Mobile Telecommunications and Health Research Programme

Communicating Uncertainty: Mobile Telecommunication Health Risks

J Barnett, L Timotijevic, R Shepherd, V Senior, J Vincent

RUM 19

Project title:	**Communicating Uncertainty: Mobile Telecommunication Health Risks**
Project reference:	**RUM 19**
Project Director:	**L Barnett**
Project Monitor:	**G Brakewell**
Project start date:	**1 April 2004**
Project end date:	**31 December 2005**
Final report date:	**8 March 2006**
Date approved by Monitor:	**22 August 2006**
Date approved by Chairman:	**22 December 2009**

Communicating Uncertainty: Mobile Telecommunication Health Risks

RUM 19

Dr J Barnett*, Dr L Timotijevic*, Prof R Shepherd*, Dr V Senior*,
Ms J Vincent*

1. Executive Summary

The aim of this programme of research conducted at the University of Surrey was to explore the impact of adopting a precautionary approach to the management of potential health risks from mobile phone handsets and base stations upon the risk perception and behaviour of groups and/or individuals. As part of this there was an assessment of public responses to the precautionary advice contained in the Department of Health (DoH) leaflets *Mobile Phones and Health* and *Mobile Phone Base Stations*. The research programme consisted of four studies.

The first study was based on a recognition of the potential importance of developing reliable and valid measures of self reported phone use. As a first step in doing this an experimental study (n= 180) sought to explore patterns of self report of both the number of calls made and duration of calls made. We found that most people over-estimated the duration of their calls and under-estimated the number of calls they had made. Participants recalling calls over a three day period underestimated the number of calls they had made more than those recalling over 24 hours. Participants who were prompted to recall by thinking of the reasons for the calls they had made underestimated the number of calls they had made more than those prompted by chronology or by thinking of the person they had called. The dominant strategy for recalling calls across all three conditions was by thinking of the person called.

In the second study a series of 11 focus groups were conducted (9 with adults and 2 with children: n = 69) to explore public understandings of risk, uncertainty and precaution relating to mobile phone handsets and base stations. In the adult groups we noted that there was broad acknowledgement of the scientific uncertainties relating to mobile telecommunications (MT) but little recognition that the government acknowledges these uncertainties or has issued precautionary advice. Indeed this was considered implausible. Reactions to an outline of the nature of precautionary advice provided by Government were predominantly sceptical and dismissive. There was some evidence that this advice confirmed existing concerns and also that it could be reassuring.

The third study assessed (a) awareness of the Department of Health leaflets; (b) recognition of the precautionary advice contained in the mobile phones leaflet and (c) the extent to which particular pieces of precautionary advice were associated with concern or reassurance. These issues were addressed in relation to a module of 19 questions included in the Office of National Statistics Omnibus Survey in November 2004 (n = 1742). Fifteen per cent of the sample reported having come across the DoH leaflet about mobile phone health risks, 10% reported coming across the base stations leaflet. Eight per cent reported having come across both leaflets. Fifty three percent of the sample (n = 926) did not correctly identify any of the three pieces of government advice we asked about; 47% (n = 816) identified at least one piece correctly.

[8]*Department of Psychology, University of Surrey, Guildford, GU2 7XH*

Only 9% recognised that consideration of SAR values was Government advice. Almost a quarter of the sample spontaneously said that none of the advice emanated from Government. Each piece of precautionary advice was associated with slightly or greatly increased concern for between 44 and 48% of participants.

Finally, an experimental study (n = 174) set out to (a) understand circumstances under which attitudes to precaution might vary and (b) to consider factors that affect intention to change mobile phone related behaviours. We found that people are positive about precaution, in principle, although less so when it is linked with government policy. Alongside this, they are likely to express concern about particular pieces of precautionary advice. There was no relationship between perceived government uncertainty and any measures of precaution. Intentions to change mobile phone behaviours (phone use and seeking relevant information) are associated with low levels of trust in government and with a belief that the public should be able to influence decision making around MT.

The implications of all four studies for communication practice and for informing future research practice are discussed. It would seem wise not to issue precautionary advice with the expectation that it will reassure public concerns. It may rather have the effect of cementing concerns - not simply about the technology - but rather about the motives and competence of Government more generally. It may also lead to scepticism in relation to the validity of risk communication in other domains.

2. Aims and Objectives

This programme of research explored the impact of adopting a precautionary approach to the management of potential health risks from mobile phone handsets and base stations upon the risk perception and behaviour of groups and/or individuals. It evaluated approaches to the communication of uncertain risks and include an assessment of the effectiveness of the Department of Health leaflets Mobile Phones and Health and Mobile Phone Base Stations (December 2000).

Specifically this research:

- Sought to identify and develop reliable and valid self-report measures of behaviour in relation to both phone use and base stations.
- Identified common understandings of uncertainty associated with MT risks
- Evaluated the effects of uncertainty upon risk perceptions and behaviour
- Assessed the role of social psychological variables such as familiarity and convenience that mediate the effects of uncertainty upon attitudes and behaviour
- Assessed the role of demographic and social characteristics relating to parenthood that moderate the effects of uncertainty on attitudes and behaviour.
- Assessed the effects of Department of Health advice upon risk perceptions, attitudes, intentions and behaviour
- Provided base line measures of awareness of possible health risks from MT, of government communication about this, of sources of this awareness and of the effects of this, in the UK

3. Participants

Principal Investigator

Dr Julie Barnett
Senior Research Fellow
Department of Psychology
University of Surrey
GUILDFORD
GU2 7XH

Research Fellow

Dr Lada Timotijevic
Department of Psychology
University of Surrey
GUILDFORD
GU2 7XH

Co-investigators

Professor Richard Shepherd
Department of Psychology
University of Surrey
GUILDFORD
GU2 7XH

Dr Victoria Senior
Department of Psychology
University of Surrey
GUILDFORD
GU2 7XH

Ms Jane Vincent
Digital World Research Centre
University of Surrey
GUILDFORD
GU2 7XH

4. Core Achievements:

The aims and objectives noted above were addressed through four modules of research. To aid clarity, the core achievements of this research programme will be presented in sections corresponding to these four modules. Each section will outline details of the method and the sample before outlining key findings. Key findings are presented in italics and the subsequent text provides more detail of these. Clearly in the space available it has been necessary to be selective about what is presented. The interpretation and implications of this research are discussed in the 'Interpretation' section below. More details of these studies can be found in the articles submitted for publication in peer reviewed journals.

4.1 Exploration of factors influencing self-reports of mobile phone use[1]

The development of valid and reliable self report measures of mobile phone use would be of considerable value in evaluating the impact of government advice. A series of expert interviews and an extensive literature review identified very little previous work in this area (Cohen and Lemish, 2003; Parslow, Hepworth and McKinney, 2003). In the light of both the interviews and the literature review, this study focused upon identifying patterns of self reported phone use, how these related to the actual calls made, and how the discrepancies between these two measures might be affected by individual characteristics (such as the amount the phone is used) and also by the ways in which recall is prompted. These questions were explored in an experimental study. Extensive pilot work was used to refine the design.

4.1.1 Method

Face to face interviews were conducted with 180 people. A £10 incentive was provided to all participants who completed the questionnaire and provided an itemised bill for the relevant period. Fifty three percent of the sample were male and 47% were female. The mean age was 31 (ranging from 18-57). 70% of participants had used a mobile phone for between 6 months and 6 years.

[1] For more details see: Timotijevic L, Barnett J, Shepherd R & Senior V (*under review*) Factors influencing self-reports of mobile phone use: developing validated measures, *New Media and Society*

Participants were asked to recall the number and duration of the calls that they had made over either the previous 24 hours or the previous 3 days. They were prompted to do this either by thinking about (a) who it was that they had called (b) the reason for the call or (c) the chronology of the calls. The study used a 2 x 3 between subjects design. A copy of the questionnaire can be found in Appendix 1.

Participants were also asked about their typical phone use and the perceived difficulty of the task. Regardless of the prompt condition they were in, participants were also asked to rate the extent to which they had used the three recall strategies.

The two main dependent variables that we constructed recorded the *relative percentage of error* in relation to (a) duration of calls and (b) number of calls. This allows us to consider patterns of over and under estimation as well as taking the amount of actual usage into account.

4.1.2 Key findings

Most people over-estimated the duration of their calls and under-estimated the number of calls they had made.

Fifty seven percent of participants overestimated *duration* and 27% underestimated duration. For *number* of calls, 53% underestimated and 31% overestimated. Using the criteria of estimates being accurate to within 10%, 15% of participants were accurate in the reporting of number of phone-calls and 15% were accurate in relation to duration of phone-calls.

There were variations in patterns of over and underestimation of number of calls as a function of time reference and recall prompt.

Chi square analyses revealed that there was a tendency for more people to underestimate their calls in the 3 day condition at the expense of accuracy. Participants whose recall prompt was ‘reason for the call’ underestimated number of calls more that those receiving the other recall prompts. There were no effects of the manipulations on estimates of call duration.

There were significant small to medium correlations between people’s actual usage and the type of phone user they saw themselves as (high/medium/low). People were also asked how typical the period of phone recall was of their general use. The relationships between actual and self classified use were stronger when this was taken into account.

The correlation between actual use and self classified use for those who considered the number of calls they had made to be typical was .312 ($n = 111$, $p < 0.001$). For those who did not consider it to be typical the correlation was ($r = .212$, $n = 43$, $p = 0.173$).

For duration of calls the correlation between actual use and self classified use for those who considered the number of calls they had made to be typical was .461 ($n = 110$, $p < 0.001$); for those who considered their use to have been atypical there was almost no correlation ($r = .005$, $n = 60$, $p = .971$). The most common ‘discrepancy’ in classification was where, in relation to both duration and number of calls, over 60% of ‘actual’ high users classified themselves as ‘medium’ users.

In part as a check on the manipulation of recall prompt, participants were asked to indicate the extent to which they used the three recall strategies. The dominant strategy for recall - across all three recall prompt conditions - was to consider the person called. There was no evidence that this led to improved recall.

Overall 73% of participants thought about the “identity of the person” quite a lot or almost entirely, 40% did this for the “reason of phone-call” and 19% for chronological recall. 81% of those that were in the ‘person called’ condition thought of the identity of the person called quite a lot or almost entirely. However they also used the other recall strategies more than those that were actually prompted to use them.

4.2 Qualitative study of public understandings of uncertainty and precaution[2]

The aim of this module was to elicit a wide range of diverse views around the risks and possible uncertainties of MT health risks and of precautionary actions. Focus groups are increasingly recognised as an effective way of exploring how people use their everyday experience and understandings to make sense of risk related issues (Petts *et al.*, 2001; Horlick-Jones *et al.*, 2004).

4.2.1 Method

Eleven focus groups were conducted in two areas: London (Richmond) and Brighton. In total there were 69 participants in the focus groups.

A. London Borough characterised by a high profile media debate and public protest about the siting of a mobile phone base station. There were 5 groups of adults: (a) Concerned about health risks, not active in protest; (b) Concerned about health risks, active in protest;

(c) Unconcerned about health risks; (d) Parents (of children 7-13) active in protest; (e)Parents (of children 7-13) not active in protest.

B. Brighton: There were 4 groups of adults (a) Aged18-30; (b) Aged 30-50; (c) Aged over 50; (d) Parents (of children aged 7-13). There were 2 groups of children (a) Aged 9-11 (b) Aged 12-13.

For the adult groups, the *focus group schedule* covered three main areas with later stages building on earlier ones:

- General discussion of the way mobile phones and masts are regulated and their benefits and risks.
- Introduction of the notion of precautionary action and advice.
- Consideration of the nature of precautionary advice around MT (e.g. reducing call length, limiting non-essential calls for those under 16, consideration of Specific Absorption Rate (SAR) values).

The focus group schedule for the two children's groups was structured around the 'good' and 'bad' things about mobile phones. If health risks were not mentioned by the children the group facilitator did not introduce the topic.

4.2.2 Key findings

There was broad acknowledgement of the scientific uncertainties relating to MT.

These related to what possible negative effects were, when they might be experienced and who would experience them. For some these caused concern; others discounted the uncertainties against the adjudged benefits. Those expressing concerns drew on evidence from their own experience, from the experience of others and from their beliefs about the ways in which other risks have been managed by government. Conflicting information and the perception of vested interests did not always lead to the inference of uncertainty. Where uncertainty was inferred, for some this was worrying; others rather used it to justify existing patterns of phone use.

There was no perception that the government acknowledges uncertainty. A range of arguments were used to explain this.

Issuing precautionary advice was seen by some to be tantamount to admission of liability - an unlikely governmental stance. A perceived lack of government independence from industry interests makes admission of uncertainty unlikely. Where there was no evidence

[2] More detail of this part of the research can be found in Timotijevic L & Barnett J (*in press*) Managing the Possible Health Risks of Mobile Telecommunications: Public Understandings of Precautionary Action and Advice, *Health, Risk and Society*

that there *were* any health risks, issuing precautionary advice would be contradictory.

There was little awareness of a precautionary approach to managing possible health risks of MT.

The existence of scientific uncertainties around MT were clearly recognised. For some this was seen as an inevitable part of technological development and would, in time, be replaced with greater certainty and thus precaution was unnecessary. For others, precaution in the face of uncertainty was simply commonsense. Whatever views were held here there was almost no recognition in any of the groups that the UK government recognised uncertainties or that, in the face of these, they had provided precautionary advice or taken precautionary action.

Indeed it was considered implausible that there was a precautionary approach to risk management around MT in the UK. Why?

Because (1) there is extensive ongoing siting of masts; (2) it is perceived that public views are not taken into account where consultation around mast siting occurs; (3) because participants believed they would have been given information telling them about possible health risks and the accompanying precautionary advice.

Reactions to precautionary advice and action included reassurance, scepticism, concern and dismissal.

Learning of the existence of precautionary advice did not generate concern about the technology itself although it was used in the protest groups to validate existing concerns. Realising that this advice had been issued, and they did not know about it, *did* raise concerns about what other areas of uncertainty there were that they did not know about. Precautionary advice was seen as irrelevant where people believed that they were knowingly taking risks and that this was done in the context of considerable benefits. Participants generally believed that in the light of the benefits and convenience afforded by MT they were unlikely to change their patterns of phone use even if the communication was of ‘certain risk’.

A precautionary stance was seen by some as reasonable and commonsense and a welcome indication of government care and responsiveness. For others precaution was seen as a rhetoric that enabled government to ‘cover their backs’ in the event of uncertain risk becoming certain risk. People often made sense of precautionary approaches in the light of what they believed about its proponents. The nature and validity of precautionary approaches to managing MT risks are understood in the context of the institutions responsible for managing these.

The children in the younger age group showed no awareness of possible health risks.

They easily identified other potential disadvantages around cost, unwanted calls or texts and getting addicted to the phone. They were aware that parents often wanted to constrain the mobile phone use of children but believed this was because their calls were unnecessary or too expensive.

The children in the older age group explained the many perceived benefits of phones with close reference to the way in which they were linked with their own lives, their own identities and the ways in which they can interact with others.

They spontaneously brought up ‘the radiation’ as one of the bad things about mobile phones. The children also made sense of radiation with reference to their own experience (of the radio buzzing when a phone was near it). They did not feel endangered themselves by this: in part this was because it seemed highly improbable (e.g. because of the size of the phone); because the mechanisms could not be visualised and finally because they had no experience of the symptoms that phones were believed to cause (e.g. loss of concentration).

4.3 Public responses to the Department of Health leaflets[3]

The aim of this module of work was to explore public responses to the Department of Health leaflets (2000 a &b). To some extent this built on previous work by Petts *et al* (2001) as well as on the qualitative work reported above. As well as exploring perceptions of, and responses to, the leaflets, this module of work further explored public responses to precaution. The main focus of this module of research was on the leaflets about mobile phones rather than the base stations leaflet as this allowed us to assess what people knew of particular pieces of precautionary advice.

4.3.1 Method

The Office of National Statistics Omnibus Survey provides nationally representative data on adults aged 18 and over living in private households in Great Britain. In November 2004 one module of this survey consisted of 19 questions focusing on awareness of the DoH leaflets about phones and base stations, knowledge of leaflet content and public perceptions of the possible health risks of mobile phones and of mobile phone masts (see Appendix 2). In addition, the ONS Omnibus Survey routinely collects a wide range of socio-demographic data relating to (for example) age, household and education. The survey achieved an overall response rate of 65 percent.

Face to face interviews were conducted with 1742 people in November 2004. Fifty three per cent of the participants were female (n = 925) and 47% were male (n = 817). The mean age was 47 years (SD 18.34). Twenty per cent were between 16 and 29 years old, 17% were between 30 and 39 years old, 27% were between 40 and 54 years old and 38% were 55 years or older. Twenty six percent were the parent (or the partner of a parent) of a child aged under 16 living in the household (n = 452) and 74% (n= 1290) were not.

Awareness of the leaflets was measured with 2 questions which asked respondents if they "had come across a Government leaflet about health risks associated with mobile phones/base stations". Response options were yes, no or don't know.

Knowledge of leaflet content was assessed by asking respondents to select up to three pieces of practical advice from a list of eight that they believed had been issued by Government (see Table 1). All participants were asked this question - not just those who had come across the leaflets.

Concern about Uncertainty was measured with 5 items (α = .92).

Three dimensions of *trust* taken from previous research (Poortinga and Pidgeon, 2003) were measured with single items: *Value Similarity*, *General Trust* and *Scepticism*.

Responses were invited to the 3 pieces of *precautionary advice* contained in the DoH phones leaflets: Responses to precautionary advice were measured with 3 items (1) people should keep their mobile phone calls short, (2) non-essential calls for those under 16 should be discouraged, and (3) customers should consider relative SAR values when buying a mobile phone. Responses on a five point scale ranging from 'greatly increases my concern' (1) to 'greatly reassures me' (5).

Participants were also asked about their current mobile phone use, if they *had objected to the siting of a base station*, whether they believed the *public could influence decisions about mast siting* and whether they had *changed their phone use behaviour in response to health concerns.*

[3] More detail of this part of the research can be found in Barnett J, Timotijevic L, Shepherd R and Senior V (*under review*) Public Responses To Precautionary Information From The Department Of Health (UK) About Possible Health Risks From Mobile Phones, *Health Policy*

4.3.2 Key findings

Fifteen per cent of the sample reported having come across the DoH leaflet about mobile phone health risks, 10% reported coming across the base stations leaflet. Eight per cent reported having come across both leaflets.

There were no significant differences between those who did and did not report seeing the leaflets in relation to gender, age, education or between those who were or were not parenting a child under 16.

Fifty three percent of the sample (n = 926) did not correctly identify any of government advice; 47% (n = 816) identified at least one piece correctly

Table 1 summarises how successful people were in identifying which pieces of practical advice had been issued by Government. It shows 'keeping calls short' and 'discouraging non-essential calls for those under 16' were both correctly identified by over 25% of the sample. Only 9% recognised that consideration of SAR values was Government advice. Almost a quarter of the sample spontaneously said that none of the advice emanated from Government.

Table 1: Percentage of participants identifying pieces of Government advice

	Total %	n
1. Keep your calls short	31	536
2. Only use a hands-free headset for health reasons	29	477
3. Discourage use for non-essential calls in children under 16	26	452
4. None of these	23	392
5. Regularly change side of your head	14	244
6. Hold the handset away from your head while dialling	10	172
7. Consider relative SAR values when buying a new phone.	9	157
8. Don't carry phones in trouser pockets	7	113
9. Pregnant women should keep phone away from stomach	5	89
10. Don't know	16	269
Base	1730	2901

The size of the total n reflects the fact that participants were asked to identify 3 pieces of Government advice

People who reported seeing the leaflets were more likely to correctly identify at least one piece of advice (Chi square = 68.7, df = 1, p ≤ .001).

Table 2: Cross tabulation of leaflet awareness and correct identification of leaflet content

	Come across leaflet	
Knowledge of leaflet content	Yes	No
Identified no advice correctly	79 (29.5%)	816 (59%)
Identified at last one piece correctly	189 (70.5%)	615 (43%)

The best predictor of correct identification of Government advice is awareness of the leaflet. However, there are other psychosocial variables that predict this knowledge independently of leaflet awareness: higher concern about uncertainty, perceived similarity of values with the Government and higher phone use were also significant predictors of knowing at least one piece of Government advice.

A logistic regression was conducted in order to see (a) how well knowledge of the leaflet could be predicted and, (b) what the significant predictors were. The outcome variable had two levels: 'no pieces of government advice correctly identified' (0) and 'at least one piece of government advice correctly identified' (1). Only those variables that had a significant association with the outcome variable were considered as predictors.

The predictors were entered into the analysis in three blocks: firstly the background variables of age, education, whether or not parenting a child of under 16 and degree of phone use; the second block consisted of the psychosocial variables of concern about uncertainty, general trust and value similarity.

Awareness of the mobile phone leaflets variable was entered in a third block. A total of 1272 cases were included in the analysis. The entry of each block

produced a significantly better fit of the model to the data.

The full model was significant (chi square = 102.56, df = 8, p < .000). Table 3 gives the summary statistics and shows how important each predictor variable was independently of the effect of the others. The final regression model indicates that more accurate recognition of Government advice is associated with higher levels of phone use, greater value similarity with Government, greater concern about uncertainty, and awareness of the Government leaflet. The Cox and Snell pseudo R-square indicates that the fit of the model to the data is poor. The model was more accurate for those that identified at least one piece of advice (66%) than for those that did not (53%).

Table 3: Summary statistics for logistic regression

		95% CI for exp b		
Included	B	Lower	Exp b	Upper
Constant	-2.47		.085	
Phone use	-.05*	1	1.05	1.12
Value similarity	.22**	1.030	1.28	1.440
Concern re uncertainty	.30***	1.12	1.34	1.51
Seen leaflet	.95***	1.89	2.59	3.56

*p<.05; **p<.01; ***p<.001; Chi square=102.56, df=8, p<.000; Cox&Snell R^2=.075

At least 44% of people say that precautionary advice increases their concern. There were no differences between people who had and had not come across the DoH leaflets.

Figure 1 depicts participant responses to the three pieces of practical precautionary advice given in the DoH leaflet. The profile of scores is similar for each item: each piece of advice was associated with slightly or greatly increased concern for between 44 and 48% of participants. There were no differences in responses to precautionary advice between those that had and had not come across the DoH leaflet.

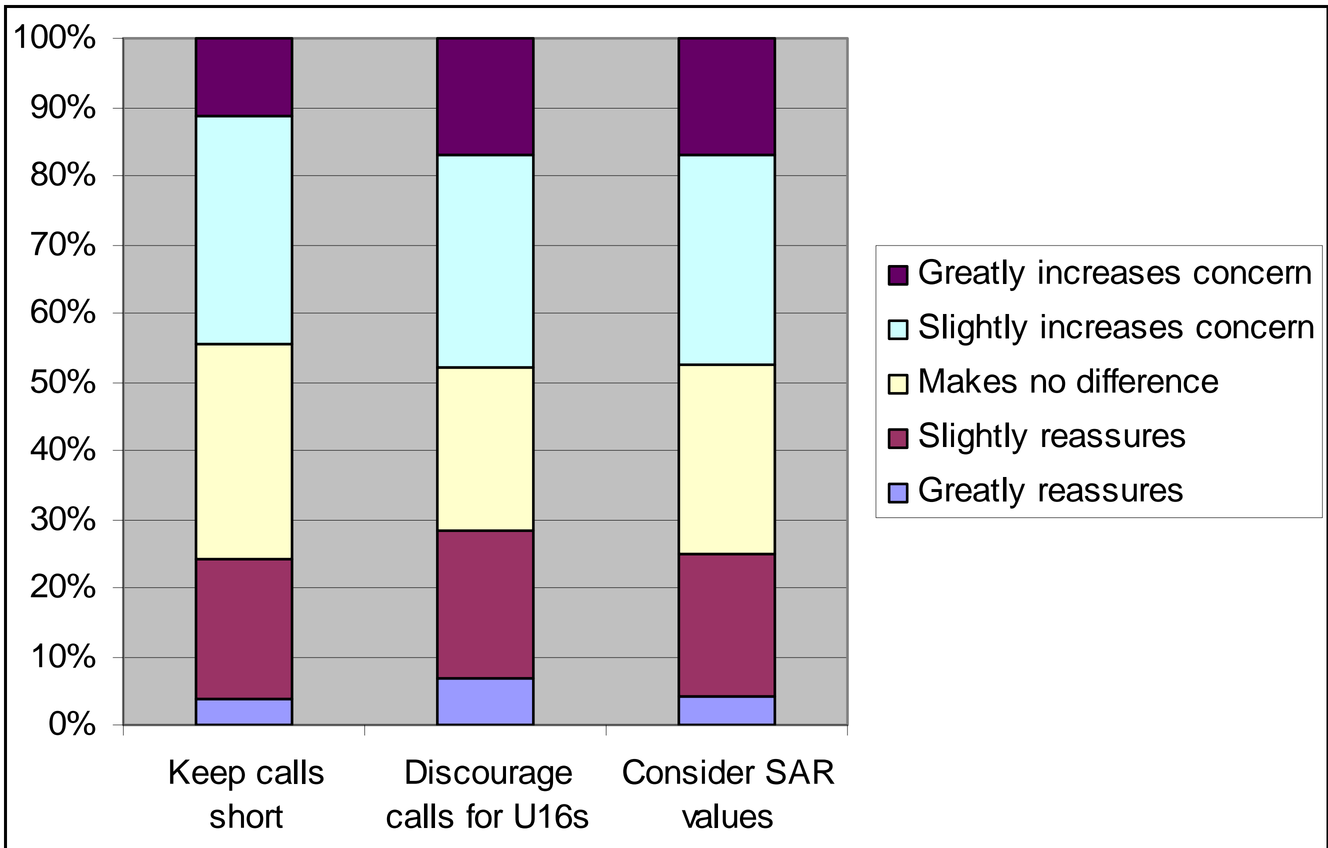

Figure 1: Percentage agreement with responses to precautionary advice

Knowing about the leaflets is associated with lower levels of concern about precautionary advice. Concern about uncertainty is associated with higher levels of concern about precautionary advice.

A MANOVA was conducted to explore (a) the effect of concern about uncertainty and, (b) the effect of recognising Government precautionary advice, upon responses to it. In summary, the outcome variables are the three precaution variables; the independent variables are concern about uncertainty (high vs. low) and knowledge of precautionary advice (identified none correctly vs identified one or more correctly). The overall MANOVA revealed main effects for both concern about uncertainty ($F = 18.26$, $df = 3$, $p < .001$) and knowledge of precautionary advice ($F = 5.45$, $df = 3$, $p < .001$). There was no interaction effect. The nature of these effects on each of the dependent variables is summarised in the table of means below (Table 4).

For both ‘keep calls short’ and ‘discourage non-essential calls for U-16s’, correctly identifying Government advice was associated with being more reassured – or at least less concerned - by it. The effect on ‘consult SAR values’ was not significant. The effect of concern about uncertainty was significant for all three pieces of advice: those with high concern about uncertainty rated all three pieces of precautionary advice as associated with significantly greater concern than did those with low concern about uncertainty.

Table 4: Results summary on Precautionary Advice Variables

	Correct Identification of Government Advice						
	YES		NO				
	mean	SD	mean	SD	F	df	p
Keep calls short	2.82	1.05	2.62	1.00	15.04	1, 1188	.001
Only essential calls for U16s	2.78	1.21	2.62	1.14	7.59	1, 1188	.006
Consult SAR values	2.69	1.13	2.60	1.09	1.89	1, 1188	NS
	Concern about uncertainty						
	HIGH		LOW				
	mean	SD	mean	SD	F	df	p
Keep calls short	2.61	1.20	2.87	.85	27.94	1, 1188	.001
Only essential calls for U16s	2.60	1.35	2.86	1.02	23.17	1, 1188	.001
Consult SAR values	2.46	1.30	2.88	.91	52.57	1, 1188	.001

5 point response scale from 'greatly increases my concern' (1) to 'greatly reassures me' (5).

4.4 Responses to precautionary advice and intentions to change relevant behaviours[4]

The final module of the research set out to explore attitudes to precaution in more detail. It aimed to explore the circumstances under which attitudes to a precautionary approach vary. It also considered factors affecting the intention to change mobile phone related behaviours.

This was an experimental study with a 2 x 2 between subjects design. A series of base line variables were followed by providing some information about the Government's precautionary approach around MT.

The information was presented either in the context of (a) risks of mobile phones, or (b) risks and benefits of mobile phones. In addition, the adoption of a precautionary approach was justified in terms of (a) scientific uncertainties, or (b) public concerns. Finally participants completed a series of outcome measures. A further manipulation was embedded within the 3 precaution variables (replicated from the ONS survey) in order to check whether dominance of the 'precaution causes concern' response may have been a function of the order of the response options.

[4] More details of this part of the research can be found in Barnett J, Timotijevic L, Shepherd R and Senior V (*in preparation*) Responses to Precautionary Advice: Concern, Reassurance and Intended Behaviour Change, *Risk Analysis*

4.4.1 Method

174 participants were recruited through adverts placed in newspapers, shops and community centres in the South of England and the Midlands in October - December 2005. A £5 token incentive was provided to all participants that returned a questionnaire. Sixty one per cent of the participants were female(n = 106); 39% were male (n = 67). Participant ages ranged between 16 and 77 with a mean age of 41 years (SD 13.03). Thirty one percent were the parent (or the partner of a parent) of a child aged under 16 living in the household (n = 54) and 68% (n= 119) were not.

A copy of the questionnaire can be found in Appendix 3.

Base line measures

- Self reported phone use (single item: high/medium/low)
- The desired influence of public on decision making (3 items α = . 82)
- Support for science(4 items α = .77)
- Trust in Government to manage health risks (6 items α = .90)
- Perceived Government uncertainty around health risks (6 items α = .79)
- Importance of mobile phone to self (5 items α = .86)

Single item measures (also repeated after manipulations)

- Worry about potential health risks of mobile phones
- Seriousness of health risks for future generations
- Control over exposure
- Likelihood of long term negative effects
- Benefits
- Extent to which risks are known
- Benefits to human health from phones for (a) self, and (b)society
- Risks to human health for (a) self, and (b)society

Outcome measures

- Manipulation checks
- Thought listing task
- 3 Principles of Precaution variables -
- necessity of precaution (2 items α = .72)
- precaution is good governance (4 items α = .79)
- good reasons for precaution (3 items α = .73)
- Emotional response to precaution, i.e. feeling concern or reassurance (3 items α = .91)
- Trust in government regulation of mobile phones (6 items α = .90)
- Intention to change behaviour in response to health risk (3 items α = .79)

4.4.2 Key findings:

There was no effect of the manipulations of the 'risk/benefit context' or of the 'justification for a precautionary approach' on any of the outcome variables.

The manipulation checks showed that the manipulations were successful but there was no effect of the manipulations on any of the outcome variables, that is, people did not have different scores on any of the outcome variables as a function of which information condition they were in.

People are positive about precaution, in principle, although less so when it is linked with government policy. At the same time they are likely to express concern about particular pieces of precautionary advice.

Mean scores on the 'necessity of precaution', 'precaution is good governance', 'good reasons for precaution' suggest that people are generally positive about precaution in principle. although they their 'emotional response' may be one of concern to particular pieces of advice (Table 5).

The correlations between the 3 precaution in principle variables are small to medium. This suggests that they are conceptually distinct. There is also little relationship between the 'precaution in principle' variables and emotional responses to precaution.

Table 5: Correlations and Means of Precaution Variables (n= 172)

		Precaution and Governence	The necessity of precaution	Reasons for precaution	Emotional response to precaution
	mean	2.91	3.76	3.80	2.47
	sd	.85	.84	.80	.98
	n	172	172	172	172
Precaution and governance	Corr	1	.197(**)	.418(**)	.154(*)
The necessity of precaution	Corr		1	.386(**)	-.080
Reasons for precaution	Corr			1	-.036
Emotional response to precaution	Corr				1

'Precaution and Governance', 'The Necessity of Precaution' and 'Reasons for Precaution': response options 1-5 with higher scores more positive about precaution; 'Emotional Response to Precaution': 1-5 with low scores indicating feeling concern and high scores indicating feeling reassured.

There is no relationship between perceived government uncertainty and any of the precaution variables

There were no significant correlations between the measure of perceived government uncertainty and any of the precaution variables. This is in line with the findings of Wiedemann and Schütz (2005) and would suggest that precaution is not necessarily seen as a response to scientific uncertainty.

Analysis of the data from the 'thought listing task' which invited people to write people down what first occurred to them on reading the information supports this. Rather than being linked with uncertainty, precautionary advice may signal 'certain risk'. It is also seen as a strategy for Government to manage its position (for example, as a way of signalling that they are active in managing the risk or as a way of reducing their accountability).

Intentions to change mobile phone behaviour are not only associated with concern but also with low levels of trust in government and with a belief that the public should be able to influence decision making

Given that one logical end point of providing precautionary advice is that there is appropriate behaviour change, a regression analysis was conducted to predict whether we could predict intention to change mobile phone related behaviours and, if we could, to identify what it was that predicts intended behaviour change.

The intended behaviour change measure was a composite of three items that asked respondents to indicate whether people would seek out information about possible health risks of phones/base stations; make less calls and continue using their phone as usual. After the appropriate recoding this was a reliable measure ($\alpha = .79$).

Only variables with significant relationships with the outcome variable were included in the analysis. Predictor variables were entered in four stages: (1) highest educational achievement; (2) concern about possible health risks of MT; (3) trust in government to manage health risks from MT; desired influence of the public around MT decision making; the necessity of precaution (4) emotional response to precaution.

Table 6 below summarises the results of the regression. 36% of the variation in intended behaviour change is explained by the predictor variables. Each step of the regression brings a significant improvement in the amount of explained variance.

Table 6: Summary table of regression

	B	SE B	Beta	T	Sig T
Step 1					
Education	-.05	.03	-.12	-1.77	.078
Step 2					
Concern	.23	.07	.24	3.26	.001
Step 3					
Trust	-.26	.09	-.20	-2.76	.006
Desired public influence	.27	.11	.18	.257	.011
Necessity of precaution	.14	.08	.16	1.70	.092
Step 4					
Emotional response to precaution	-.18	.07	-.18	-2.57	.011
Constant	*2.18*	*.56*		*3.88*	*.000*

Note: Adj $R^2 = 0.363$, $F (6, 153) = 16.12$, Sig $F < .001$

In the final regression the effect of education is nearing significance. A higher level of educational achievement is associated with greater intended behaviour change. Concern is the strongest of all the predictors with greater intention to change being associated with greater concern. Trust is the next strongest predictor. The direction of this relationship is interesting: higher trust in government is associated with less intended behaviour change. Desired public influence predicts further variance and this works in the opposite direction to trust: greater desired public influence is associated with greater intention to change. Assent to the necessity of precaution is not an independent predictor of intended behaviour change. In the final step, the emotional response to precautionary advice is also independently associated with intention to change. The negative direction of this tells us that it is feeling concerned rather than reassured that predicts intention to change mobile phone behaviours.

5 Analysis of Objectives Met

The aims and objectives of the original research brief have largely been acheived. The sequential nature of the studies has enabled us to extend our consideration of some of the research questions. In particular we have been able to incorporate a more thoroughgoing consideration of public understandings of precaution. Another factor that has arguably contributed to the success of the research programme is the complementary range of methods used. We have also had a variety of opportunities to communicate ongoing findings to a range of academic, policy and industry audiences. This has been a valuable two way process and has helped us to maintain our awareness of current debates and issues.

There have been some changes of emphasis over the course of the research. We would identify two in particular.

1. Across all four modules of work outlined above, our concern to develop the research questions relating to public understandings of precaution led to less focus on base stations than we anticipated. The precautionary advice issued in relation to handsets in the DoH leaflets formed a common thread through the focus group, survey and experimental work. The notion of precautionary advice that people can act upon themselves is less relevant around base stations.

2. We have had less focus on the question of how best to communicate SAR values than we initially anticipated. SAR values were, however, considered in each module of work (apart from the self report of phone use study) as one dimension of precautionary advice. According less priority to the communication of SAR values *per se* was also informed by the results of the focus groups and survey where we found that SAR values were largely irrelevant in informing choice decisions vis-à-vis other qualities of handsets.

6 Interpretation

We would like to draw attention to a series of implications that emerge from this programme of research. These are discussed more fully in the various publications based on this research.

6.1 Developing self report measures of phone use:

This study documented the different types of error routinely associated with recall of call duration and number of calls. It also identified instances where there is likely to be an increased likelihood of, or exception to, these patterns of response.

To maximise the accuracy of self report it would seem advisable to use shorter periods of recall (e.g. 24 hours) along with an assessment of how typical this recall period is of patterns of call use.

Given the predominance of thinking about 'the person called' as a strategy for recalling phone use, it is likely to be valuable to develop ways in which this strategy will lead to enhanced accuracy rather than attempting to stimulate recall in other ways.

Further attention should also be given to ways of better understanding the association – or lack of it - between actual levels of phone use and identification as a particular category of user. This is likely to be important in terms of targeting communications appropriately: for example, bearing in mind the large percentage of 'high users' who did not define themselves as such, many people who use their phones a lot may not consider communications targeted at high users as relevant to them.

6.2 Public understandings of precaution:

Public understandings of precaution are not the same as expert understandings of precaution. From the point of view of the regulator, a precautionary approach is ostensibly necessitated by scientific uncertainties, although in the case of MT, precautionary approaches were also clearly justified as being a response to public concerns (Timotijevic and Barnett, *in press*). This research suggests that the provision of precautionary advice is often not seen as a response to scientific uncertainty. The nature and validity of precautionary advice is seen through a lens that is shaped by direct or vicarious experience and by 'evidence' (or the lack of it) of regulatory care.

People are, in principle, positive about precaution. They are also largely positive about the provision of information. Feeling uninformed, or that information is being withheld, can cause concern. There also seems little doubt that the provision of particular pieces of precautionary advice around MT tends to lead to concern rather than to providing reassurance.

This research suggests that it would be wise not to issue precautionary advice with the expectation that it will reassure public concerns. It may rather have the effect of cementing concerns – not simply about the technology – but rather about the motives and competence of Government more generally. It may also lead to scepticism in relation to the validity of risk communication in other domains.

We have considered the relationship of responses to precautionary advice to intentions to change behaviour. Notwithstanding the well documented 'gap' that often exists between intentions and behaviour, it is interesting that it is concern – both general concern about uncertainty and particular concern in response to precautionary information - that is linked to a willingness to consider behaviour change. This is not a new finding in itself but it is of particular interest in the light of the assumption that precautionary advice should reassure rather than maintain or promote concern. The relevance of this finding is also likely to be enhanced when more careful thought is given to the precise aims of communicating uncertain or precautionary information – e.g. is behaviour change a desired outcome?

We can also note in passing the relationship of trust and of 'desired public influence' (Barnett, Cooper and Senior, *under review*) to intentions to change behaviour. Trust is generally considered as a dependent variable, that is, the focus is often upon what is it that produces trust or how institutions might become more trusted. In this study trust in government was used as a predictor of intended behaviour change: independent of level of concern, higher levels of trust were linked with less intention to change behaviour. This links with the recent literature suggesting the value of 'critical trust' (Poortinga and Pidgeon, 2003). On the other hand 'desired public influence' was linked with greater willingness to change behaviour.

6.3 Communication of precautionary approach:

Arguably both awareness of the Department of Health leaflets and recognition of Government advice was low (although our impression is that there was no particular 'target' figure against which the penetration of the leaflets and information might be judged).

If the DoH consider the production of another leaflet that aims to reach a wider audience, consideration should be given to identifying more effective ways of communicating this information. One of the clear themes of recent risk research that can be noted here is that information should be linked with and embedded within people's everyday practices in a relevant way. For example, one way in which wider awareness of the leaflet and its contents might be best achieved would be by including a leaflet in the box containing a new phone.

The data collected in this research is useful baseline information against which the effect of future communications in this area can be evaluated. However, it would seem important to be very clear about the purpose of providing such precautionary advice. Who is the advice addressed to and what outcome is expected? Is it intended to reduce concern? Is it intended to provide options for those that are concerned to reduce their exposure? Is it aimed at reducing exposure of particular at risk groups?

7 Future Priorities

There are undoubtedly many interesting and potentially productive areas of social science research in this area. However, there are three sets of ideas that emerge directly from this research programme.

1. This research has found that (a) publics perceive limited links between scientific uncertainty and precaution, and (b) there are often important differences between public and expert views as to what constitutes valid precautionary action/advice.

In the light of this it would be valuable to conduct further qualitative work that *started* with an 'expert' or 'stakeholder' explanation of what the scientific uncertainties around MT are and then to encourage dialogue and deliberation to explore what precautionary actions are seen to be effective and reasonable in the light of such uncertainty[5]. A valuable extension to such a design would be to introduce a further deliberative element and ask the group to present both the uncertainties and their agreed accompanying precautionary measures to other participants who would in turn interrogate and challenge them. If necessary the group could then refine their 'uncertainty/precaution' package(s) in the light of this.

Analysis of an audio-visual record of the entire deliberative process would provide policy makers and other interested parties with highly specific information about (a) the nature of the arguments, evidence, links and disclaimers that are made in response to scientific uncertainties, (b) and the nature of, and the reasoning behind the adoption and rejection of specific precautionary measures.

Of course more than one group could be run, each focusing on a different dimension/degree of uncertainty, or the same one presented by different sources. It would also be informative to have groups that were more or less concerned about possible health risks of MT and thus to see how the relationship between the presented uncertainty and the suggested precautionary measures varied as a function of this.

[5] This value of this approach emerged in discussion with Branden Johnson (a US academic that has written extensively about communicating uncertainty) when presenting some of this research at the Society of Risk Analysis International Conference.

2. This research programme found that (a)there was limited awareness of the Department of Health leaflets and of the precautionary advice that they contain, and (b) people are aware of, and often positive about the role of research in addressing scientific uncertainties. Other relevant background is that: (a) we now have good base line measures of awareness and recognition of government advice; (b) the government have recently confirmed an ongoing precautionary stance around MT (NRPB, 2004) and, (c) many of the MTHR programme projects are finishing.

We would argue that it is vital that the ongoing results of the MTHR programme are visible, communicated well and effectively linked to the continuation (or otherwise) of a precautionary stance. This is perhaps a particularly important consideration should there be many null effects.

In the light of this we would suggest that there should be a programme of work to identify (a) findings that should be communicated and (b) the development of appropriate rationales about the relationship of these findings to precautionary approaches. The approach taken in (1) above could be useful in gaining important input from publics to the approach that might be taken. Alternatively, experimental studies could be conducted to assess what format, content and style of communication is most likely to be effective in relation to particular aims.

3. This research illustrated the apparent contradictions that people are (a) largely positive, in principle, about precaution and about information provision and yet (b) may respond with concern about particular pieces of precautionary advice; (c) are sceptical about serial risk communications that, from expert viewpoints, may be thought to constitute transparent and open communication, and; (d) draw 'unwarranted' conclusions from the apparent absence of information

Research should be conducted to understand the 'lay logics' that underlie the juxtaposition of these beliefs and the conclusions that experts draw from such 'contradictions'. The implications of both of these dimensions for communication and engagement practices should also be explored.

8 Publications

Timotijevic L & Barnett J (*in press*) Managing the Possible Health Risks of Mobile Telecommunications: Public Understandings of Precautionary Action and Advice, *Health, Risk and Society*

Barnett J, Timotijevic L, Shepherd R, Senior V, Vincent J (*in press)* Understanding Public Responses to Precautionary Action and Advice, Proceedings of World Health Organisation Workshop on Base Stations & Wireless Networks: Exposures & Health Consequences
15-16 June 2005

Barnett J, Timotijevic L, Shepherd R, Senior V, and Vincent J (*in press*) Understandings of the Precautionary Principle: 'No smoke without fire' or 'Better Safe than Sorry'. In Risk Perception and Risk Communication: Tools, Experiences and Strategies in Electromagnetic Fields Exposure. Proceedings of JRC/EIS-EMF Risk Perception & Communication Workshop, Eds) De Pozo C, Papameletiou D, Weidemann P and Ravazzani P Ispra, July 2004

Timotijevic L, Barnett J, Shepherd R and Senior V (*under review*) Factors influencing self-reports of mobile phone use: developing validated measures, *New Media and Society*

Barnett J, Timotijevic L, Shepherd R and Senior V (*under review*) Public Responses To Precautionary Information From The Department Of Health (UK) About Possible Health Risks From Mobile Phones, *Health Policy*

Barnett J, Timotijevic L, Shepherd R and Senior V (*in preparation*) Responses to Precautionary Advice: Concern, Reassurance and Intended Behaviour Change, *Risk Analysis*

9 Financial Summary

	Allocation	Expenditure
Salaries	46689.28	46174.16
OHDs	28013.54	27704.50
Consultants/ Subcontractors		
Equipment	900.00	900.00
Fixed Asset Spend		
Consumables		
Travel & Subsistence	2472.00	3107.96
Student Fees Paid		
Other Costs	22150.40	20325.34
Total	100225.22	98211.96

RUM19A

	Allocation	Expenditure
Sub-Total	46689.28	46174.73
OHDs	28013.54	27842.35
Consultants/Subcontractors		
Equipment	900.00	900.00
Fixed Asset Spend		
Consumables		
Travel & Subsistence	2472.00	2466.16
Student Fees Paid		
Other Costs	22150.40	22549.78
TOTAL	100225.22	99933.02

The planned and agreed dissemination strategy of the results of this project is ongoing. There are two relevant conferences later in 2006 where we plan to present papers based on this project. Costs have been allowed for these in the summary of expenditure noted above. Costs to present a paper at RiskCom 2006 in Gothenburg have been included in expenditure for RRX102 (£950); costs to present a paper at the Society of Risk Analysis (Europe) annual conference in Ljublana have been included in the expenditure for RUM19A (£800).

10 References

Barnett J, Cooper H, Senior V (*under review)*) Belief in public efficacy, trust and attitudes to modern genetic science. Risk Analysis

Cohen, A.A. and Lemish, D. (2003) Real Time and Recall Measures of Mobile Phone Use: Some Methodological Concerns and Empirical Applications, New Media and Society, 5(2): 1687-183.

Department of Health (2000a) Mobile phones and health. London: Department of Health

Department of Health (2000b) Mobile Base Stations and Health

Horlick-Jones, T., Sime, J., Pidgeon, N. (2004) Social Dynamics of Environmental Perceptions: Implications for Risk Communication and Practice. In: N Pidgeon, RE Kasperson, P Slovic, The Social Amplification of Risk, Cambridge: Cambridge University Press

National Radiological Protection Board (2004) Mobile Phones and Health, Documents of the NRPB, Vol 15, No 5, Didcot: NRPB

Parslow, R.C., Hepworth, S.J. and McKinney, P.A. (2003) Recall of Past Use of Mobile Phone Handsets, Radiation Protection Dosimetry, 106(3): 233-240.

Petts J, Wheeley J, Homan J, & Niemayer S (2003) Risk Literacy and the Public: MMR, Air Pollution and Mobile Phones, Department of Health: London

Petts, J. Horlick-Jones, T and Murdock, G. (2001) Social Amplification of Risk: The Media and the Public. Health and Safety Executive Contract Research Report 329/2001, Sudbury: HSE Books

Poortinga, W. & Pidgeon, N. (2003). Exploring the Dimensionality of Trust in Risk Regulation. *Risk Analysis, 23,* 961-972.

Wiedemann P M & Schütz H (2005) The Precautionary Principle and Risk Perception: Experimental Studies in the EMF Area, Environmental Health Perspectives, 113, 4, 402-405.

MTHR Scientific Co-ordination Team
www.mthr.org.uk

c/o Health Protection Agency
Centre for Radiation Chemical and
Environmental Hazards
Chilton, Didcot, Oxfordshire OX11 0RQ