The Institute of Cancer Research

ICNIRP

6th International NIR Workshop

Rio de Janeiro

15th October 2008

Mobile phones & cancer – how does epidemiology investigate this?

- There are now >2 billion cellular phone users in the world, and by 2010 there will be 3 billion.

Radiofrequency radiation

- RFR has insufficient energy to disrupt molecular bonds directly.
- No consistent laboratory evidence that RFR can cause cancer in animals.

Radiofrequency radiation

- Balance of biological evidence suggests that RF field exposures below guideline levels do not cause mutation or initiate or promote tumour formation.

- Nevertheless, there is public concern and scientific questions have been raised about possible carcinogencity, and several epidemiological studies have consequently been undertaken to investigate risks.

Epidemiology: study of the distribution and causes of disease in human populations.

Epidemiology : strengths

- Assessment of risks in human beings, not in animals or cells.

Epidemiology : limitations

- Can only investigate the types of exposure that have already occurred frequently several years in the past.

How does epidemiology investigate this question, and what features of epidemiological studies should you look at carefully when assessing published epidemiological studies?

Epidemiological investigation of cancer risk in relation to RF exposure

Epidemiological studies have investigated risk of cancer in relation to occupational, recreational, residential and phone exposures.

Types of epidemiological study

(1) Analyses of routinely-collected mortality or cancer registration data from populations.

e.g. mortality or cancer risks over time in relation to extent of phone use over time.

(2) Case-control studies, comparing extent of mobile phone exposure in persons with a particular disease (e.g. brain tumour) with that in control individuals without the disease.

(3) Cohort studies, following disease risk over time in persons with a particular exposure (e.g. mobile phone subscribers).

Cohort Studies

Can be:

1) Retrospective – exposure and diseases have occurred when study started.

or

2) Prospective – disease not yet occurred ± exposure not yet occurred at start of study

Case-control studies : strengths

- Relatively quick and cheap (compared with cohorts)

Case-control studies : limitations

- Recall inaccuracy: mobile phone use over a period of years is remembered very inaccurately, which will make any real effects appear weaker than they truly are.
- RF exposure: mobile phone use is only a crude proxy of RF exposure, so if there are real effects of RF, they will appear weaker in studies based on phone use data.

Case-control studies : limitations

- Recall bias: if exposure is assessed by recall at interview there is scope for bias (i.e. cases remember phone use differently as a consequence of knowing they have cancer and believing it is caused by phone use).

  This applies especially to recall of side of phone use.

Case-control studies : limitations

- Participation bias: some potential subjects may not take part (e.g. because they have died or are unwilling), and this non-participation may be biased

  e.g. phone users may preferentially take part as controls, raising apparent use by controls.

  Therefore greater non-participation → more scope for bias.

Case-control studies : limitations

- The presence of a brain tumour may biologically affect memory and cognition, and hence reporting of phone use, and before diagnosis may affect actual phone use.

- For acoustic neuroma, the tumour may affect hearing and hence phone use before diagnosis, or lead to earlier diagnosis in phone users.

Case-control studies : limitations

- Control selection: controls may be biased if they do not accurately represent the source population of the cases – especially a problem for hospital-based studies.

- Interviewer bias: if interviewers are not blinded to case/control status of the subject they interview, they may ask questions and record answers differently between cases and controls, because of their own views on whether phones cause cancer.

Cohort studies : strengths

- Phone use assessment not biased by presence of disease.
- All cancer cases included, unconstrained by fatality or co-operativeness

Cohort Studies : limitations

- Need very large numbers of subjects and long follow-up, so slow and expensive.

Cohort Studies : limitations

- If phone use is assessed from billing records:-

  * Cannot be sure who is the user (as opposed to the bill-payer)

  * There may be no information on incoming calls

  * Cannot assess behavioural factors (e.g. side of use, hands-free use).

Interpretation of Epidemiological Results

- Consider whether epidemiological results are due to bias, confounding, errors or chance
- and assess them against the 'Bradford Hill' criteria:- strength of association, dose-response, consistency, biological plausibility, etc.

- It is important, as in other biological science, to seek confirmation of results from one investigator by others, before giving them too much weight, and to give weight to results that are replicated by many investigators, especially using different methods.


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