



TEACHING ABOUT SCIENCE

E ASSESSING DATA QUALITY: MOBILE PHONES – HEALTH RISK OR SCARE ?

This is a lesson aimed at helping students to develop their understanding of how to assess the quality of scientific data.

Resources for students

Downloaded from www.nuffieldfoundation.org/aboutscience

OHTs E0.1 Aims, E0.2 Headlines

OHTs E1.1A/B Glossary of terms (2 sheets)

Student sheets E1.1C/D Research project reports

Student sheets E1.2A/B/C Mobile phone safety debate

Student homework sheet E3.1A What scientists said

Student homework sheet E3.1B Homework questions

OHT E3.2 Stewart Report findings (2 sheets)

Teachers' notes (separate download)

Download from www.nuffieldfoundation.org/aboutscience

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E MOBILE PHONES – HEALTH RISK OR SCARE?

When science attempts to answer the question of whether a piece of technology poses a health risk:

- 1** a clear causal link can be difficult to establish so research focuses on identifying an increased risk;
- 2** the validity, reliability, and repeatability of scientific data are important in assessing the quality of evidence;
- 3** researchers and experts do not always agree on the interpretation of a body of evidence.

E MOBILE PHONES – HEALTH RISK OR SCARE?**Headlines about health risks from mobile phones**

New studies link brain
tumours to mobile phones

Phone firms dismiss
worries over radiation

Mobile phone firms vow to
allay child health fears

Mobile telephones are not
a health hazard, say MPs

Scientists at a loss to
explain unusual symptoms

Why experts let us make up our own minds: the long-awaited Stewart Report has left Britain's mobile phone users with as many questions as answers

E MOBILE PHONES – HEALTH RISK OR SCARE?

Glossary of terms as used in this lesson

1 What is the evidence trying to show?

Mechanism

An understanding of the process by which mobile phone use might result in a specific health effect.

Example: it has been shown in experiments that microwave radiation speeds up cell division. This could explain how radiation could cause cancers.

Correlation

A statistically significant link between two factors.

Example: a statistically significant increase in the number of incidents of brain tumours among mobile phone users as compared with a control group, who do not use mobile phones.

E MOBILE PHONES – HEALTH RISK OR SCARE?**Glossary of terms as used in this lesson*****2 How do you decide how good the evidence is?*****Is it valid?**

How well do the results of a scientific enquiry relate to the question being investigated?

Example: how valid is it to draw conclusions about effects on humans from effects observed in other animals?

Is it reliable?

How consistent is the evidence? Reliability is influenced by the quality and size of any sample used.

Example: is a sample of 13 people going to give reliable evidence about all mobile phone users?

Is it repeatable?

Can experimental findings be repeated with different study groups or by different scientists?

Example: if two groups of scientists perform similar experiments and get different findings, what does this say about the quality of the evidence they present?

E MOBILE PHONES – HEALTH RISK OR SCARE?

Research project 1

David De Pomerio and team – University of Nottingham

The team of researchers beamed microwaves at tiny nematode worms. These were chosen because their cell biology is simple and well understood. In one experiment the team found that larvae exposed to an overnight dose of microwaves wriggled less and grew 5% faster than those in a control group. This suggests that microwaves may be speeding up cell division. The group now plans to investigate whether a similar effect can be observed in mammalian cells, a finding that would raise fears about a possible link with cancer.

Research project 2

Henry Lai – University of Washington, Seattle

A team in Seattle has researched the effect of microwaves on levels of stress in rats. They have found evidence that exposure to microwaves in rats causes the production of corticotrophin releasing factor, a stress hormone that disrupts neurotransmitters in the brain which are involved in memory and alertness. The rats showed an increased tendency to binge on alcohol and take longer to learn the location of a submerged platform in cloudy water.

Research project 3 John Tattersal and colleagues – Defence Evaluation and Research Agency

This team exposed slices of rat brain to microwaves. They found that the exposure reduced electrical activity and weakened response to stimuli. The brain slices were taken from the hippocampus, a part of the brain with a role in learning. However John Tattersall has indicated he thinks the hippocampus is too deeply buried within the brain to be affected by mobile phones. His more recent research has shown that nerve cell synapses may become more receptive to changes linked to memory when they are exposed to microwaves.

Research project 4

Alan Preece and colleagues – University of Bristol

The group used a device that mimicked the emissions of mobile phones to test the responses of volunteers asked to recall words and pictures shown on a screen. The microwave emissions had no effect on recall but when response time was tested by asking the volunteers to press a button matching a 'Yes' or 'No' image on screen those with the headsets switched on showed about a 4% improvement in response times. The effect was seen in two separate groups of volunteers.

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Research project 5

Michael Repacholi and research group – Royal Adelaide Hospital

The group spent 18 months exposing mice to emissions that mimicked those of mobile phones. The group used mice that had been genetically engineered to increase their susceptibility to lymphoma in order to make the experiment more sensitive. They found that twice as many mice exposed to radiation developed lymphomas as those in the control group.

Research project 6

Brooks Air Force Base – San Antonio, Texas

Experts used mice genetically engineered to be susceptible to breast tumours in a similar study to Repacholi's. They exposed the mice to radiation for 20 hours a day for 18 months. There was no increase in the rate of tumours in these mice.

Research project 7

Lennart Hardell – Orebro Medical Centre

A study was made of 209 people with brain tumours and a control group of 425 without brain tumours. They found that mobile phone users were no more likely to develop tumours than non-users. Of those with tumours however, mobile phone users were 2.5 times more likely to develop tumours close to their 'phone ear' than the non-users. There were only 13 mobile phone users with tumours in the study group so the result may not be statistically significant.

Research project 8 George Carlo – Wireless Technology Research, Washington DC

Here they studied 450 people with brain tumours and a control group of 425. There was no general link between brain cancers and mobile phone use. However the study identified a smaller group of 30 people who had a particular form of brain tumour called a neurocytoma. 40% of this group were mobile phone users. This compared with the control group without neurocytomas, in which only 18% were mobile phone users. This result is statistically significant.

E MOBILE PHONES – HEALTH RISK OR SCARE?

MOBILE PHONE SAFETY DEBATE: GROUP A

A telecommunications employee has brought a case against his employer on the grounds that his ill health, which has caused him to leave work, is linked to prolonged use of a mobile phone as part of his former job.

Your group has been asked to act as expert witnesses for the team of prosecution lawyers acting for the employee bringing the case.

There are two ways that you can help the lawyers.

Task 1

Present the three best pieces of evidence from the projects that support the claim that mobile telephones cause health problems.

Task 2

Prepare to question the evidence that the defence team presents. They have access to the same information as you. Look particularly to question whether it is reliable, valid and repeatable. Remember that they will do the same to your evidence.

To prepare for these two tasks you will need to look carefully at the evidence from all the projects. The following checklist might help you organise your thoughts. Use the definitions on the OHT/board to help you.

Try to cover all the evidence in the time you have rather than concentrating on the checklist too much.

E MOBILE PHONES – HEALTH RISK OR SCARE?

MOBILE PHONE SAFETY DEBATE: GROUP B

A telecommunications employee has brought a case against his employers on the grounds that his ill health, which has caused him to leave work, is linked to prolonged use of a mobile phone as part of his former job.

Your group has been asked to act as expert witnesses for the team of defence lawyers acting for the telecommunications company being sued.

There are two ways that you can help the lawyers.

Task 3

Present the three best pieces of evidence from the projects that undermine the claim that mobile telephones cause health problems.

Task 4

Prepare to question the evidence that the prosecution team presents. They have access to the same information as you. Look particularly to question whether it is reliable, valid and repeatable. Remember that they will do the same to your evidence.

To prepare for these two tasks you will need to look carefully at the evidence from all the projects. The following checklist might help you organise your thoughts. Use the definitions on the OHT/board to help you.

Try to cover all the evidence in the time you have got rather than concentrating on the checklist too much.

E MOBILE PHONES – HEALTH RISK OR SCARE?

MOBILE PHONE SAFETY DEBATE: EVIDENCE EVALUATION CHECKLIST FOR GROUPS A AND B

Research project

	1 De Pomeroi	2 Lai	3 Tattersal	4 Preece	5 Repacholi	6 Brooks	7 Hardell	8 Carlo
The research is attempting to identify a physiological mechanism by which microwaves from phones can effect the tissues of living organisms.								
The research is attempting to identify a correlation between the occurrence of health problems and the emissions from mobile phones.								
The research indicates that there may be an increased risk of health problems from using mobile phones.								
The research is of limited use because the link between its findings of effects on animal tissue and cancer in humans is not necessarily valid								
The research is of limited use because other research groups have been unable to repeat the findings in similar experiments.								
The research is of limited use because the size of the sample used make its statistical significance questionable and therefore not reliable.								

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WHAT THE SCIENTISTS SAID ABOUT THE EVIDENCE

The conclusions of those who carried out the research

Alan Preece, University of Bristol:

I'm pretty sure there is no effect on short-term memory.

Dr Lennart Hardell, Orebro Medical Centre:

There is biological indication that there is a problem which should be studied much more. I think that until we have a definite conclusion, the definitive result of much larger studies, we need to minimise the exposure to human beings.

Dr George Carlo, Wireless Technology Research:

We clearly have results that suggest something more here than meets the eye. The science we have today clearly shows that this is not black and white. That we have moved now into a grey area that suggests there could be a problem that needs to be looked at very, very carefully.

Comments from other scientists interested in this research

John Moulder, Radiation Oncologist, Medical College of Wisconsin:

These experiments tend to work in one lab but fail in others, suggesting that technical glitches are responsible for the results.

If it doesn't reliably cause cancer in animals at high doses, then it probably isn't going to cause cancer in humans.

Comments from spokespeople of government and industry agencies

John Stather, National Radiological Protection Board

This study [by Lennart Hardell of the Orebro Medical Centre] doesn't tell us much that we didn't already know, other than that we need larger more extensive studies.

Tom Wills-Sandford, Federation of the Electronics Industry:

The industry takes all the reports seriously and does not try to conceal anything. The limits set by the NRPB [National Radiological Protection Board] are up to 50 times lower than those which might produce adverse tissue warming.

Dr Michael Clark, National Radiological Protection Board:

We honestly see no reason to change our recommendations. But no scientist would ever say the risk was zero ... we will be the first to tell people if present research on mobiles suggests a need for change.

E MOBILE PHONES – HEALTH RISK OR SCARE?**HOMEWORK QUESTIONS**

After you have read the comments made by people working in the field of mobile phones and health, give your answers to the following questions.

Use the ideas and terms you have learnt in the activity on mobile phones in your answers as much as possible.

- 1** Why do you think Lennart Hardell recommends minimising exposure from mobile phones?

- 2** What reason does John Moulder give for being unconvinced by the evidence of risk from mobile phones?

- 3** Do you agree with John Stather's assertion that larger studies are needed? Explain your answer.

- 4** To what extent do the scientists agree about the risks?

- 5** Do you think scientific research can give a certain answer about the risk?

- 6** Would you be happy to use mobile phones in the same way as you do now, given the evidence you have studied?

E MOBILE PHONES – HEALTH RISK OR SCARE?**STEWART REPORT FINDINGS**

The Stewart Report commissioned by the British Government from the Independent Expert Group on Mobile Phones, published in June 2000, concluded that:

‘The balance of evidence to date suggests that exposures to radiation below National Radiological Protection Board guidelines do not cause adverse health effects to the general population,’

but that

‘there is now scientific evidence ... which suggest that there may be biological effects occurring at exposures below these guidelines.’

continued

E MOBILE PHONES – HEALTH RISK OR SCARE?**STEWART REPORT FINDINGS**

The Stewart Report therefore concludes that

‘It is not possible at present to say that exposure ... is totally without potential adverse health effects, and that the gaps in knowledge are sufficient to justify a precautionary approach.

The widespread use of mobile phones by children for non-essential calls should be discouraged.

We also recommend that the mobile phone industry should refrain from promoting the use of mobile phones by children.’

www.iegmp.org.uk