

Cell Phones: Safe or Carcinogenic?

With an estimated 5 billion worldwide users, the public debate over cell phone and the possible link to cancer is one of critical importance. The concern is that cell phones may cause the growth of any one of three types of tumors: cancer of the parotid (a gland near the ear), glioma (a rapidly spreading brain tumor), and acoustic neuroma (a tumor that typically develops on the nerve connecting ear and brain).

Scientist 1

There is growing evidence to support the conclusion that there may be a cell phone-cancer connection. The Interphone Study is the largest and longest study of cell phones and cancer. Including nearly 20,000 participants from 13 countries, the study found that those who used cell phones most frequently had a 40% higher incidence of glioma. Another peer-reviewed study conducted in Israel found that there was 58% greater occurrence of parotid tumors among heavy cell phone users. A Swedish survey of 16 scientific studies concluded that the incidence of acoustic neuroma and glioma was two times greater among those who used cell phones for 10 years. After reviewing a large collection of published studies, a group of 31 scientists from 14 countries commissioned by the World Health Organization classified cell phones as a possible carcinogen. This classification indicates that there is sufficient evidence of the connection to warrant further investigation and watchfulness. Reporting in an esteemed peer-reviewed journal, the National Institute of Health showed that a single hour of cell phone use significantly increases glucose metabolism rates at locations closest to the antenna. Even areas far from the antenna showed biological effects, a sign that the radiation may be capable of so-called non-thermal effects upon the brain. Cell phone radiation may be stimulating free radicals to destructive action or even initiate some form of inflammatory response within the brain. These could trigger a chain of actions that lead to tumor development.

Scientist 2

There is no credible evidence establishing a connection between cell phone use and cancer. Studies like the Interphone Study and others are observational studies that show only an association between cell phone usage and the occurrence of cancer. Such studies are biased in terms of how survey questions are asked of cell phone users who have acquired cancer. These methodological flaws do not lend credibility to their results. Statistical studies like these are not cause-effect studies. They do not isolate other variables and so they cannot determine that the cancer was actually caused by cell phone use. Furthermore, the tumors that are associated with cell phone use are so rare that even a doubling of probability of cancer would be equivalent to a small increase in the total numbers. Cell phones give off a form of radiation known as **non-ionizing radiation**. The frequencies associated with this form of electromagnetic radiation are too low and the signal is too weak to be able to break biochemical bonds within body tissues and to be able to damage DNA molecules. Such effects are known as *thermal effects*. Study after study has shown that cell phone radiation does not have a thermal effect upon the brain; that is, it doesn't *fry our brain*. No scientist has yet proposed an acceptable biological mechanism to explain how cell phones can cause cancer via *non-thermal effects*. Simply speculating that there is increased glucose metabolism rate associated with cell phone use does not establish that cell phones cause cancer. Because there is no cause-effect model proposing how cell phones cause cancer, and because the studies associating cell phone use with cancer have obvious flaws, there is no reason for the general public to fear that cell phone use causes cancer.

Questions:

1. The Interphone Study found a 40% higher incidence of glioma in heavy users of cell phones . The data from the study also found that the incidence of cancer among all cell phone users - from heavy to light use - was slightly less than the incidence of cancer among non-users of cell phones . How would **Scientist 2** most likely interpret the results of this study?
 - a. Cell phones should be used in moderation to avoid the consequences associated with heavy use.
 - b. Heavy use of cell phones can cause cancer; light use of cell phones actually protects the user from cancer.
 - c. The radiation given off by cell phones becomes more ionizing as the cell phone is used with higher frequencies.
 - d. These two findings regarding the cell phone-cancer connection contradict each other; none of the results can be trusted.

2. Which one of the following statements would both **Scientist 1** and **Scientist 2** disagree with?
 - a. Cell phones emit low frequency, non-ionizing radiation.
 - b. Cell phone radiation does not have thermal effects upon the brain.
 - c. If cell phones cause cancer, it is important to identify a biological mechanism by which it does.
 - d. Statistical studies that associate the frequency of cell phone use with cancer are important sources of evidence.

3. The study published in 2011 by Dr. Nora Volkow of the National Institute of Health showed that there was a significant increase in glucose metabolism in areas of the brain that are closest to the cell phone antenna. Which of the following inferences of this study would **Scientist 1** and **Scientist 2** agree with?
 - a. The Volkow study is merely statistical and does little to establish that there is a cell phone-cancer connection.
 - b. This is the first evidence that cell phone use causes cancer on the side of the brain that the phone is most often held.
 - c. Cell phones have a very positive affect upon the brain, improving alertness in areas that are exposed to the radiation.
 - d. Perhaps non-ionizing radiation can affect biological function in the brain; further research should occur to determine if this results in any long-term impact.

4. Which one of these facts is **NOT** part of the arguments of **Scientist 1**?
 - a. Even non-ionizing radiation can have negative biological consequences by non-thermal effects.
 - b. Statistical studies have shown a clear correlation between cell phone use and cancer incidence.
 - c. Cell phone radiation is an ionizing form of radiation that is capable of altering DNA molecules and destroying body tissue.
 - d. It is not important to propose a biological mechanism for the cell phone-cancer connection if statistical studies prove the connection.

5. Suppose that a biological mechanism attributing tumor development to non-thermal effects caused by cell phone radiation was proposed and then validated by a research study. Which statement describes the most likely effect that this development would have on the thinking of the two scientists?
- Scientist 1** would no longer believe in the validity of statistical studies.
 - Scientist 1** would advocate research into thermal effects of cell phone radiation.
 - Scientist 2** would call for more statistical surveys of cell phone users who developed tumors.
 - Scientist 2** would accept the conclusion that there is evidence for a possible cell phone-cancer connection.
6. Cell phones are one of 900 environmental factors that the World Health Organization (WHO) has studied over the last couple of decades. The WHO categorizes these factors in one of five ways - definitely carcinogenic (107 cases), probably carcinogenic (59 cases), possibly carcinogenic (266 cases), definitely not carcinogenic (1 case), and non-classifiable (508 cases). An environmental factor receives the non-classifiable categorization if they are unable to reach an evidence-based conclusion. Which one of the following statements would best represent **Scientist 1's** response to the categorizing of cell phone radiation as possibly carcinogenic?
- Cell phones are definitely cancer causing and should be banned until further research proves their safety.
 - The fact that the WHO has only placed one factor of 900 in the definitely not carcinogenic category indicates a strong bias.
 - The fact that WHO categorized cell phones as only possibly carcinogenic indicates that their study cannot be used to support the possibility of a cell phone-cancer connection.
 - The fact that WHO categorized cell phones as possibly carcinogenic indicates that they saw possible evidence for a cancer connection. In the absence of such evidence, they would categorize them as non-classifiable or not carcinogenic.
7. Which slogan below is inappropriately matched to the scientist's feelings regarding cell phone use and cancer?
- Scientist 1**: Better safe than sorry.
 - Scientist 1**: Cell phones are guilty until proven innocent.
 - Scientist 2**: Cell phones are innocent until proven guilty.
 - Scientist 2**: You can prove just about anything using statistics.
8. Which one of the following findings would support the arguments of **Scientist 2**?
- A 10-year study of 100,000 cell phone users provided statistical evidence that the more frequent users were 20% more likely to acquire glioma.
 - Two research groups attempted to repeat the study performed by the National Institute of Health and failed to show any effects of cell phone use on glucose metabolism.
 - A study showed that the increase in glucose metabolism during cell phone use was the result of the brain cells' response to stress and in effort to produce heat shock proteins.
 - Lab rats exposed to cell phone radiation tended to increase glucose metabolism in a manner that resulted in dysfunction of the blood-brain barrier and the buildup of toxins.