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Fatal collision? Are wireless headsets a risk in treating patients?

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ABSTRACT

Wireless-enabled headsets that connect to the internet can provide remote transcribing of patient examination notes. Audio and video can be captured and transmitted by wireless signals sent from the computer screen in the frame of the glasses. But using wireless glass-type devices can expose the user to a specific absorption rates (SAR) of 1.11–1.46 W/kg of radiofrequency radiation. That RF intensity is as high as or higher than RF emissions of some cell phones. Prolonged use of cell phones used ipsilaterally at the head has been associated with statistically significant increased risk of glioma and acoustic neuroma. Using wireless glasses for extended periods to teach, to perform surgery, or conduct patient exams will expose the medical professional to similar RF exposures which may impair brain performance, cognition and judgment, concentration and attention and increase the risk for brain tumors. The quality of medical care may be compromised by extended use of wireless-embedded devices in health care settings. Both medical professionals and their patients should know the risks of such devices and have a choice about allowing their use during patient exams. Transmission of sensitive patient data over wireless networks may increase the risk of hacking and security breaches leading to losses of private patient medical and financial data that are strictly protected under HIPPA health information privacy laws.

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The recent surge in wireless technology for use in medical and healthcare applications brings with it unintended health consequences that may be placing both physicians and patients at risk of health harm. As wireless headsets or wireless glasses are being introduced to medical professionals, there is no examination or disclosure of potential health effects to the physician, nor consideration of consequences to patients being treated. There is reason for concern.

Current public safety limits for exposure to pulsed radiofrequency (RF) radiation are massively inadequate (Sage & Carpenter, 2012). Many thousand scientific studies over four decades (Lai, 2014) have provided warnings of serious biological effects and potential health harm from electromagnetic fields (EMF). The World Health Organization International Agency for Research on Cancer (IARC) has classified RF radiation as Group 2B Possible Human Carcinogens. This classification applies to all RF emissions stemming from wireless devices (Baan et al., 2011). Yet industries that promote new wearable wireless technologies are running far ahead of scientific knowledge on potential health harm (Yakymenko, 2017). Despite the evidence for increased risk of glioma and acoustic neuroma from mobile phone use which is sufficiently well established (Carlberg & Hardell, 2017; Hardell & Carlberg, 2014; Hardell et al., 2013; Interphone Study Group, 2010, 2011) there appears to be no "informed consent" for users and no disclosure of potentially lethal effects of long-term usage of wearable RF radiation devices like these headsets.

The evidence that RF radiation can cause disruption of electrophysiology in the brain, damage to the blood–brain barrier, neuron damage and death, significant impairment of cognition spatial memory and performance, and damage to the hippocampus in both morphology and function should reasonably lead to the conclusion that wireless device use by professionals may undermine their ability to practice, whether in medicine, education or other fields where wireless is becoming embedded without discussion of health implications. Why would any medical professional think it is okay to wear a wireless device all day long on their head when there is plentiful scientific evidence that it can impair judgment, concentration, attention, memory, and problem-solving? Wireless exposures can cause short-term effects on cognition, memory and learning, behavior, reaction time, attention and concentration, and altered brainwave activity (altered EEG). Multi-tasking physicians often suffer from both physical and psychological chronic stress and the use of wireless devices can make stress worse. Sufficient scientific evidence is already available to warrant caution in

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any use of wireless radiation devices in healthcare settings (Hardell & Sage, 2008; Herbert & Sage, 2013a, 2013b). This is particularly for doctors and other healthcare professionals, who examine patients, render medical opinions and write prescriptions where the potential for increased medical errors may rise due to mental impairment from continued wireless exposure to the brain. Medical errors in clinical practice are already reported to be the third leading cause of death in the US, according to a recent Johns Hopkins study (Makary & Daniel, 2016), and wireless effects on cognition may worsen this problem.

There is substantial scientific literature on both extremely low frequency (ELF) and RF radiation effects causing various impairments in functioning of the central nervous system (CNS). Some effects include disruption of neural control, altered electrophysiology and brainwave activity (Herbert & Sage, 2013a, 2013b; Sage & Carpenter, 2012), disruption of electromagnetic signaling, synchrony and sensory processing (Funk et al., 2009; Herbert & Sage, 2013a, 2013b) oxidative damage to DNA (Lai, 2014), blood–brain barrier disruption (Salford et al., 2012), induction of stress proteins (Blank & Goodman, 2009), neuroinflammation and immune system disregulation (Funk et al., 2009; Johansson, 2007; International Commission for Electromagnetic Safety, 2010; National Research Council, 2008).

But most pertinent to the discussion of wireless headset users are the reported effects on brain performance leading to impairing thinking ability, memory and judgment. The brain is an information processing system that operates through networks of synchronized electrical oscillations or brain waves (Funk et al., 2009; Herbert & Sage, 2013a, 2013b). Pulsed RF radiation can disrupt normal electrophysiology, leading to abnormal brain function (Daniels et al., 2009), degeneration of the hippocampus, spatial memory deficits and impaired cognition (Daniels et al., 2009; Ding et al., 1998; Li et al., 2015; Lu et al., 2012; Saikhedkar et al., 2014; Tong et al., 2013; Wang et al., 2013, 2015; Wu et al., 1999).

What are wireless headsets and why are healthcare professionals being encouraged to use them?

Wearable wireless headsets are being pushed as a new, cost- and time-saving technology for doctors and other healthcare professionals, including Physician Assistants (PA-C), and nurses to wear during patient examinations. Engineering entrepreneurs are selling the idea that wearing wireless headsets can do the work of the doctor to write up private medical notes on patients, or eliminate the human scribe (one who follows the MD and writes up notes of each patient visit). Wireless headsets are wireless-radiating glasses that put a computer on your face. They connect via pulsed RF radiation signals to the internet via a pair of glasses with a small computer screen attached to the right earpiece. They allow the wearer to take a photo or video of the patient, record a conversation, access the Internet, read their own email, get directions or send a tweet. The headset has the ability to capture the sound and sight of any encounter and to broadcast it wirelessly to others. It may save time writing things down for medical record-keeping but poses other hazards well-being and privacy of the patient that should not be ignored

What is the problem for the medical professional?

Wireless headsets can produce very high exposure levels of RF radiation. The exposure can be as high as or higher than many smart phones emit (Moskowitz, 2014). SAR test results submitted to the Federal Communications Commission (FCC) report transmissions in the 2.4 GHz range for 1 gram of tissue estimate the energy delivered is characterized by an SAR of 1.11 W/kg maximum (FCC, 2013). Pizarro and De Salles (2014) reported SARs substantially higher than allowable under ICNIRP and FCC regulations. *"The tissues showing the highest simulated absorbed power values were the muscles, the bones and the skin. Some simulated psSAR values were around 8 [W/Kg], well above the FCC and the ICNIRP limits (e.g., in the SAM phantom using the Google glass with monopole)."* (Pizarro & De Salles, 2014).

Wireless headsets and smart phones may expose the user to the similar RF radiation intensities for the duration of use, but a physician may potentially wear a wireless headset for 8–12 h a day while seeing patients. Thus, it is probable that this new application of wireless technology will create some of the most excessive, prolonged RF exposures seen in professional occupations. This is a continuous exposure and it may be worn for many hours per day emitting intense microwave radiation against the right eye and that same side of the head. There is currently no option that can increase the distance of a wireless headset from the head, brain, face and eye in order to reduce RF exposure, as is possible with speakerphone and texting uses on a smart phone.

Both doctors and their patients should be concerned with digital distraction issues that are already known to compromise behavior, judgment and especially performance in wireless device users. The use of cell phones impairs performance while driving (Strayer & Drews,

2004; Strayer et al., 2006, 2003; Strayer & Johnston, 2001). This is likely related to a brain condition termed "inattention blindness" where the brain is unable to successfully handle both activities at once (Strayer & Drews, 2004; Strayer et al., 2003; Strayer & Johnston, 2001). The use of cell phones while driving increases the risk of collision by 400% (Strayer et al., 2006). This is as risky as drunk driving with a blood alcohol concentration of 0.08% weight/volume (Strayer et al., 2006). Wearing wireless headsets may cause inattention blindness for the same reasons and with the same adverse consequences during care and treatment of patients.

What is the problem for the patient?

It is not just health risks to physicians, physician assistants and nurses wearing wireless headsets that matter here. The quality of medical care provided to their patients may suffer. Wireless headset RF exposures are so high that hours of prolonged exposure may lead to impaired cognition and performance, and as a result, patients may get less-than-competent professional medical treatment. Why would any patient want to see a physician or take their child to a pediatrician who wears wireless glasses with what is already known about the effects on brain performance? Why would any family go to a doctor who is cognitively impaired by electronic gadgets used in office visits, since wireless headsets can be expected to produce the same distraction and worse wireless exposures than using a smart phone at the head? Personal relationships with patients may also be undermined. A multi-tasking doctor who wants to expedite patient visits may instead make the patient feel uncomfortable or ignored during the examination. Iltifat Husain, MD cautions "W*hen talking to a patient … and actively using Glass at the same time, there is a good chance you're coming off as unprofessional….. I call it the blank glazed-over stare……it's the same loss of eye contact…..(W)ith Glass, if you're talking to someone, it's immediately noticeable if the person is looking at their Glass screen in their right upper visual field.*" (Husain, 2014)

Privacy and security are also important considerations. It is unrealistic today to expect complete security of records or sensitive information transmitted by wireless devices, given the poor record of health insurance companies who have failed to ensure the privacy of patient data. The security of transmitting wireless medical observations and records cannot be guaranteed. The giant health insurance company Anthem was hacked in 2015, exposing tens of millions of medical records containing personal and financial information of the patients it insures (Mathews, 2015). Wireless transmission increases the risk of hacking and illegal sale of private information, and is particularly worrisome where medical information breaches are a violation of patient HIPPA privacy rights. In the US, Public **Law** 104–191 or the **Health Insurance Portability and Accountability Act** of 1996 (**HIPAA)** establishes standards for the electronic exchange, privacy and security of health information. The Privacy Rule standards address the use and disclosure of individuals' health information—called "protected health information" by organizations subject to the Privacy Rule — called "covered entities," as well as standards for individuals' privacy rights to understand and control how their health information is used. HIPPA mandates strict privacy protections in the doctor's office.

Furthermore, wireless headsets are designed to take photos or videos of patients without their knowledge, making it impossible to monitor whether and when patients and bystanders are being wirelessly monitored and video-recorded without their knowledge or consent.

What's the advice to medical professionals?

Physicians have a duty to themselves and to their patients to learn about adverse health effects of wireless device exposures. The International Agency for Research on Cancer (IARC), and the National Toxicology Program (NTP) have issued advisories that RF exposures from devices like smart phones and wearable wireless-type devices worn on the body can pose a risk of cancer. Exposure during an 8-h work day to wireless RF emissions is ill-advised, and avoidable. This technology is poised to become widely embedded into healthcare with virtually no health and safety advisories. It will be a costly mistake that can be avoided with reliance on hard-wired instead of wireless technological applications, and with human scribes to transcribe patient notes.

Physicians and other healthcare professionals should not be sold on the use of these wearable technologies without knowledge of potential risks to themselves, and to their patients. Informed consent signatures by medical professionals should be required for wireless headset users who opt to use them, documenting that they have been advised of the carcinogenic potential of extended use, and that they are aware of the medical risks to themselves with prolonged use. For pregnant medical professionals there are clear indications that using a wireless device (cell phone) during pregnancy can result in altered fetal brain development in their child, resulting in increased risk of behavioral and learning problems by the time that child is in primary school (Birks et al., 2017; Divan et al., 2008, 2012). As the RF emissions from smart phones and from wireless headsets in wearable glasses are about the same intensity,

pregnant medical professionals should take heed. Further, those who wear them for hours each day in clinical practice do not have the option of using "speaker phone" mode, as pregnant women are able to do when using a cell phone.

Healthcare professionals can choose to set personal examples of precaution in their own practices and reject using wireless devices that must be worn on the body. The scientific evidence is more than sufficient to demonstrate that existing emissions limits are grossly inadequate to protect public health. At present, it is up to individuals to exercise personal choice and take precautionary actions to protect themselves against misuse of technologies. Medical professionals can promote knowledge of emerging health risks and alternatives for safer use of technologies, by their own example and by discussing these issues with professional colleagues, staff, administrators and patients. Using human scribes to take patient exam notes instead of wireless transmitters is likely to be more cost effective and protect health in the long run, and patients will appreciate the human connection to their doctors. No physician, Physician Assistant (PA-C), nurse or other medical assistant should be required by economy-minded administrators to wear a wireless device on the side of the forehead (or anywhere else on the body) for hours on end.

What's the advice to patients?

Patients should be asked in advance if they agree to the use of wireless headsets by their doctor or other medical professional during office visits. There should be information provided about the potential health risks associated with extended use of wearable wireless headsets on cognition and judgment of persons wearing the device and a signed informed consent should be required from the patient or their guardian. "*The most important goal of informed consent is that the patient has an opportunity to be an informed participant in her health care decisions. Informed consent is the process by which the treating health care provider discloses appropriate information to a competent patient so that the patient may make a voluntary choice to accept or refuse treatment. It originates from the legal and ethical right the patient has to direct what happens to her body and from the ethical duty of the physician to involve the patient in her health care.*" (De Bord, 2014).

They should have the right to examinations without wireless transmission via wireless headset, and the right to have their healthcare records be prepared by the attending physician, or their Physician Assistant, nurse or the scribe who assists them.

Patients should also inquire about whether their physician and other key healthcare staff who administer tests or provide drugs or injections wear wireless headsets on a routine basis. This may be an indication that they are not functioning up to professional capabilities due to performance impairment from prolonged wireless exposures.

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