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Epidemiologic Studies of Electric and Magnetic Fields and Cancer: A Case Study of Distortions by the Media

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James R. Jauchem

Armstrong Laboratory
Occupational and Environmental Health Directorate
Radiofrequency Radiation Branch
8308 Hawks Road
Brooks Air Force Base, TX 78235-5324

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Articles alleging hazards of electric or magnetic fields, based on epidemiologic studies, have appeared in the popular press. Some of these articles, which contain distortions of the scientific evidence, have been cited in the scientific and medical literature, thereby being given some degree of apparent legitimacy. In particular, articles appeared in 1989 in **The New Yorker** magazine, claiming a strong association between exposure to electric or magnetic fields and cancer. Assertions made in these articles (and a book dealing with essentially the same information) have been challenged by members of the scientific community. This paper will identify some additional misconceptions presented in two more recent articles from **The New Yorker**. Scientists and physicians should be aware of the deficiencies in these articles and are encouraged to seek a more balanced view of the research performed in this area.

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EPIDEMIOLOGIC STUDIES OF ELECTRIC AND MAGNETIC FIELDS AND CANCER: A CASE STUDY OF DISTORTIONS BY THE MEDIA*

JAMES R. JAUCHEM

Directed Energy Division, Occupational and Environmental Health Directorate, Armstrong Laboratory, Brooks Air Force Base, TX 78235, U.S.A.

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Abstract—Articles alleging hazards of electric or magnetic fields, based on epidemiologic studies, have appeared in the popular press. Some of these articles, which contain distortions of the scientific evidence, have been cited in the scientific and medical literature, thereby being given some degree of apparent legitimacy. In particular, articles appeared in 1989 in **The New Yorker** magazine, claiming a strong association between exposure to electric or magnetic fields and cancer. Assertions made in these articles (and a book dealing with essentially the same information) have been challenged by members of the scientific community. This paper will identify some additional misconceptions presented in two more recent articles from **The New Yorker**. Scientists and physicians should be aware of the deficiencies in these articles, and are encouraged to seek a more balanced view of the research performed in this area.

Electromagnetics Electrical workers Neuroblastoma Cancer

INTRODUCTION

Potential health problems associated with exposure to electric or magnetic fields (EMF) have been reported in both the popular press and scientific journals. Most of the data used in support of this alleged association were obtained from epidemiologic studies. Regarding biologic effects of EMF, Bridges and Preache [1] reported in 1981 that "certain sensationalized media accounts have heightened public fears and clouded real scientific issues". Not much has changed in this respect during the past decade; this statement is still valid today.

In an analysis of news stories that describe scientific results, Singer [2] concluded that "in the process of making science lively and acceptable, most media reports introduce some errors of omission, emphasis, or fact. . . . Some of the inaccuracies seem to result from the media's need to dramatize the research findings". Cohen [3] noted "a clear pattern of the media giving the most coverage to those with the lowest credibility in the scientific community".

The New Yorker magazine published a series of three articles (12, 19 and 26 June 1989) written by Paul Brodeur, alleging hazards of EMF. The appearance of these articles and a book dealing with essentially the same information (**Currents of Death: Power Lines, Computer Terminals, and the Attempt to Cover Up Their Threat to Your Health**. New York: Simon and Schuster; 1989) was followed by several commentaries from the scientific community. These responses [4–10] indicated that Brodeur oversimplified the scientific evidence, misinterpreted data, and ignored the body of work in this area in the scientific literature.

The potential effect of Brodeur's articles to unnecessarily alarm the public is disturbing in itself. In addition, the articles have been cited in

*The views and opinions expressed in this paper are those of the author and do not necessarily state or reflect those of the U.S. Government.

the medical and scientific literature, and some degree of ligitimacy has been conferred upon them by scientific editors [11], research scientists [12–14], and clinicians [15–17]. The validity of some of these citations has been questioned previously [18–23].

Brodeur wrote two additional articles for **The New Yorker** (9 July and 8 November 1990), relating to EMF and a supposed connection with cancer incidence. The purpose of this commentary is to address some additional misconceptions presented by Brodeur. Most of these fallacies will be dealt with by citing direct quotations from previous reports in the scientific literature.

"ANNALS OF RADIATION: CALAMITY ON MEADOW STREET"— THE NEW YORKER, 9 JULY 1990

In this article, Brodeur cited an investigator (N. Wertheimer) who claimed that "a majority of the scientific studies conducted since 1979 showed that there was an association between exposure to electromagnetic fields and the development of cancer". Actually, the majority of studies have revealed only a negligible link between the two. As Cartwright [24] aptly summed up the research: "Our present scientific knowledge points at the very best to a minute risk of EMF verging on the point of non-existence." Wertheimer and Leeper's original 1979 study [25] contained numerous flaws that have been pointed out by other investigators. Brodeur chose to ignore these criticisms. Miller [26] was one of the first investigators to challenge the study's indirect measures of EMF exposure and pointed out that a dose–response relationship, which had been suggested by Wertheimer and Leeper, was *not* present. Many others have noted other major flaws in the study (e.g. Sheikh [27], Park [28], and Poole and Trichopoulos [29]).

Brodeur wrote that "Savitz was about to publish a new analysis of data . . . showing four times the expected rate of brain cancer in children whose mothers used electric blankets in their first trimester of pregnancy, as well as higher than expected levels of leukemia". In this case, Brodeur picked the one specific subgroup with the greatest odds ratio in the Savitz *et al.* study [30]. This subgroup contained only 9% (39 subjects) of the whole population studied for prenatal exposure to electric blankets (439 subjects). Savitz *et al.* [30] stated that "for some cancer subgroups, elevated odds ratios were observed, though there is no clear pattern to the finding" and that "results are very imprecise". The overall odds ratio for the association of childhood cancer incidence with prenatal electric blanket exposures of the total population studied was only 1.3. An editor [31] of the journal that published the Savitz *et al.* study (**Am J Epidemiol**) has criticized the authors' use of the term "effect" since it "makes an implicit claim to causality, although the criteria for calling electromagnetic radiation from electric blankets a cause of childhood cancer are not met in this study or by the body of literature on the topic. It misleads the uncritical reader."

In addition to brain tumors, Brodeur seemed to blame exposure to EMF for the following ailments: Osgood–Schlatter syndrome, ganglion cysts, keratinous cysts, scoliosis and other spinal deformities, parotid gland inflammation, hypospadias, heart defects, lipodystrophy, glomerulonephritis, strep throat, fever, dark brown urine, pain and swelling in the eyes, swelling of the face, arm numbness, severe headaches, and keratoacanthoma. Surely it would be difficult to find a scientific basis for linking EMF exposure to this menagerie of ailments.

Brodeur stated that Johnson and Spitz "found that children whose fathers were electricians ran three and a half times the risk of developing tumors of the central nervous system than other children ran". Brodeur implied that this finding related to EMF exposure. In the Johnson and Spitz article [32], however, this elevated ratio was related to "fathers who were electricians", not to fathers with jobs involving potential EMF exposure. This distinction is important. In contrast to the 3.5 ratio mentioned above, the odds ratio for occupations in industries involving possible EMF exposure was 1.6. Johnson and Spitz stated: "The highest risk estimate in our analysis was the odds ratio of 10.0 for construction electricians. . . . people in this trade work largely with unenergized wiring, implying that they have a limited exposure to electromagnetic fields . . . this result directed our attention to chemical exposures." Thus, Brodeur incorrectly indicated that the 3.5 ratio related to EMF exposure. As Johnson and Spitz wrote: "Electrical and electronics apparatus workers have potential exposure to chlorinated diphenyls and naphthalenes, epoxy and phenolic resins, rubber, solder fumes, synthetic waxes and varnishes among others. Work in the electronics industries additionally involves the use of solvents, soldering fluxes, machine oils, cool-

ing agents, platinum and tellurium." In assessing the role of EMF exposures in causing tumors, Johnson and Spitz noted that "convincing evidence has yet to be reported". In an earlier study by Thomas *et al.* [33], a significantly increased risk of death from brain tumors was observed in occupations supposedly involving EMF exposure. However, after removing subjects who had exposure to lead, soldering fumes, and organic solvents, the increased risk disappeared. Thus, it seems that the increased risk of death may be related to these other agents rather than to EMF. More recently, Bunin *et al.* [34] found no significant associations between neuroblastoma and parental employment in jobs with EMF exposure.

Concerning a draft report of the U.S. Environmental Protection Agency, Brodeur mentioned what he called the "apparent involvement of the White House in countermanding the efforts of responsible government officials to define and take action regarding an important environmental-health issue ...". In fact, the description of EMF as a "probable" human carcinogen has been questioned for scientific reasons, *not* political reasons. EMF simply do not meet the criteria required for the classification. The report was released as a "Workshop Review Draft" and contained, on each page, the words "DRAFT—DO NOT QUOTE OR CITE". Brodeur, however, commented on the report before scientific review was completed and before the release of a final version. Brodeur seemed to think that being asked not to cite a draft report was synonymous with a "cover-up". With his premature account of the report, he presented a distorted view of current research.

Several epidemiologists have observed that their investigations of purported cancer clusters have been severely hindered by the reaction of the general public to the misconceptions and inaccuracies in **The New Yorker** article [35]. As Michaelson [36] has noted, "This article fanned the fires of public concern" despite the lack of evidence of a causal relationship.

"DEPARTMENT OF AMPLIFICATION"—THE NEW YORKER, 8 NOVEMBER 1990

In both the previous article and this one, Brodeur mentioned evidence suggesting that a cancer cluster had occurred in association with EMF exposure in one particular location—the town of Guilford, Connecticut. The state's Department of Health Services concluded that there was no cluster [37]. As Schulte *et al.* [38] have explained, the "attention to apparent clusters ... is often accompanied by a climate of heightened emotion ... and intensive media coverage. ... The distribution of cancer cases in space and time can be affected by ... chance alone. It is difficult to explain the concept of 'chance' (i.e. random distribution) to anxious people." Rothman [39] and Bender [40] have, in turn, added: "As a surveillance system, lay reports of disease clusters yield an extremely high proportion of false alarms. Epidemiologic research should be based on better information than can be obtained from these informal reports of disease clusters"; and "the vast majority of these reports have no statistical or biologic basis and ... almost all of them have no public health significance". Undue attention to the reports will result in an increased drain on resources of public health departments.

Brodeur wrote that "some two dozen epidemiological studies ... (showed) that children and workers exposed to power-line magnetic fields were developing cancer—chiefly leukemia, lymphoma, melanoma, brain tumors, and other central-nervous-system cancers—at rates significantly higher than those observed in unexposed people", and that "between 1985 and 1989 no fewer than twelve studies had shown more brain tumors than were to be expected among people exposed to electric and magnetic fields at home or at work". These are misleading statements. As explained in the most recent reviews of this research topic [41–43], the majority of epidemiologic studies do not support the contention that there is an association between EMF exposure and cancer.

Brodeur mentioned a study by Swerdlow [44] and stated that "eye melanoma ... has been found to be 'notably high for electrical and electronics workers', who are known to be exposed to strong magnetic fields". Swerdlow [44], however, did *not* mention exposure to EMF. In a more recent study by Vagero *et al.* [45], electrical and electronics workers did not have a higher incidence of cutaneous melanoma. Brodeur also claimed that "melanoma of the skin is ... prevalent among workers in electrical and electronic occupations, and thus associated with exposure to magnetic fields". The major problem with this statement is that occupational titles are inadequate for determining possible exposure to EMF. Knave and Floderus [46] have stated that "for many of these occupations

with presumed exposure, we do not know whether there is, in fact, exposure to magnetic fields ... and whether or not there is exposure to other known carcinogens ... There is no solid evidence from current experimental studies to support the hypothesis of carcinogenicity." Savitz and Chen [47] noted that "job titles may not accurately identify exposures due to errors in reporting, but especially due to the inherent variability in activities and environments associated with any given job title". As Gallagher *et al.* [48] have mentioned, "workers in electronics and electrical occupations may also be exposed to chemicals and solvents, and the effects of long-term exposure to these compounds should be considered along with exposure to electromagnetic fields".

Brodeur has requested that health departments in several states undertake full-scale investigations of alleged EMF hazards. On the basis of the available evidence, one must question whether the money spent on such studies would be warranted. As Weisburger [49] has argued, "with limited funds available for serious research efforts, a program on electromagnetic fields and cancer could be counterproductive by diverting effort and money from more relevant research and public information activities". As Rothman [39] has pointed out, greater effort should be directed toward public education about the random nature of disease occurrence and less time spent in performing intensive epidemiologic studies in nonproductive settings.

ANALOGOUS TOPICS

The subject of EMF effects is not unique when it comes to distortions by the media in reporting scientific data. There are several analogous situations in the media's reporting of other potential health hazards, many of which are based in large part on epidemiologic studies. The following quotes from other authors concerning nine other topics could apply just as easily to the EMF question:

(1) "A non-scientific association was made ... and was quickly promulgated by the news media ... all these studies used the case–control method, and serious questions are posed ..." [50]. "Emotional role-playing by the national news media has had tragic consequences for the American ... people in a number of ways. It has undermined ... morale by promoting unfounded fears of a cancer epidemic, of increases in the number of children born with defects, and misguided ideas of a 'risk-free' society" [51]. "The fact that birth defects (and) cancers ... occur in people who have not been exposed ... is forgotten" [52]. (Agent Orange and its associated dioxin.)

(2) "From a journalistic point of view, the ... story was as good as it gets. It offered little guys/big-guys conflict and human interest, and it involved a tangle of environmental, scientific, political, and legal issues" [53]. (Trichloroethylene in Silicon Valley water.)

(3) "... because of intense and often misleading media coverage of this issue and a lack of understanding ..., government created strict regulations ... The result is an extraordinary increase in cost with no environmental or public health benefit" [54]. (Infectious waste.)

(4) "... a 'leaked' story appeared on the television evening news, announcing the unconfirmed results of an uncontrolled 'study'" [55]. "... a ubiquitous, insidious peril, striking indiscriminately (was) responsible for a new epidemic of cancer and birth defects" [56]. (Chemicals at Love Canal.)

(5) "... the cancer scares of the past two decades ... have been hysterical false alarms ... Almost any scientist who has had contact with the media has (a) collection of favourite horror stories involving misquotation, distortion, sensationalism, hype, or simple misunderstanding" [57]. (Chemicals, in general.)

(6) "In the last five years, there has been wide media publicity for the anecdotal reports of birth defects ..." [58] (Debendox.)

(7) "Available data do not support the concept that low-level exposure ... is a health hazard .. Panic has been fueled by unsupported concepts ..." [59] "overreacting may actually injure more people by wasting precious resources in ineffective pursuits" [60]. (Low-level exposure to asbestos.)

(8) "The negative study did not identify increased carcinogenic risk ... many newspapers have ignored this negative message" [61]. (Cancer in people residing near nuclear facilities.)

(9) "... background information, such as comparison of actual and expected numbers of cases, environmental causes and their confounders, and the existence of other clusters, was not frequently reported. ... (there was) a preponderance of risk asserting statements

in the beginning of stories, which implies a bias toward catching readers' attention with assertions of risk" [62]. (Cancer clusters in New Jersey.)

It is interesting to note that Brodeur had written a previous book titled **Outrageous Misconduct: The Asbestos Industry on Trial**, dealing with another topic filled with controversy and in which the scientific evidence concerning low-level effects was oversimplified.

CONCLUSIONS

In his July 1990 article, Brodeur quoted a spokesman for an *ad hoc* parents' committee: "We wanted something done now—we weren't sure what we wanted it to be—but we wanted something done, by God" This kind of statement typifies public reaction to articles in the popular press dealing with EMF health effects.

It is unfortunate that popular newspapers and periodicals report work that does not stand up to critical analysis. Regarding epidemiologic studies in particular, Feinstein [63] has noted that "the research often becomes public without passing through the customary evaluative process used in scientific investigation. The results may appear in lay media long before any formal documents are issued . . ." As Koshland [64] has stated: "Individuals and institutions are made accountable in journalism and in science by taking seriously those who are consistently accurate and reliable and ignoring or decrying those who are consistently sensationalized and inaccurate." Unfounded claims, such as those presented by Brodeur, should not be accepted as being representative of the medical and scientific literature relating to EMF. Public health professionals should be cognizant of these distortions and must oppose the appearance of such statements in both the popular press and in scientific and medical journals.

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Editors' Note—Because the foregoing paper refers to material published by **The New Yorker**, the Editor of that journal was invited to prepare a response or rebuttal. No reply was received.