

doi: 10.1111/1753-6405.12706

Wi-Fi radiation exposures to children in kindergartens and schools – results should lessen parental concerns

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The International Agency for Research on Cancer classified radiofrequency electromagnetic radiation (RF-EMR) as a possible human carcinogen in 2011.¹ Since then, there has been increasing interest regarding human exposure to RF-EMR sources and potential health effects. In particular, the World Health Organization recommended epidemiological research focus on assessment of RF-EMR (e.g. Wi-Fi) exposures to humans, including children.²

RF-EMR exposure guidelines

The guidelines of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) have been followed internationally to limit RF-EMR exposures to the general public, including children.³ The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) has similar guidelines to those of the ICNIRP.⁴ They mainly protect humans from established short-term health effects (e.g. tissue heating). Although the guidelines include safety factors, they do not necessarily cover potential health effects related to long-term low-level RF-EMR exposures. Available data are insufficient to provide a basis for setting exposure restrictions in relation to the potential long-term effects of exposure (e.g. cancer).⁴ Some countries have recommended different approaches to limit RF-EMR exposures to children.⁵ In Australia, parents are encouraged to reduce RF-EMR exposures for their children.⁵

Wi-Fi exposure sources

Wi-Fi is a popular wireless technology mainly operating at 2.4–2.5 gigahertz (GHz). This frequency is similar to that emitted by microwave ovens, Bluetooth and medical

appliances. Microwave oven exposure has been highly prevalent in developed countries since the 1960s.⁶ Since high intensity of RF-EMR exposure is well contained within the ovens, the leakage exposure from most domestic ovens is very low compared to the exposure limit.⁷ Surprisingly, epidemiological studies on the health effects from long-term use of domestic microwave ovens are limited,^{8,9} possibly due to the difficulty of good exposure assessment.

Nevertheless, epidemiological studies examining health effects of Wi-Fi alone are not available as most of the RF-EMR epidemiological studies so far involved exposures to mobile and cordless phones, mobile phone base stations, radio/TV towers, etc. Wi-Fi installations ('hotspots'/routers) send and receive RF-EMR to and from Wi-Fi enabled devices such as laptops, tablets/iPads and smart phones. Depending on the distance of a Wi-Fi antenna from the human body, the origin of exposure is either far-field (e.g. Wi-Fi 'hotspots'/routers) or near-field (e.g. laptops, tablets/iPads, etc); later contributing most of the total human RF-EMR exposures.

Wi-Fi exposure in kindergartens/schools

With the increasing use of Wi-Fi and Wi-Fi enabled devices in schools, there has been a growing concern among parents regarding RF-EMR exposure from Wi-Fi and potential effects on their children's health.¹⁰ Children in schools are exposed to Wi-Fi exposures voluntarily or involuntarily – either from Wi-Fi enabled devices or Wi-Fi routers, respectively.

Until recently, there have been little data available regarding children's Wi-Fi exposures.^{11,12} Recently, two independent groups of Australian researchers have published findings on children's exposures to Wi-Fi in kindergartens and schools.^{10,13} These data are amongst the first comprehensive Wi-Fi exposure measurements in these settings.

In 2016, we reported environmental and far-field personal RF-EMR exposures [88 megahertz (MHz)–5.8 GHz] in 20 kindergartens across Melbourne, Victoria.¹³ The survey also involved personal RF-EMR exposure measurements in 10 children. Median Wi-Fi exposure was much lower than that from mobile phone base stations, but comparable to the radio/TV exposures.

The contribution of Wi-Fi to total exposure was only ~10%.¹³ The maximum Wi-Fi environmental and personal exposures were 0.05% and 0.02% of the ICNIRP limits, respectively.

In 2017, ARPANSA published the environmental (classroom and schoolyards) Wi-Fi exposure levels measured in 23 schools in Victoria and New South Wales.¹⁰ The median of average Wi-Fi levels was in the order of 10⁻²–10⁻⁴ % of the ICNIRP limits.

Conclusions

These recent findings indicate that children's exposures to Wi-Fi at kindergartens/schools are very low. This should be reassuring to parents who worry about this exposure. Since these measurements only represent far-field exposures, further research should include near-field exposures. The data on far-field and near-field personal exposures would better describe children's total Wi-Fi exposures. Furthermore, monitoring of Wi-Fi exposures should be continued in future to inform the general public regarding RF-EMR exposures.

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The authors have stated the following conflict of interest: MJA holds a small parcel of shares in Telstra which operates a cell telephone network in Australia.

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