The Academy of Medical Sciences

Identifying the environmental causes of disease: how should we decide what to believe and when to take action?

Report synopsis

November 2007

The Academy of Medical Sciences

The Academy of Medical Sciences promotes advances in medical science and campaigns to ensure these are converted into healthcare benefits for society. Our Fellows are the UK's leading medical scientists from hospitals and general practice, academia, industry and the public service.

The Academy plays a pivotal role in determining the future of medical science in the UK, and the benefits that society will enjoy in years to come. We champion the UK's strengths in medical science, including the unique opportunities for research afforded by the NHS, encourage the implementation of new ideas and solutions – often through novel partnerships, promote careers and capacity building and help to remove barriers to progress.

Acknowledgements

The Academy of Medical Sciences is most grateful to Dr Geoff Watts FMedSci for preparing this synopsis. The Academy wishes to thank the Chairman, Professor Sir Michael Rutter CBE FRS FBA FMedSci, and members of the working group who conducted the study upon which this synopsis is based. Our thanks also to the review group, the Academy's Officers, Council and staff, participants at the workshop, and all respondents to the consultation for their helpful contributions to this inquiry. The Academy is grateful to the University Hospitals Association for its generous support of this project. Further details of the report that underpins this synopsis, those involved with the study and the process of evidence gathering, consultation and production are available at: http://www.acmedsci.ac.uk/publications

The **Academy** *of*
Medical Sciences

Identifying the environmental causes of disease: how should we decide what to believe and when to take action?

Report synopsis

November 2007

Introduction

In 2006 the Academy of Medical Sciences established a working group to produce a set of principles, illustrated with specific examples, to determine the potential problems and likely success of non-experimental methods in identifying the environmental causes of disease.

The foundations of this proposal lie in a feeling of scepticism amongst professionals and the public about the value of non-experimental approaches in identifying the environmental causes of disease, which has arisen when claims from one study are so soon reversed by the findings of another. For example, until recently hormone replacement therapy was thought to be protective against heart disease but it is now thought to be a risk factor. Nevertheless, in some other cases, non-experimental methods have clearly been successful, for example in determining the health risks associated with smoking.

The final report of this inquiry, entitled *'Identifying the environmental causes of disease: how should we decide what to believe and when to take action?'*, was published in November 2007. It contained five key recommendations and set out guidelines for the wide range of stakeholders involved in generating, communicating and translating research on the environmental causes of disease into policy and practice. This synopsis provides a précis of that report, complete copies of which can be found at: http://www.acmedsci.ac.uk/publications

Disease with an environmental cause

Knowing what to believe; deciding when to take action

Many of our illnesses are the outcome, not of inheritance or of growing old, but of agents in our surroundings. These 'environmental causes', as they are known, could be something in our food or drink, something in the air we breathe, a harmful microbe, or one of the vast number of other experiences and influences to which our bodies are regularly exposed: anything from a difficult childhood to household chemicals to the natural radioactivity of certain types of rock.

During the past 50 years medical scientists have identified many of these environmental hazards. Where the risk is judged significant and avoidable, governments may try to limit it - as has happened with vehicle exhaust fumes - or remove it, as with the insecticide DDT. Or they may leave it up to us, individually, to act as we see fit.

So what is the problem?

The problem lies in the difficulty of proving that a particular environmental factor really is responsible, at least in part, for causing a particular illness. The simplest way of finding out would, of course, be to perform direct tests. When doctors want to check whether a new drug is effective at treating an illness they recruit a group of volunteer patients, divide them at random into two groups, and give the drug to just one of the groups. If the drug works, those patients who receive it should do better than those who do not.

To use this method in testing the effects of, say, a suspected environmental contaminant would obviously be unacceptable. In other cases the barriers to understanding are less to do with ethics than with cost or practicability. Research on animals often provides valuable guidance - though not necessarily a definitive answer. Animals and humans do not always respond in exactly the same way.

Fortunately experiments - whether on humans or animals - are not the only way of trying understand the world. Another approach relies on closely observing it. All sorts of events and occurrences can be exploited for this purpose; they may be the result of human planning, may have been entirely unplanned, or may be entirely natural in origin.

The value of looking

A great deal of medical progress has stemmed simply from astute observation. From the discovery of penicillin's beneficial effects to the realisation that asbestos can cause cancer, many developments in medicine owe their origins to scientists in labs and doctors on wards who just noticed something they thought potentially important, or merely intriguing.

Then there are natural disasters. These may change the circumstances of a group of people in a way that would be ethically unacceptable in experimental science. A population-wide famine of the kind that occurred in Holland following World War II, for example, may offer insights into the part played by diet in causing illness. Likewise, studies of change in the health of people who have undergone a migration - Japanese people moving to the West coast of America, for example - can offer clues about the health consequences of different environments.

More common than these natural experiments are planned but non-experimental studies, usually of the health of people in relation to their circumstances and behaviour. The best known of these is the discovery of the association between smoking and lung cancer: a link that emerged by comparing the disease rate among smokers with that among non-smokers.

Interpreting what you see

In testing the effect of a new treatment, doctors can carry out a controlled trial: 'controlled' because it involves two groups of subjects chosen to be

as similar as possible. The only difference between them is that one group receives the treatment and the other does not.

When studying a group of people living ordinary lives, and trying to understand why some of them get a disease and some do not, researchers have no such control. All of us are continually exposed to a variety of influences; it may have been difficult to identify which are responsible for the illness, and whether one factor is important, or several.

The example of smoking and lung cancer remains not only the most familiar but also the most successful example of research of this kind. However, it is worth noting that to achieve a degree of certainty about the harmful effects of tobacco took many years of research on large numbers of people. And even then the conclusions were initially disputed. Even now, of course, no one has proved experimentally that smoking causes cancer in humans. Moreover, the effects of tobacco smoke are relatively powerful. Many of the environmental influences that researchers study are much weaker – which makes their effects even harder to discern.

Sometimes the researchers get it wrong. Early studies of women taking hormone replacement therapy suggested that the treatment was producing an unexpected bonus: protection against coronary artery disease. In this case the finding could be tested by a controlled trial. When this was done, no protective effect could be found.

Why we are concerned

One consequence of these difficulties is that different studies of the cause or causes of an illness may reach different conclusions. Claims about the importance of this toxin or that diet appear regularly in the media, often in connection with serious disorders such as cancer or heart disease. But many of these findings are never confirmed by subsequent research. Moreover, scientists themselves may disagree about the significance that should be attached to a piece of work.

It follows that, for the general public, interpreting and weighing the importance of new evidence is even harder. Understandably confused by such contradictory claims there is a danger that people will decide to disregard all these findings as unreliable.

These and other concerns led the Academy of Medical Sciences to convene a working group to investigate the issue. The key questions we asked were: how should we decide what to believe; and when should we take action? In attempting to answer them we sought the opinions of experts in many branches of science, medicine and policymaking.

What we concluded

There are some medical scientists who remain critical of non-experimental approaches as a satisfactory way of trying to understand the world. Our examination of the evidence persuaded us that these methods have played, and will continue to play, a valuable role in illuminating the causes of disease, provided they meet various stringent conditions. These include:

- A carefully considered study design chosen to maximise the chances of reaching reliable conclusions.
- The use of appropriate methods of analysing the data collected.
- The replication of such studies by other researchers working with different subjects.
- A recognition that evidence of this non-experimental kind should be considered not in isolation but in conjunction with the findings of other research strategies - experimental as well as non-experimental, and animal as well as human.

Our report offers guidelines that researchers may find helpful in analysing and interpreting their findings, and in deciding whether or not observed associations really do have a cause and effect connection. We also warn researchers against overstating the importance of their findings.

How should policymakers respond to new findings?

With caution! They should assess the strength and reliability of the evidence before using it to formulate public policy. Governments should, where possible, carry out pilot studies of any intended policy change. And when a new policy is to be introduced more widely, they should ensure that arrangements are made to monitor its benefits - and any unforeseen outcomes.

In general, we would like to see science more firmly integrated into policymaking.

So much for the experts; what about everyone else?

Offering detailed guidance to the public on how to weigh the significance of new findings was beyond our remit. However, most people first learn of research findings via the media. For this reason some of our suggestions are directed to those scientists who will be explaining their work to journalists, and to journalists themselves. We have stressed the importance of considering how the public may respond to the new information, and of expressing the true measure of any perceived hazard simply and unambiguously. If both groups follow our suggestions, the likelihood of public misunderstanding and confusion should be reduced.

It will not, of course, be eliminated. For this reason we hope that listeners, viewers and readers will also think critically about what they hear, see and read in the media. If a new study is very small, or comes from researchers with no experience of the topic, or has not been replicated, or makes exceptionally dramatic claims, or flies in the face of current mainstream scientific thinking… be cautious. If it does all these things… be very cautious indeed!

Academy of Medical Sciences
10 Carlton House Terrace
London, SW1Y 5AH

Tel: +44(0)20 7969 5288
Fax: +44(0)20 7969 5298

Email: info@acmedsci.ac.uk
Web: www.acmedsci.ac.uk