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Can evidence change belief? Reported mobile phone sensitivity following individual feedback of an inability to discriminate active from sham signals

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Abstract

Objective: In this study, we tested whether providing individuals, who described being sensitive to mobile phone signals, with accurate feedback about their ability to discriminate an active mobile phone signal from a sham signal had any impact on their subsequent symptom levels or their perceived sensitivity to mobile phones. **Methods:** Sixty-nine participants who reported sensitivity to mobile phones took part in a double-blind, placebo-controlled provocation study. Perceived sensitivity to mobile phones was assessed using a version of the Sensitive Soma Assessment Scale (SSAS) and the severity of any symptoms attributed to mobile phones was recorded. Both the overall ("negative") findings of the provocation study and the participant's own individual results ("correct" or "incorrect" at detecting a mobile phone signal) were then described to them. Six months later, perceived sensitivity and symptom severity were measured again. **Results:** Fifty-eight participants (84%) received feedback and participated in the 6-month follow-up. No significant differences in SSAS scores or in symptom severity scores were found between individuals told that they were correct (n=31) or incorrect (n=27) in their ability to detect mobile phone signals in the provocation study. **Conclusion:** The provision of accurate feedback was insufficient to change attributions or reduce symptoms in this study. However, an overtly negative reaction to feedback was not observed among most participants, and some participants were willing to consider that factors other than electromagnetic field may be relevant in causing or exacerbating their symptoms. Discussing possible psychological factors with electromagnetic hypersensitivity patients may be beneficial for some.

Keywords: Electromagnetic fields; Electrosensitivity; Idiopathic environmental intolerance; Mobile phones; Reassurance; Provocation study

Introduction

Electromagnetic hypersensitivity (EHS) is a poorly understood condition in which people report nonspecific symptoms after perceived exposure to weak electromagnetic fields (EMF) [1,2]. For the last 2 decades, increasing interest in this problem has resulted in research mainly focused on establishing the role of EMF in causing or exacerbating these symptoms. The lack of evidence to support this association [3] suggests that EMF plays little, if any, role in the pathogenesis of the condition.

There is a scarcity of research regarding treatment for EHS. Although some studies have reported that cognitive behavioral therapy (CBT) may help these individuals [4], little is known about the most appropriate way to treat EHS. One intervention for this group that is sometimes attempted is to inform patients that EMF is unlikely to be the cause of their problems and that other, possibly psychological, mechanisms may underlie their symptoms. A more individualized approach has also sometimes been used to demonstrate to patients that they are unlikely to be sensitive to EMF. For example, one Swedish case report exists in

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Table 1
Basis for categorizing participants as correct or incorrect for the purposes of feedback

Participant's response in double-blind provocation study		
Condition was GSM	Condition was Sham	Categorization for feedback study (*n*)
"Emitting"	"Not emitting"	Correct (*n*=16)
"Not emitting"	"Emitting"	Incorrect (*n*=17)
"Emitting"	"Emitting"	If more confident about GSM decision [a]—Correct (*n*=11)
		If more confident about Sham decision [a]—Incorrect (*n*=11)
"Not emitting"	"Not emitting"	If more confident about GSM decision [a] – Incorrect (*n*=5)
		If more confident about Sham decision [a]—Correct (*n*=2)
For participants who withdrew prior to completing both GSM and Sham		
GSM session "emitting," no sham, no CW		Correct (*n*=3)
CW session "emitting," no sham, no GSM		Correct (*n*=3)
CW session "emitting," sham "not emitting," no GSM		Correct (*n*=1)

[a] Confidence for each assessment was measured using a 100-mm Visual Analogue Scale.

which a single EHS patient was repeatedly provoked under double-blind conditions using her clinician's computer [5]. The results showed that the patient was unable to detect EMF at better-than-chance levels, and after this was discussed with her as part of her treatment, the patient subsequently improved.

The effects of providing individual feedback which challenges the beliefs of patients with medically unexplained symptoms needs further examination. In the present study, we provide pilot data about the effects of giving individualized feedback to people who reported "sensitivity" to global system for mobile communication (GSM) mobile phones and who participated in a previous double-blind provocation study designed to test that aetiology [6]. Our hypothesis was that providing disconfirming evidence to these individuals would alter their perceived sensitivity to mobile phones at 6 month follow-up. The results of this pilot study may have implications not only for the management of EHS but also for the wider array of medically unexplained/contested diagnoses [7].

Methods

Design

In this prospective cohort study, measurements were taken as part of a baseline assessment made prior to our provocation study (Time 1), immediately prior to the provision of feedback (Time 2), and then again 6 months later (Time 3). The primary dependent variable was the degree of self-reported sensitivity to mobile phone signals reported at Time 3, with the main independent variable being the individual feedback that each participant received as to whether they were "correct" or "incorrect" in our provocation study. Which type of feedback the participant received was determined by their actual performance in the provocation study.

The original lead researcher from our provocation study (G.J.R.) obtained data at Time 1 and Time 2 and provided feedback. A different researcher (R.N.H.) obtained outcome data at Time 3. R.N.H. was blind as to whether participants had received feedback that they were correct or incorrect in the provocation study.

Ethical approval for this study was granted by the South London and Maudsley NHS Trust Research Ethics Committee.

Participants

The participants for this study were recruited from a sample of EHS volunteers who previously reported headaches triggered by exposure to GSM mobile phone signals and who participated in an experimental provocation study designed to test this aetiology [6].

Participants were recruited between September 2003 and June 2005 using different strategies: advertising in primary care clinics, by interested clinicians, and by an EHS support group in addition to articles and adverts published in the general press and in specialist health publications [6].

In the provocation study, participants were exposed under double-blind conditions to two testing sessions, one involving a GSM mobile phone signal, and one, a sham signal. In order to test whether the pulsing nature of the GSM signal was important in triggering symptoms, participants also took part in a third testing session involving exposure to a nonpulsing carrier wave signal (CW). Each of the three testing sessions lasted for 110 min and consisted of an initial 30 min baseline period with no exposure; a 50-min period of exposure to either GSM, CW, or sham; and a final 30-min resting period with no exposure. Sessions were separated by a minimum of 24 h, and the order of the sessions for each participant was randomized and counter-balanced within each block of 6 consecutive participants. During the course of each testing session, participants recorded whether they had experienced headaches or other subjective symptoms using visual analogue scales, and at the end of each session they recorded whether they believed a signal had been present (yes or no), their confidence in that belief (0–100 Visual Analogue Scale), and the reasons for that belief (open-ended question). The main results of the experiment have

been published elsewhere [6]. In short, although participants did report symptoms during the experiment, these were just as likely to occur in the sham condition as in the GSM or CW conditions. In addition, although some participants correctly discriminated between the three conditions, the numbers apparently able to do this were no greater than what would be expected by chance alone. When asked to describe how they had decided whether a testing session had involved exposure to a signal, most (n=64, 93%) reported using the presence or absence of symptoms as a guide.

All 69 participants who took part in at least one exposure session in the provocation study [6] were eligible for inclusion in the present study. At the time of their enrolment into the provocation study, all participants were between 18 and 75 years of age and reported headaches which they attributed to exposure to GSM mobile phone signals.

Feedback

Participants were categorized as belonging to the correct or incorrect feedback groups according to the protocol given in Table 1. As participants were recruited on the basis of perceived sensitivity to GSM and were often unsure as to how CW might affect them, wherever possible, this categorization was based solely on their results for the GSM and sham testing sessions. However, as 7 participants withdrew from the study before completing both the GSM and the sham conditions, this was not always possible. For these participants, feedback was based on whichever conditions they had participated in, including the CW condition where relevant (see Table 1). Appendix A illustrates how feedback was provided to the participants.

Measures

Data regarding a participant's age, sex, ethnicity, educational status, and occupational status were collected at Time 1. In addition, at Time 1, we also measured whether participants explicitly used a label such as "electromagnetic hypersensitivity" to describe their condition, what percentage of mobile phone calls triggered headaches for them, and how long they had been sensitive to mobile phones for.

Perceived sensitivity to mobile phones was assessed at Times 2 and 3 using a version of the Sensitive Soma Assessment Scale (SSAS) [8]. The SSAS was originally designed to assess perceived sensitivity to medication and was modified in this study to assess perceived sensitivity to mobile phones. This scale consisted of five items: "my body is very sensitive to the effects of mobile phone signals," "my body reacts strongly to mobile phone signals," "I usually have stronger reactions to mobile phone signals than other people," "I have had a bad reaction to mobile phone signals in the past," and "even very small exposure to mobile phone signals can upset my body." The response format for each statement was "strongly agree," "agree," "uncertain," "disagree," and "strongly disagree," with scores of 5, 4, 3, 2, or 1 being allocated to each response, respectively. For the medication version of the scale, Horne at al [9] reported an internal consistency of between 0.92 and 0.78 in five different samples, a test–retest reliability of 0.89, and a moderate correlation with the thematically related Beliefs about Medicine Questionnaire. The predictive validity of the scale was also demonstrated in a separate study assessing predictors of symptom reporting following vaccination [10]. In the present study, Cronbach's alpha for the items at both Time 2 and Time 3 was 0.9.

In addition, the following question was asked at Times 1, 2, and 3 to assess the severity of symptoms attributed to mobile phones: "Which of these statements best reflects you at the moment?: mobile phones do not cause me symptoms/cause me minor symptoms/cause me moderately strong symptoms/cause me severe symptoms/cause me unbearable symptoms." Responses were categorized into three groups according to whether no symptoms, minor or moderate symptoms, or severe or unbearable symptoms were reported.

Following feedback at Time 2, participants were asked the following open-ended question: "How do you feel about those results". Their answers were recorded verbatim by the interviewer. Answers were subsequently coded according to whether or not the participant indicated that they were questioning the underlying causes of their symptoms.

Procedure

Time 1 assessments were included in a pack of questionnaires completed by participants prior to their first testing session in our provocation study. Shortly after the publication of our provocation study results, participants were contacted again by telephone for the Time 2 assessment. These phone calls took place a median of 1.6 years (interquartile range of 1.4–2.1 years) after the participants' first provocation test. Participants were first asked for their verbal consent for us to ask them some additional questions. The SSAS and the question regarding mobile phone–related symptom severity were then asked. Participants were then reminded of the provocation study design, informed about the overall results, and provided with their individual feedback. Following feedback, participants were asked the open-ended question; any other questions the participants had about the study were answered and the call ended. Six months later, participants were contacted again, and the Time 3 questions were completed.

Analysis

The effect of feedback (correct vs. incorrect) on perceived sensitivity to mobile phones was tested using analysis of covariance (ANCOVA) with SSAS score at Time 3 as the dependent variable, feedback that participant was correct vs. feedback that participant was incorrect as the independent

variable and SSAS score at Time 2 as a covariate. A multinomial logistic regression was also run using mobile phone-related symptom severity at Time 3 as the dependent variable, feedback condition as the independent variable, and mobile phone-related symptom severity at Time 2 as a covariate. Time 2 was included in all analyses as a covariate to adjust for baseline differences. Other potentially important covariates (age, sex, educational level, self-reported "electromagnetic hypersensitivity") were first tested for using univariate analyses comparing correct versus incorrect participants and only included in the models if a significant association was identified.

In addition, a post hoc ANCOVA was run with SSAS score at Time 3 as the dependent variable, whether or not the participant appeared to be questioning the underlying causes of their symptoms (reconsidered attribution) as the independent variable, and SSAS score at Time 2 as a covariate. A post hoc multinomial logistic regression was also run using mobile phone related symptom severity at Time 3 as the dependent variable, reconsidered attribution as the independent variable, and mobile phone related symptom severity at Time 2 as a covariate.

Results

Response rate

We were able to obtain Time 2 data and provide feedback to 61 of the 69 eligible participants who took part in the original provocation study (88%). Of the remaining eight, at least one had moved to an isolated rural location in order to avoid EMF and was no longer contactable. We were unable to ascertain the whereabouts or health status of the other seven. A total of 58 participants (response rate of 84%) subsequently took part in the Time 3 assessments (one participant declined to participate in the interview and we were unable to contact the remaining two).

Participants' demographics

Out of the 58 participants who took part in the follow up, 32 participants were female and 26 were male [mean age=37.7 years (S.D.=13.5)], 83% were Caucasian, 67% had completed higher education, and 9% were unemployed. At Time 1, participants reported usually experiencing headache-like symptoms in a mean of 70.7% of calls. All but one participant considered themselves to have been sensitive for at least 12 months (median=4 years, interquartile range: 2–5.5 years), and 15 respondents used a label such as "electromagnetic hypersensitivity" to describe their condition.

Respondents vs. nonrespondents

Comparing the 11 nonrespondents with the 58 respondents revealed no significant differences in terms of age (t=1.2, df=67, P=.2), sex (χ^2=.001, df=1, P>.9), educational level (χ^2=.7, df=1, P=.4), correct/incorrect categorization (χ^2=.24, df=1, P=.6) or self-reported "electromagnetic hypersensitivity" (χ^2=.01, df=1, P=.9).

Correct vs. incorrect

Out of the 58 respondents, 31 were categorized as being correct in the provocation study and 27 as incorrect. No differences were found in age (t=1.0, df=56, P=.3), sex (χ^2=1.2, df=1, P=.3), educational level (χ^2=3.1, df=1, P=.08), or self-reported electromagnetic hypersensitivity (χ^2=.00, df=1, P>.9) between participants who were categorized as correct or incorrect. Similarly, a t test showed that there was no difference between correct and incorrect participants with regard to their SSAS score at Time 2 (t=0.3, df=56, P=.7), whereas a χ^2 test showed no difference in terms of symptom severity (no symptoms, minor/moderate, and severe/unbearable symptoms) at Time 2 (χ^2=0.4, df=2, P=.8) (see Table 2).

Effects of feedback

When assessed for changes in sensitivity to EMF, the results of ANCOVA did not reveal a significant effect [F(1,55)=.03, P=.9] between individuals who were correct and incorrect in detecting the presence of a mobile phone signal in terms of SSAS scores at Time 3 when holding SSAS score at Time 2 constant (see Table 2). The results of the multinomial logistic regression using mobile phone-related symptom severity at Time 3 as the dependent variable showed that being correct and incorrect at detecting signals were both independent as the test did not reveal significant values (Wald χ^2=.6, df=2, P=.7) .

Responses to feedback

Out of the 61 participants interviewed at Time 2, 24 (39%) made comments that suggested that they were reconsidering their attribution of symptoms to mobile phone signals (15 were incorrect and 9 were correct at detecting a mobile phone signal). For 17 of those, the change seemed to result from the feedback that we provided and/or their participation in our provocation study (e.g. "I left the session thinking it might be psychosomatic," "so the results suggest it may all be in my head"). For the other seven, changes in their attribution may have occurred for other reasons unrelated to our study (e.g., "I re-evaluated my symptoms after replacing my mobile handset"). Of particular interest were 10 participants (five correct and five incorrect) who now appeared to be considering whether psychological mechanisms might be at least partly responsible for their symptoms (e.g., "So it suggests that it is psychological, not physiological, which is relieving," "The results are very interesting. A psychosomatic explanation does make sense to me and may well apply in my case").

Table 2
Difference between participants who received feedback of having been correct or incorrect in a double-blind provocation study in terms of SSAS scores and symptom severity attributed to mobile phones at Times 2 and 3

Outcome	Feedback that participant was correct (n=31)	Feedback that participant was incorrect (n=27)
Time 1 (immediately prior to provocation study)		
SSAS scores [mean (S.D.[a])]	Data not collected	Data not collected
Symptom severity (number (%) reporting)		
No symptoms	1 (3%)	0 (0%)
Minor or moderate symptoms	21 (68%)	20 (74%)
Severe or unbearable symptoms	9 (29%)	7 (26%)
Time 2 (immediately before feedback)		
SSAS scores [mean (S.D.[a])]	18.2 (5.5)	17.7 (4.7)
Symptom severity [number (%) reporting]		
No symptoms	5 (16%)	4 (15%)
Minor or moderate symptoms	23 (74%)	19 (70%)
Severe or unbearable symptoms	3 (10%)	4 (15%)
Time 3 (6 months after feedback)		
SSAS scores [mean (S.D.[a])]	17.8 (4.8)	17.6 (4.7)
Symptoms severity [number (%) reporting]		
No symptoms	8 (26%)	8 (30%)
Minor or moderate symptoms	19 (61%)	16 (60%)
Severe or unbearable symptoms	4 (13%)	3 (11%)

[a] SSAS scores range from 5 to 35: higher score=more sensitive.

The remaining 37 participants (61%) did not show any apparent reconsideration in their beliefs about whether mobile phone signals triggered their symptoms. There appeared to be four different reasons given for this. First, potential technical faults in our study were mentioned by 23 individuals (38%) as reasons for rejecting the findings (e.g., "equipment may be faulty," "signal frequency not high enough," "maybe the other participants were not as sensitive as I am"). Second, general distrust in science was mentioned by four participants: two commented that "the science in this is and will always be inconclusive" and "I am not really interested in general results as I have lost complete faith in science and medicine," while two others questioned our independence from the mobile phone industry (e.g., "these results are good for mobile phone companies"). Conflicting evidence seemed to be a third source for disbelief, and three individuals mentioned apparently contradictory evidence obtained from the scientific literature or from complementary and alternative healthcare practitioners (e.g., "the results disagree with a recent study on cancer," "impossible to believe, my homeopath says I am very sensitive"). Finally, for three participants, the individual feedback results were given more importance than the general results of the study (e.g., "from my own results, at least I know that I am quite sensitive").

The results of the ANCOVA analysis identified no significant effect [$F(1,55)=.2$, $P=.6$] between individuals whose responses suggested a change in attribution and those whose responses suggested no changes in terms of mean SSAS scores at Time 3 when holding SSAS score at Time 2 constant (see Table 2). Similarly, the results of the multinomial logistic regression using mobile phone-related symptom severity at Time 3 as the dependent variable showed that giving responses that suggested a change in attribution and those whose responses suggested no changes were both independent (Wald $\chi^2=2.6$, $df=2$, $P=.3$) (see Table 3).

Discussion

Over the past 20 years, the effects of EMF on the reporting of symptoms has been investigated in over 30 blind or double-blind provocation studies, whereby individuals who believe that they are particularly sensitive to EMF are experimentally exposed to real and fake signals [3]. A nocebo effect has been a common response in these studies, with individuals reporting symptoms regardless of whether they are exposed to genuine or sham EMF. Although helpful in testing the aetiology of medically unexplained sensitivities, the use of provocation experiments as a form of treatment has been relatively untested, although case studies reporting the effectiveness of such interventions exist dating back over a hundred years [11].

Despite this, our pilot study found no evidence to suggest that providing individualized feedback about a person's capacity to discriminate accurately between active and sham mobile phone signals in a provocation study altered their perception of themselves as sensitive to mobile phones or altered the severity of the symptoms that they experienced in relation to mobile phone use. One explanation for this may be that challenging a patient's attributions for their symptoms is not sufficient to bring about an improvement in their symptom perception. Even comparing those patients who did reconsider their attributions against those who did not failed to identify any significant differences in symptom severity or perceived sensitivity. A similar phenomenon has been observed before in trials of CBT for patients suffering from chronic fatigue syndrome.

Table 3
Differences between participants whose responses suggested a reconsidered attribution after the provision of feedback of the results of a double-blind provocation study in terms of SSAS scores and symptom severity attributed to mobile phones at Times 2 and 3

Outcome	Participant reconsidered attribution following study (*n*=23)	Participant did not reconsider attribution following study (*n*=35)
Time 1 (immediately prior to provocation study)		
SSAS scores [mean (S.D.[a])]	Data not collected	Data not collected
Symptom severity [number (%) reporting]		
No symptoms	0 (0%)	1 (3%)
Minor or moderate symptoms	20 (87%)	21 (60%)
Severe or unbearable symptoms	3 (13%)	13 (37%)
Time 2 (immediately before feedback)		
SSAS scores [mean (S.D.[a])]	16.1 (4.2)	19.2 (5.2)
Symptoms severity [number (%) reporting]		
No symptoms	4 (17%)	5 (14%)
Minor or moderate symptoms	18 (78%)	24 (69%)
Severe or unbearable symptoms	1 (4%)	6 (17%)
Time 3 (6 months after feedback)		
SSAS scores [mean (S.D.[a])]	16.2 (4.0)	18.8 (4.9)
Symptoms severity [number (%) reporting]		
No symptoms	9 (39%)	7 (20%)
Minor or moderate symptoms	13 (56%)	22 (63%)
Severe or unbearable symptoms	1 (4%)	6 (17%)

[a] SSAS scores range from 5 to 35: higher score=more sensitive.

While CBT can be effective for such patients, whether or not their beliefs about the causes of their illness change during the course of treatment does not predict whether their health will improve [12]. It is possible that, for EHS, as with chronic fatigue syndrome, encouraging patients to change their behaviors and their beliefs about symptom management may be more important than challenging their beliefs about the underlying cause of the symptoms themselves [4,13].

An alternative explanation may be that methodological issues with our study prevented us from detecting a genuine effect of feedback. The methodology of this study was constrained by the methods used in our previous provocation study, which was not specifically designed to be part of a therapeutic intervention. In particular, the provocation study was intended to test the sensitivity of a group of participants, rather than diagnosing individual participants as sensitive or not sensitive. This allowed us to reduce the number of exposure sessions for each participant to three: one GSM session, one session involving a non-pulsing CW signal, and one sham session. Case studies of the use of provocation trials in treatment have typically incorporated many more exposure sessions, demonstrating more thoroughly that an individual does not react to the substance being tested (e.g., 5). Such treatments also often include a detailed discussion prior to testing about what "positive" or "negative" results would mean and what implications they would have for a patient's understanding of their illness. Recent research into the provision of reassurance to patients suggests that providing such pretest information can help patients to understand and appreciate the meaning of test results when they come back "normal" [14]. As such, providing feedback on its own may not be enough to change attributions in people suffering from EHS. Instead, a more cognitive approach such as discussing how psychological factors can cause or exacerbate physical symptoms and discussing what negative test results might mean for the patient may be an important first step prior to running the provocation tests.

Another possible methodological issue was the use of a participant's ability to detect the presence or absence of a signal as the basis for deciding whether or not to categorize them as correct or incorrect. Given that participants were recruited because they experienced symptoms in connection with mobile phones, it could be argued that the presence or absence of symptoms during each condition would have been a more valid indicator. In practice, however, this distinction is unlikely to have made much difference: 93% of our participants reported using the presence or absence of symptoms to guide their decisions as to whether or not a signal was present. Other idiosyncratic experiences were also occasionally reported as an indicator of the signal's presence, such as feeling "pulsing in a nerve" or "pressure on the nose," sensing the signal's "vibes," or simply "feel[ing] that the phone gave signals at different times." Using a participant's overall judgment as to whether a signal had been present or not allowed us to take these other sensations into account and, thus, improved the face validity of our feedback for our participants.

Finally, the time gap between participation in the provocation sessions and the provision of feedback was not ideal. This delay, of up to 25 months, resulted from the need to maintain double blinding in the provocation study and may have minimized the effects of feedback. It is possible that providing feedback closer to the time of the provocation would have enhanced its "immediacy" and

given it a greater impact. Although our participants appeared to have clear memories of the study and required little reminding of what happened, future studies should ensure that feedback is provided more promptly.

Suggesting that a patient's illness may have a psychogenic component can sometimes have a negative effect on the therapeutic relationship between doctor and patient and can cause offence to some [15]. In this study, some of our participants were openly hostile to our feedback and many others attempted to find rationalizations to explain why our results were either flawed or did not apply to them. Overall, however, hostile reactions were in the minority and we were struck by the willingness of some participants to accept that psychological factors may have been relevant to them. Although negative reactions are to be expected from time to time, these results imply that physicians should not be discouraged from raising the possibility of psychological mechanisms with patients who report sensitivity to EMF.

A final word of caution may be in order concerning our results. Although 31 participants were categorized as correct for the purposes of this study, it is important to note that this proportion is what would be expected by chance if our participants, as a group, were randomly selecting which conditions involved real signals and which were sham (see Ref. [6] for detailed analysis). The results must not be taken as implying that 31 participants were genuinely sensitive. Based on current evidence [3], future studies employing repeated testing of individuals as part of a therapeutic package may find that somewhere between most and all of their participants end up being classified as incorrect.

Conclusions

Current guidelines concerning the treatment of patients who report having EHS urge caution when it comes to using double-blind provocation trials as a form of clinical intervention [16]. As the guidelines note, unless agreement can be reached with the patient prior to testing about what any positive or negative results will mean, then there is little point proceeding. Moreover, blinding such trials can be difficult and unless this is done properly, it is possible that a patient's conviction that they are able to detect the emissions from an electrical device will be inadvertently reinforced. Our results reemphasize this need for caution, as we were unable to observe any beneficial effects of informing participants that they were unable to differentiate between real and sham EMF under double-blind conditions. At the same time, however, our qualitative results suggest that more research into this may be worthwhile, particularly for patients who are already willing to consider that factors other than EMF may be relevant in causing or exacerbating their symptoms.

Acknowledgments

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Appendix A

Protocol for providing feedback

Feedback received by all participants:

"If you remember, we exposed you to three things: a digital mobile phone signal, a nonpulsing mobile phone signal, and a session in which there was no active signal—a "placebo" session. In all, we tested 60 people who, like you, reported that they had experienced problems with mobile phone signals. The results showed that, overall, these people could *not* tell the difference between these three types of exposure. Although some people were correct in their answers, just as many were incorrect.

We also looked at whether people experienced symptoms during the study—whether they experienced headaches, fatigue, dizziness, and the like. Although people did report these symptoms, which were sometimes quite severe, they were just as likely to report them in our placebo session as they were in the two active sessions.

Overall, then, our results *do not* suggest that mobile phone signals are responsible for causing the kind of symptoms that people have been describing to us."

Individual feedback:

"I can also tell you how you yourself did in the experiment. When we exposed you to the nonpulsing signal you said you thought you [could/could not detect a signal], and you were *X*% confident about that. So you were [correct/incorrect] for that decision. [Repeat for GSM and Sham].

Because of this, we think that your results are [consistent/inconsistent] with what you told us about your previous problems with mobile phones.

Obviously, though, we place more emphasis on our overall results, which suggested that mobile phones do not cause these type of symptoms."

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