be advised not to use cell phones extensively” (Gutschi 2011).*
- *“The results show that human spermatozoa exposed to RF-EMR have decreased motility, morphometric abnormalities and increased oxidative stress, whereas men using mobile phones have decreased sperm concentration, motility..., normal morphology, and viability. These abnormalities seem to be directly related with the length of mobile phone use” (La Vignera 2012).*

Table1: Peer-reviewed studies of the effects of cell phone radiation on male reproduction

Reference	Study design	Finding	Type of exposure
Davoudi M, Brossner C, Kuber W. 2002. The influence of electromagnetic waves on sperm motility. <i>Journal für Urologie und Urogynäkologie</i> 19: 19-22.	Semen analysis for 13 male volunteers who carried a cell phone on the belt and actively used it for 5 days.	Compared to a period of cell phone use on the belt by the same volunteers, cell phone use was associated with decreased sperm motility. The percentage of highly motile sperm (classified as "rapid progressive sperm") dropped from a mean of 32% to a mean of 26% after the exposure.	GSM phone; study participants used phones for at least 6 hours/day.
Fejes I, Zavaczki Z, Szollosi J, Koloszar S, Daru J, Kovacs L, et al. 2005. Is there a relationship between cell phone use and semen quality? <i>Arch Androl</i> 51(5): 385-93.	Semen analysis for 371 men who attended an infertility clinic in 2002-2004.	Low-volume cell phone users (less than 15 minutes a day) had a higher percentage of rapid progressive motile sperm (48.7%) than high-volume (more than one hour a day) cell phone users (40.6%).	Pattern of use identified by a questionnaire, including duration of phone possession and frequency of daily use.
Kilgallon SJ, Simmons LW. 2005. Image content influences men's semen quality. <i>Biol Lett</i> 1(3): 253-5.	Analysis of sperm samples from 52 healthy men aged 18-35.	Men who carried a cell phone in a hip pocket or on the belt had lower sperm motility (49.3% motile sperm) than men who did not use a cell phone near the hip (55.4% motile sperm).	Questionnaire responses identified men who carried a cell phone in a hip pocket or on the belt, non-users and those who kept a phone elsewhere.
Erogul O, Oztas E, Yildirim I, Kir T, Aydur E, Komesli G, et al. 2006. Effects of electromagnetic radiation from a cellular phone on human sperm motility: an in vitro study. <i>Arch Med Res</i> 37(7): 840-3.	Semen samples collected from 27 men exposed to cell phone radiation under laboratory conditions.	Exposed specimens had a decrease in rapid progressive sperm from 13% to 9%; a decrease in slow progressive sperm from 44% to 34% and an increase in immotile sperm from 36% to 51%.	Test specimens were exposed for 5 minutes to GSM cell phone radiation at 900 MHz.
Wdowiak A, Wdowiak L, Wiktor H. 2007. Evaluation of the effect of using mobile phones on male fertility. <i>Ann Agric Environ Med</i> 14(1): 169-72.	Sperm parameters examined in a group of 304 males enrolled at an infertility clinic in 2004-2006.	16.7% of regular cell phone users had normal semen morphology, compared to 55.6% of non-users. In 35% of frequent cell phone users, sperm motility dropped by up to a half; only 9% of non-users had comparable decreases in sperm motility.	Based on questionnaire responses, 99 participants were classified as cell phone non-users; 157 had used GSM phones sporadically for 1-2 years; and 48 had used cell phones regularly for more than 2 years.
Agarwal A, Deepinder F, Sharma RK, Ranga G, Li J. 2008. Effect of cell phone usage on semen analysis in men attending infertility clinic: an observational study. <i>Fertil Steril</i> 89(1): 124-8.	Sperm parameters examined in 361 men undergoing infertility evaluation in 2004-2005	Patients who used cell phones more than 4 hours a day had a 42% lower sperm count and 33% lower sperm motility than non-users. The percentage of sperm with normal morphology in high-level users was half that of non-users. Rates of normal morphology were decreased with greater levels of cell phone use.	Based on questionnaire responses, cell phone exposure was classified in four groups: no use; less than 2 hours/day; 2-4 hours/day; and more than 4 hours/day.
Agarwal A, Desai NR, Makker K, Varghese A, Mouradi R, Sabanegh E, et	Semen samples collected from 23 normal healthy donors	Semen samples exposed to cell phone radiation showed a significant drop in sperm motility (52% to 49%) and	Samples exposed for 1 hour to radiation from GSM cell phone in talk mode at 850 MHz frequency.

al. 2009. Effects of radiofrequency electromagnetic waves (RF-EMW) from cellular phones on human ejaculated semen: an in vitro pilot study. <i>Fertil Steril</i> 92(4): 1318-25.	and 9 infertile patients were exposed to cell phone radiation under laboratory conditions.	viability (59% to 52%); nearly doubled production of reactive oxygen species levels; and a decrease in total antioxidant capacity, a measure of oxidative stress.	
De Iuliis GN, Newey RJ, King BV, Aitken RJ. 2009. Mobile phone radiation induces reactive oxygen species production and DNA damage in human spermatozoa in vitro. <i>PLoS One</i> 4(7): e6446.	Purified human sperm from 22 healthy donors were exposed to cell phone radiation under laboratory conditions.	Exposed sperm samples showed lower sperm motility and vitality, production of reactive oxygen species and DNA fragmentation. At SAR of 1.0 W/kg sperm, motility decreased from 86% in unexposed sperm to 68%; vitality decreased from 89% to 65%.	Samples were exposed to 1800 MHz radiation at a range of SAR values from 0.4 W/kg to 27.5 W/kg for 16 hours, at a constant temperature of 21°C to rule out thermal effects.
Falzone N, Huyser C, Becker P, Leszczynski D, Franken DR. 2011. The effect of pulsed 900-MHz GSM mobile phone radiation on the acrosome reaction, head morphometry and zona binding of human spermatozoa. <i>Int J Androl</i> 34(1): 20-6.	Purified human sperm collected from 12 healthy volunteers were exposed to cell phone radiation under laboratory conditions.	Cell phone radiation exposure appeared to affect sperm's fertilization potential. Exposed sperm's head area dropped by 50%. Sperm-oocyte interaction was decreased by 28% compared to unexposed controls.	Samples were exposed for 1 hour to 900 MHz GSM mobile phone radiation at SAR of 2.0 W/kg.
Gutschi T, Mohamad Al-Ali B, Shamloul R, Pummer K, Trummer H. 2011. Impact of cell phone use on men's semen parameters. <i>Andrologia</i> : 43(5): 312-6.	Analysis of semen samples from 2,100 men seen at an infertility clinic in 1993-2007.	68% of the sperm from cell phone users had pathological morphology, compared to 58% of sperm from non-users. Abnormal sperm morphology diagnosed in 45% of cell phone users versus 27.7% of non-users.	Retrospective study compared 991 cell phone users and 1,119 non-users identified via questionnaire responses.

Given the backdrop of increasing infertility rates (Swan 2006), the research findings should be a wake-up call to male cell phone users who are trying to have children or may want to in the future.

Even as scientists continue to gather new data on health risks from cell phone radiation, the findings underscore that consumers should practice simple, precautionary safe-cell-phone-use habits, such as keeping the phone away from the body, in order to protect their health and fertility. Men, in particular, should avoid carrying a cell phone on the belt or in a pants pocket when in use.

What About Women's Health?

There are no published studies examining the effect of cell phone radiation on reproductive health in women. Such studies are much more difficult to carry out, since they often require invasive techniques. However, several recent articles suggested that cell phone radiation might be harmful to the developing fetus. For

example, a 2009 study in Turkey found that after pregnant rats were exposed to cell phone radiation for 15 minutes twice a day during the entire gestation period, their female pups had fewer ovarian follicles (Gul 2009). A 2012 study by researchers at the Yale University School of Medicine found that mice exposed to cell phone radiation during gestation were hyperactive and had impaired memory (Aldad 2012).

There have been similar findings in two human studies. UCLA researchers reported that cell phone exposure during pregnancy and after birth was associated with behavioral problems in young children (Divan 2008; Divan 2012). This line of research is just beginning, but a recent review article emphasized that cell phone radiation might impact reproduction and development *in both men and women* (Merhi 2011).

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