

## Wireless technology: A risk to health?

**R**adio communications and human exposure to radio frequency (RF) energy date back more than 100 years. However, the late 20th century saw a proliferation of wireless technologies, including cellular phones and their base tower infrastructure, television and radio signals, cordless phones, wireless Internet, and smart meters. Today, wireless communication devices are ubiquitous in homes, hotels, airports, schools, and libraries.

The RF band is a band of non-ionizing radiation that ranges from 3 kHz to 300 000 MHz.<sup>1-3</sup> It is part of the electromagnetic spectrum, with frequencies below those associated with visible light and X-rays, and higher than those associated with power lines.

The bulk of research in RF has been on cellular phones. Cellular phones have been in use longer than Wi-Fi and are associated with higher field strengths. Thus, when considering total RF exposure,<sup>4</sup> it is important to remember that Wi-Fi may represent only a small proportion of an individual's overall RF exposure.<sup>5</sup>

In most countries, exposure limits for RF are set at the national level. Industry Canada regulates RF in this country. For protection of human health from adverse effects of RF exposure, Industry Canada has adopted Health Canada's Safety Code 6 (revised 2009), which sets exposure limits<sup>6</sup> for controlled and uncontrolled environments based on temperature increases in living tissue. With the proliferation of wireless devices, there have been increased concerns and questions raised as to whether expo-

sure limits set on the basis of tissue heating are sufficiently protective.

Researchers at the United Kingdom National Radiological Protection Board have undertaken modeling of RF exposure. In studies on mobile phone exposures, they found that head and neck exposures to RF with maximum handset use (resembling a controlled exposure of 100% RF absorbed by tissue) was 3.09 to 4.61 W/kg.<sup>7</sup> Exposures related to Wi-Fi are much lower. For a child using a laptop within good signal range of a wireless router, RF exposure to the head was 0.0057 W/kg. This represents less than 1% of the specific energy absorption rate calculated for a typical mobile phone exposure, and well below the 1.6 W/kg limit to the head for uncontrolled exposures.<sup>5</sup>

National standard-setting organizations maintain that current limits are protective against known effects of exposure to RF energy. The World Health Organization has concluded: "No obvious adverse effect of exposure to low level radio frequency fields has been discovered... further research aims to determine whether any less obvious effects might occur at very low exposure levels."<sup>8</sup>

However, there are some who argue otherwise (e.g., the BioInitiative Working Group, an ad hoc group of scientists and public policy analysts). Their report<sup>9</sup> dramatically stated that "it is not unreasonable to question the safety of RF at any level." The report goes on to suggest a precautionary level for human exposure to electromagnetic fields that is approximately 10 000 times lower than existing regulatory limits.

A review by other scientists<sup>10</sup> points out that the practical implications of the limits proposed by the BioInitiative Working Group would

affect the use of public safety RF devices, including airport radar installations, and police and emergency communication systems.

The Royal Society of Canada performed a highly credible review in 1999, with two updates, the most recent in 2009.<sup>11-13</sup>

The degree of precaution that should be incorporated into exposure limits for the public is always a subject for debate. There is general agreement that the exposure limits in Health Canada's Safety Code<sup>14</sup> are protective against effects produced through tissue heating. Consistent evidence on the level at which this occurs is available, exposure limits can be set on the basis of this well-established effect, and the use of safety factors selected by the standard-setting organization.

Recently published research demonstrates that Wi-Fi exposures are not only well within recommended limits, but are only a small fraction (less than 1%) of what is received during typical use of cellphones.<sup>5</sup>

For this reason, much of the research on possible effects of RF energy has been focused, and will likely continue to focus, on exposures from cellphones rather than the lower exposure devices such as Wi-Fi or smart meters.

Given the experience with other sources of non-ionizing radiation (e.g., power lines) that have been in use much longer than cellphones or Wi-Fi, it is unlikely that all controversies related to potential RF effects will be resolved even after decades of additional research.

In the meantime, those who wish to reduce their exposures to RF can put a bit of distance between themselves and their wireless devices by using earpieces with their cellphones and keeping their laptops off their lap.

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*This article is the opinion of the Council on Health Promotion and has not been peer reviewed by the BCMJ Editorial Board.*

Consumers should have access to reliable information on the power outputs of wireless devices. As uses of wireless technology continue to expand, better tracking of trends in RF levels present in community settings would also be a prudent measure to ensure that public exposures are kept well below levels at which effects on health may occur.

—Ray Copes, MD, FRCPC  
Environmental Committee

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