

Electromagnetic Aftereffects of Near-Death Experiences

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ABSTRACT: Near-death experiencers (NDErs) have reported malfunction of electrical devices in their vicinities (Atwater, 1994; Bonenfant, 2005; Ring, 1992; Ring & Valarino, 2000). In this quantitative, retrospective study we investigated electromagnetic effects among NDErs, people who reported a close brush with death without an NDE, and people who reported never having been close to death but who used their most life-changing event as a past reference point. All participants completed a demographic questionnaire and two versions of the researchers-developed Electromagnetic Experiences Questionnaire: during the past year and before the designated life event. Participants who reported a close brush with death also completed the Near-Death Experience Scale (Greyson, 1983). Participants were adults with equivalent demographics: 36 NDErs, 20 nonNDErs who reported a close brush with death, and 46 people who had not been close to death. Results were a greater incidence of reported electromagnetic effects among NDErs than among participants in the other two groups; that retrospectively reported NDEs, more than close brushes with death or life-changing events, tended to mark an increase in electromagnetic effects; and that more electromagnetic effects were correlated with deeper NDEs. Implications for future research are discussed.

KEY WORDS: near-death experiences; aftereffects; physiological changes; electromagnetic fields; electromagnetic interference.

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One distinct area of physiological aftereffects that near-death experiencers (NDErs) have reported is electromagnetic effects. These effects include malfunctions of electrical devices, both alternating current and direct current (battery-operated), including wrist watches, lights, televisions, radios, computers, appliances, vehicles, and cell phones, in close proximity to NDErs (Atwater, 1994; Bonenfant, 2005; Ring, 1992; Ring & Valarino, 2000). Though early researchers of NDE aftereffects did not mention electromagnetic effects (Grey, 1985; Kason, 1994; Moody, 1975; Ring, 1980, 1984; Sutherland, 1992), more recent investigators and researchers have increasingly reported them (Atwater, 1994; Bonenfant, 2005; Ring, 1992; Ring & Valarino, 2000). One reason may be the time Westerners, who have been the primary NDE research population, began using many electronic devices. For example, quartz watches became available in the early 1970s (Silva, 2007), computers became available to the public during the mid 1980s (Boeree, n.d.), and cell phones gained widespread use during the mid 1990s (Keith, 2004).

Kenneth Ring (1992) reported the first systematic study of electromagnetic effects. In his retrospective research, he compared 74 NDErs with 54 nonNDErs interested in NDEs. His Omega Psychophysical Changes Inventory contained one item related to electromagnetic effects: "I found that electric or electronic devices (e.g., car batteries or electrical system, lights, watches, tape recorders, computers, etc.) more often malfunctioned in my presence than I remember being the case before" (p. 268). Whereas 24 percent of NDErs endorsed the item, only 7 percent of nonNDErs did, a highly statistically significant difference (p. 157). Ring indicated that in this, his third major study of NDEs, he was discovering this "anomaly" for the first time (p. 157).

In looking back at narrative comments his participants had provided, Ring (1992) found several. A 36-year-old female NDEr with a high school education wrote:

Dr. Ring, I have a difficult time as many computers malfunction and lights will blow when I walk under them. This has happened for years, and I tried to ignore that this was happening. I simply cannot wear a watch for long before it breaks down. I went to ... a department store and walked in front of their brand new computer and it quit working... When I [held a fluorescent light in my hands], the entire bulb lit up, like it was turned on. It seemed like there was a lot of static electricity. (Ring, 1992, p. 159; bracketed and deleted material original)

Ring (1992) found that women in his sample more often reported such electrical phenomena than men (p. 160). Nevertheless, one NDEr, a 39-year-old male with a high school diploma whose NDE occurred when he was 22 years old, reported: "When upset lights blow; electrical components malfunction when new" (p. 160).

P. M. H. Atwater provided more narratives from her interviews with NDErs:

Watches do not keep time for me. But mechanical things seem to work, even for no reason.... If I get too close to FM radio frequencies I raise Cain with reception.... Recording equipment won't work for me.... I started dead car batteries with my energy. But as the years go by, my energy field has diminished. Things that were once true are no longer. I lost a lot in order to live in this world. (Atwater, 1994, pp. 139–140)

Jim Knittweis (1997) conducted an informal study to see whether a detectable difference between electrical fields of NDErs and non-NDErs existed. He employed two devices in his tests: a thermistor for testing heat from the participants' fingers and an electronic electro-scope to measure the electron flow. Knittweis tentatively concluded that most NDErs do not show differences in heat or electron flow from their hands compared to nonNDErs; however, NDErs who reportedly have gained healing abilities from their NDEs seem to have more overall heat and electron flow from both hands compared to nonNDErs. Because of the absence of masking in the research design, the absence of a comparison group, and other factors that either were not controlled or were not explained in detail, these results can be considered only suggestive. However, these admittedly suggestive findings do point in the same direction as Ring's and Atwater's.

The most extensive testimony currently available is probably that of Rebecca Stephens, a physician and director of the Leaseburg Hospital in Gainesville, Florida. At the 2005 International Association for Near-Death Studies (IANDS) conference presentation titled "Electromagnetic Sensitivity: A Physician's Experience Following a Childhood NDE", psychologist Richard Bonenfant featured Dr. Stephens as a case study. Stephens described her experience with her wrist watches: "They either go backwards, they stop, or the watch man knows me that he just has to put a new battery in every couple of months." Regarding cell phones, Stephens reported:

I have had lots of problems with cell phones not working. I have to have them constantly changed out ... after I had touched the cell phone which is just the borrowed cell phone [I'm using] right now,

because I had to send mine into the shop to get it repaired, it just beeps all day long if I touch it until I turn it off. (Bonenfant, 2005; bracketed material added)

She also described her experience with computers:

[The technology specialists at work] would tell me I had too much static; so, I actually used static mats; I actually have something on my keyboard before I even touch my computer. So, [having] gone through 6 hard drives in 5 years, [my employers] have spent some money on me to make sure I'm not full of EM [electromagnetic] energy; but in the same sense it affects everything that I do. (Bonenfant, 2005; bracketed material added)

As suggestive as these narratives and preliminary studies have been, they have left several questions unanswered or unconfirmed. For example, if asked in greater detail, might nonNDErs report electromagnetic effects as often as NDErs? If NDErs do indeed report electromagnetic effects more frequently, is that increased incidence associated specifically with an NDE or might it be related to coming close to death, whether or not the close brush included an NDE? If NDErs more frequently report electromagnetic effects, has the increase manifested only since the NDE, or might it have preceded the experience? And if only some NDErs report increased electromagnetic effects, what might be the relationship between nature and/or depth of NDEs and increased electromagnetic effects? It was to answer these questions that we undertook this study.

Although people have reported experiences phenomenologically equivalent to NDEs but not during a close brush with physical death (Greyson, 2000), we limited our scope to NDEs pertinent to our research questions: those occurring during illness or injury involving an actual or potential close brush with physical death. The first purpose of this study was to investigate the comparative incidence of electromagnetic effects during the last year before participation in the study among NDErs, people who experienced a close brush with death without an NDE, and people who reported never having experienced a close brush with death and who used a self-identified "most life-changing event" as a reference point in their pasts. The second purpose was to investigate the comparative change in the incidence of electromagnetic effects among the three groups before and after their designated life event (NDE, close brush with death, or life-changing event). The third purpose was to investigate the relationship between the reported overall depth and specific components of the subjective

experiences of people who had a close brush with death – both NDErs and nonNDErs who reported a close brush with death – and their reported incidence of electromagnetic effects.

Method

Participants and Procedure

We defined three research groups of adult participants. NDErs reported memory of psychological events of a paranormal and mystical nature that occurred during a close brush with death that happened at least one year before participating in the study and scored 7 points or higher on the Near-Death Experience Scale (NDE Scale; Greyson, 1983). NonNDErs who reported a close brush with death reported no memory of psychological events during a near-death event that occurred at least one year before participating in the study and scored 6 points or lower on the NDE Scale. People who had not been close to death reportedly had never experienced a near-death event but, for the purpose of comparison, used a self-identified “most life-changing event” that occurred at least one year before participating in the study as a before-and-after past reference point.

Once the study received Institutional Review Board approval, we solicited participants through research announcements to IANDS, including its newsletter and the more than 50 IANDS U.S. local groups for NDErs and people with personal and/or professional interest in NDEs and related experiences; the Association for Death Education and Counseling; the International Society for the Study of Subtle Energies; the Institute of Noetic Sciences; letters to local physicians; a bulk mail message to undergraduate and graduate students in the counseling program of a large southwestern public university; and word of mouth. The announcements stated:

If you are 18 and over, you can contribute to a study that involves effects of various life experiences, including a close brush with death, on people's experiences with electromagnetic devices such as cell phones, TVs, watches, and computers.

We offered a Sony MP3 player to three participants through random drawing at the end of data collection. Participants could complete questionnaires either online or in hard copy delivered and returned by hand or by mail.

The complete set of research materials included a recruitment letter; informed consent form; researcher-created Demographics Form, Close Brush with Death Question Form (CBDQF), Life-Changing Event Question Form (LCEQF), Electromagnetic Effects Questionnaire—Last Year (EMEQ-L) and Electromagnetic Effects Questionnaire—Before Event (EMEQ-B); NDE Scale (Greyson, 1983); and stamped, pre-addressed envelope for those who received the surveys in hard copy. As described below, not all initial respondents completed all forms/instruments.

Instruments

We developed the Demographics Questionnaire to collect seven categories of information about participants. We also developed additional instruments and used one established instrument.

Group assignment instruments. We developed the CBDQF to make preliminary assignment of respondents to one of the three groups. The first item was: "I have experienced a close brush with death; for example, a life threatening illness or injury in which I either was resuscitated, was expected to die, or was very likely to die." We directed participants who answered "no" to discontinue the CBDQF and proceed to the LCEQF to identify and describe a life-changing event and the year it occurred and to answer a few items about their transcendental and mystical experiences – the latter to enable follow-up analysis, if indicated, for participants who reported numerous intense transcendental and mystical experiences outside the context of a close brush with death (Jourdan, 1994). Of this group of people who reportedly had not been close to death, those who responded online did not have access to the NDE Scale, and those who responded using hard copy were directed to bypass the NDE Scale.

We asked participants who answered "yes" to the first CBDQF item to answer a further item based on Bruce Greyson's (1983) definition of an NDE:

During my close brush with death, I remember a distinct experience of profound psychological events with transcendental features (such as profound peace, out-of-body experience, and/or encountering deceased loved ones) and/or mystical features (such as encountering spiritual entities and/or an all knowing being of light).

We directed both nonNDErs who reported a close brush with death (those who answered "no") and NDErs (those who answered "yes") to

complete the NDE Scale. Members of both groups also indicated the year of their designated event and provided a brief description of its circumstances.

Hypothesis testing instruments. We used Greyson's (1983) NDE Scale, which he wrote was "clinically useful in differentiating NDEs from organic brain syndromes and nonspecific stress responses, and can standardize further research into mechanisms and effects of NDEs" (p. 369). The NDE Scale consists of 16 questions grouped into four clusters of cognitive, affective, paranormal, and transcendental features of NDEs.

The NDE Scale has high internal consistency, split-half reliability, and test-retest reliability: "Mean scores and standard deviations on the two halves were 7.64 ± 4.22 and 7.38 ± 3.94 ; the resultant Pearson product-moment reliability coefficient between the two halves was .84, Spearman-Brown corrected to .92" (Greyson, 1983, p. 373). Internal consistency of the entire scale using Cronbach's coefficient alpha was .88. Reliabilities for subscales were .75 for the cognitive component, .86 for the affective component, .66 for the paranormal component, and .76 for the transcendental component. Alpha values of 0.7 and 0.8 are generally considered satisfactory (Nunnally, 1978). According to Greyson (1983; Lange, Greyson, & Houran, 2004), the criterion score of at least 7, one standard deviation below the mean among people who reported an NDE in a near-death encounter, seems a valid cut-off point for determining the presence of an NDE.

We developed the EMEQ to assess the incidence of electromagnetic effects. Based on a review of the relevant literature, we compiled a list of equipment that NDErs had reported to malfunction in their presence. We then narrowed the list to the four devices they seemed to report most frequently: lights, watches, computers, and cell phones. We added a fifth category addressing how a respondent's emotional state influenced the functioning of all devices.

Next we developed two- to five-item subtests for each of the five categories, for a total of 20 items. Within each category were items worded positively, indicating malfunction of electronic devices (for example, "Computers seemed to malfunction when I was nearby"), and negatively, indicating no malfunction (for example, "I never noticed the operation of lamp light, street lights, or other lights being affected by my presence"). We used a 5-point Likert scale from 1 = "strongly disagree" to 5 = "strongly agree;" for the nine items in which it was relevant, we provided one additional choice: 6 = "I have reduced or

stopped my use of [specific devices] because I have had so many problems with them." For computation purposes, we reverse-coded the negative items so that, for all items, high scores indicated malfunction. For the items with an anchor point 6, we treated it as anchor point 5 ("strongly agree") for the positive statements and as anchor point 1 ("strongly disagree") for the negative statements. In addition, in calculating the subtest means in the case of missing data, we used a 75/25 rule (Nunnally, 1978); that is, if a respondent omitted more than 25 percent of the items in a subtest, we did not compute the subtest mean.

We pilot tested the survey for language clarity with five adult readers, two native English speakers and three who spoke English as their second language, and made some wording changes based on their recommendations. Two experts in the field examined face validity: one of us, JH, a scholar with over 20 years of research experience in the field of near-death studies, and the other, Richard Bonenfant, a psychologist with research interest in the area of electromagnetic effects among NDErs. Both experts confirmed the survey had face validity with several minor wording recommendations, many of which are reflected in the final questionnaire. We then piloted the instrument to establish and, if necessary, improve its reliability.

Results

Pilot Study

Twelve volunteers participated in the pilot study: one NDEr, three nonNDErs who reported a close brush with death, and eight people who reportedly had not been close to death. To assess internal consistency of the EMEQ-L, we calculated Cronbach's coefficient alpha for the entire scale and each subscale. Alphas were .94 for the entire scale, .87 for the four items on the Watches subscale, .96 for the four items on the Computers subscale, .76 for the four items on the Lights subscale, .67 for the six items on Cell Phones subscale, and .85 for the two items on the Emotion subscale.

Further analysis revealed that one item in the Lights subscale and three items in the Cell Phone subscale had low inter-item correlations in their respective subscales. After deleting these items (Hair, Black, Babin, Anderson, & Tatham, 2005), the Cronbach's alphas increased for the entire scale to .95, Lights to .85, and Cell Phones to .79.

Because an alpha of .8 or higher is considered to represent very good reliability (Nunnally, 1978), we used the 16-item EMEQ in the main study.

Main Study

Participants. By the time we met our target of at least 20 respondents in each of the three preliminary groups, 110 participants had returned usable data sets. Of these, seven respondents we had assigned to the NDE group scored below 7 on the NDE Scale; we excluded them from further data analysis. Thus, the final participants included 37 NDErs, 20 nonNDErs who reported a close brush with death, and 46 people who reportedly had not been close to death.

Chi-square tests on the seven demographic variables of gender, age, education, ethnicity, residence, country of birth, and religion indicated no significant differences on the data distributions in the three groups; thus, the three groups were demographically similar regarding these variables. Participants were approximately 80 percent female and 20 percent male. They ranged in age from 18 to over 65 years, with approximately two-thirds in the 35–64 years range. Bachelor's degree and master's degree holders were somewhat more represented than high school diploma, associate degree, and doctoral degree holders. Caucasians accounted for 85 percent of participants, with African-American, Asian, Hispanic, Native American, and "other" ethnicities also participating. More than 95 percent of participants were United States residents, and approximately 75 percent had been born in the United States, though participants included people born in Australia, Canada, Iran, Mexico, the Philippines, Sweden, Syria, Taiwan, and the United Kingdom. Approximately 45 percent of participants were Christian; others indicated atheism, Buddhism, Islam, Judaism, "other," or affiliation with both Christianity and at least one other designation.

The nature of participants' designated events is summarized in Table 1. Thirteen of the 46 people who had not been close to death and one of the 37 NDErs did not respond to this question; their data are included in the "not specified" category.

Time since participants' designated events is summarized in Table 2. The largest single group of participants in all groups reported their designated events occurred more than 20 years ago.

EMEQ reliability and tests of significance. Regarding the reliability of both versions of the EMEQ, Cronbach's alpha coefficients for both

Table 1
Nature of Participants' Designated Events

Type of event	Near-death experience (<i>n</i> = 37)	Close brush with death (<i>n</i> = 20)	Life-chang- ing event (<i>n</i> = 46)	Total
Serious illness	17 (46%)	10 (50%)	1 (2%)	28 (27%)
Accident-related injury	16 (43%)	4 (20%)	0 (0%)	20 (19%)
Profound loss	0 (0%)	0 (0%)	10 (22%)	10 (10%)
Life-threatening event without injury	0 (0%)	6 (30%)	2 (4%)	8 (8%)
Childbirth or adoption	0 (0%)	0 (0%)	7 (15%)	7 (7%)
Cardiac arrest	3 (8%)	0 (0%)	0 (0%)	3 (3%)
Social adjustment (wedding, divorce, move)	0 (0%)	0 (0%)	12 (26%)	12 (12%)
Spiritual transformation	0 (0%)	0 (0%)	1 (2%)	1 (1%)
Unspecified	1 (3%)	0 (0%)	13 (28%)	14 (14%)

total scales and all subscales met Jum Nunnally's (1978) guideline of at least .70 except the Computer EMEQ-L subscale alpha of .64. In assessing construct validity, all subscales were significantly correlated ($p < .001$), indicating convergent validity, and correlations ranged from .46 to .75, indicating discriminant validity.

In testing hypotheses, we set the criterion for statistical significance at $p < .05$, except where noted. Regarding the assessment of practical

Table 2
Years Since Participants' Designated Events

Years lapsed	Near-death experience (<i>n</i> = 37)	Close brush with death (<i>n</i> = 20)	Life-changing event (<i>n</i> = 46)	Total
1-5 years	4 (11%)	5 (25%)	11 (24%)	20 (19%)
6-10 years	5 (14%)	4 (20%)	10 (22%)	19 (18%)
11-15 years	2 (5%)	0 (0%)	4 (9%)	6 (6%)
16-20 years	1 (3%)	1 (5%)	3 (7%)	5 (5%)
20 or more years	25 (68%)	10 (50%)	18 (39%)	53 (51%)

significance, in the absence of norms for effect size in NDE research, we adopted Cohen's (1988) cautious suggestion for η^2 minimum thresholds of .01 for small effect, .10 for medium effect, and .25 for large effect. Effect size is the percent of variance accounted for by the independent variable; for example, eta squared of .25 means that 25% of the variance in EME is accounted for by group.

Electromagnetic effects in the last year. We had hypothesized that on the EMEQ-L, NDErs, nonNDErs who reported a close brush with death, and people who reportedly had not been close to death would not differ in either their total scores or subscale scores. The data met the assumptions underlying use of ANOVA (Hinkle, Wiersma, & Jurs, 2003) for randomness/independence and normal distribution, as well as for homogeneity of error variance in five of the six subscales ($p \geq .510$) but not the Watch subscale ($p < .001$).

The data supported rejection of the null hypothesis of no difference among the three groups for all six dependent variables. As Table 3 shows, John Tukey's Honestly Significant Differences (HSD) Post Hoc Test (Maxwell & Delaney, 2004) revealed statistically significant differences between the NDE group and both the comparison groups of nonNDErs who did not report NDEs and those who reportedly had not been close to death, but no significant difference between the two comparison groups. Practical significance ranged from $\eta^2 = .22$ to $\eta^2 = .40$, indicating upper medium to large effects. Thus, although nonNDErs who reported a close brush with death and people who reportedly had not been close to death did not differ in reported frequency of electrical device malfunctions during the last year before the study, NDErs reported significantly more malfunctions than did both of those comparison groups.

Electromagnetic effects before and after the designated event. We had hypothesized that with reference to participants' designated events that occurred at least one year before participation in the study – an NDE, a close brush with death without an NDE, or a reportedly most life-changing event – there would be no difference between the three groups regarding changes in their total EMEQ scores or subscale scores with respect to electromagnetic effects they reported retrospectively before the event (EMEQ-B) versus those they reported during the last (most recent) year (EMEQ-L). Because three of the four devices came into widespread use after some participants' designated events, they had no basis to report electromagnetic effects with those

Table 3
Analysis of Variance for the EMEQ-L

	<i>F</i>	<i>df</i>	<i>p</i>	η^2	NDErs*		CBrs**		LCErs***	
					<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Total scale	33.13	2, 102	< .001	.40	3.38	.81	2.32	.80	2.05	.69
Tukey's post-hoc tests: NDE > life-changing event ($p < .001$) NDE > close brush with death ($p < .001$) close brush with death > life-changing event ($p = .385$)										
Subscales:										
Light	23.31	2, 102	< .001	.32	3.52	1.09	2.43	.94	2.00	.98
Tukey's post-hoc tests: NDE > life-changing event ($p < .001$) NDE > close brush with death ($p < .001$) close brush with death > life-changing event ($p = .265$)										
Watch	25.09	2, 102	< .001	.33	3.62	1.20	2.41	1.25	1.98	.84
Tukey's post-hoc tests: NDE > life-changing event ($p < .001$) NDE > close brush with death ($p < .001$) close brush with death > life-changing event ($p = .284$)										
Computer	13.99	2, 102	< .001	.22	2.91	.76	2.29	.79	2.04	.73
Tukey's post-hoc tests: NDE > life-changing event ($p < .001$) NDE > close brush with death ($p < .010$) close brush with death > life-changing event ($p = .449$)										
Cell phone	17.27	2, 102	< .001	.26	3.53	1.02	2.40	1.10	2.28	.97
Tukey's post-hoc tests: NDE > life-changing event ($p < .001$) NDE > close brush with death ($p < .010$) close brush with death > life-changing event ($p = .890$)										
Emotion	26.02	2, 102	< .001	.34	3.39	1.09	1.90	.91	1.93	.93
Tukey's post-hoc tests: NDE > life-changing event ($p < .001$) NDE > close brush with death ($p < .001$) close brush with death > life-changing event ($p = .991$)										

Bold font indicates significance at $p < .05$.

*NDErs = near-death experiencers.

**CBrs = participants reporting close brush with death without NDE.

***LCErs = participants reporting no close brush with death and using a most life-changing event as a past referent.

Table 4
Analysis of Variance for EMEQ-L Gain Scores

	<i>F</i>	<i>df</i>	<i>p</i>	η^2	NDErs*		CBrS**		LCErs***	
					<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Total scale	5.19	2, 101	.007	.09	.70	1.05	.16	.27	.08	.94
Post-hoc tests: NDE > life-changing event ($p < .007$)										
NDE > close brush with death ($p < .085$)										
close brush with death > life-changing event ($p = .939$)										
Subscales:										
Light	6.67	2, 101	.002	.12	.86	1.19	.12	.50	.01	1.19
Post-hoc tests: NDE > life-changing event ($p < .002$)										
NDE > close brush with death ($p < .040$)										
close brush with death > life-changing event ($p = .936$)										
Watch	3.60	2, 70	.033	.10	1.01	1.54	.27	.45	.16	1.20
Computer	.38	2, 51	.683	.02	.37	1.06	.00	.59	.19	1.06
Cell phone	5.98	2, 40	.006	.24	1.64	1.36	-.30	.73	.27	1.48
Post-hoc tests: NDE > life-changing event ($p < .023$)										
NDE > close brush with death ($p < .007$)										
close brush with death > life-changing event ($p = .537$)										
Emotion	6.73	2, 101	.002	.12	.78	1.28	-.18	.41	-.07	1.30
Post-hoc tests: NDE > life-changing event ($p < .004$)										
NDE > close brush with death ($p < .011$)										
close brush with death > life-changing event ($p = .937$)										

Bold font indicates significance at $p < .01$.

*NDErs = near-death experiencers.

**CBrS = participants reporting close brush with death without NDE.

***LCErs = participants reporting no close brush with death and using a most life-changing event as a past referent.

devices prior to their events. Thus, in testing this hypothesis, we included data for only those participants whose designated events occurred after the following years: electronic watches, 1972; computers, 1984; and cell phones, 1994.

To assess group differences in change scores, we used the gain score approach (Maxwell & Delaney, 2004). The gain scores on all subscales except for the Watch subscale met the normality assumption.

To test the significance of difference in gain scores between the three groups, we calculated analyses of variance (ANOVA); results

appear in Table 4. The homogeneity assumption of the error variance was rejected on all subscales ($p \leq .007$) except the Computer subscale ($p = .084$) and the Cell Phones subscale ($p = .072$). As recommended by Gene Glass, Percy Peckham, and James Sanders (1972), we changed the alpha level to .01 to reduce the risk of Type I false positive error.

Four gain scores turned out to be statistically significant: the entire scale and the Light, Cell Phone, and Emotion subscales. Therefore, we rejected the null hypothesis for these four variables but retained it for the Watch and Computer subscales. Tukey's HSD Post Hoc Test showed that: (a) the NDE group gained more electromagnetic effects on the Light and Emotion subscales and entire scale than did the people who had not come close to death; (b) the NDE group gained more on the Cell Phone subscale than did the nonNDEs who had come close to death; and (c) the two comparison groups did not differ in change scores either on the entire scale or any subscale. For statistically significant gain scores, practical significance ranged from $\eta^2 = .09$ to $\eta^2 = .24$, indicating effects ranging from the upper end of small to the upper end of medium.

Thus, in comparing increases in electromagnetic effects before the designated event versus during the last (most recent) year, whether with regard to the difference overall, specific devices, or the effect of emotional arousal on electromagnetic effects, nonNDEs who reported a close brush with death and people who reportedly had not been close to death consistently did not differ statistically. However, regarding electromagnetic effects overall, electromagnetic effects with lights, and the effect of emotional arousal on electromagnetic effects, NDEs' reported increases were significantly greater than those of people who had not been close to death, but not significantly greater than those of nonNDEs who reported a close brush with death. Regarding cell phones, NDEs' reported increases in electromagnetic effects were significantly greater than those of nonNDEs who reported a close brush with death, but not significantly greater than those of people who had not been close to death. Regarding watches and computers, NDEs' reported increases in electromagnetic effects were not significantly greater than those of either comparison group.

Electromagnetic effects and experience during close brush with death. We had hypothesized that among the combined group of NDEs and nonNDEs who reported a close brush with death, there would be no relationship between the incidence of reported electro-

magnetic effects during the last year, as measured by total EMEQ-L scores, and the reported depth of subjective experience during a close brush with death, as measured by NDE Scale scores. A bivariate Pearson product-moment correlation revealed a significant positive relationship between total EMEQ-L scores and total NDE Scale scores for participants who reported having come close to death ($r = .595, p < .001$). Thus, we rejected this null hypothesis. Among all participants who had experienced a close brush with death, those who reported the most electromagnetic effects overall tended also to report deeper NDEs, and those who reported the least electromagnetic effects tended also to report an absence of NDEs.

Further analysis of the correlation of total EMEQ-L scores with each subscale of the NDE Scale also revealed significant positive correlations between the EMEQ-L and the cognitive component ($r = .536, p < .001$), affective component ($r = .577, p < .001$), paranormal component ($r = .552, p < .001$), and transcendental component ($r = .453, p < .001$). Thus, participants who reported the most electromagnetic effects during the last (most recent) year tended also to report deeper cognitive, affective, paranormal, and transcendental components of their NDEs, and those who reported the least electromagnetic effects tended also to report an absence of each component in their subjective experiences during their close brushes with death.

Anecdotal data. The EMEQ ended with five open-ended questions about participants' experiences with electromagnetic devices. We asked participants to state how often they had experienced problems with each of the devices (lights, watches, computers, and cell phones) in the past year. We also asked them to state additional comments about their experiences with electromagnetic devices.

Overall, 70% of NDErs reported at least one electromagnetic effect during the year prior to participation in the study, compared to only 20% of nonNDErs who reported a close brush with death and 11% of people who had not been close to death. Depending on the device, the range of electromagnetic effects was 68–70% for NDErs, compared to 10–20% for nonNDErs who reported a close brush with death and 0–11% for people who had not been close to death. In other words, only 30% of NDErs reported no problems with electromagnetic devices, compared to 80% of nonNDErs who reported a close brush with death and 89% of people who had not been close to death. Conversely, NDErs' reports of electromagnetic effects "all the time" during the last year ranged from 16–57%, depending on the

device, whereas the comparison groups' reports ranged from 0–20%. In no case – overall or regarding any individual device – did the two comparison groups report more electromagnetic effects than did the NDErs.

NDErs provided the following additional information. Two NDErs (5%) indicated noticing a difference in types of lights involved in electromagnetic problems. Five NDErs (14%) expressed uncertainty about the source of their problems with cell phones and considered poor service as a possible explanation; and two NDErs (5%) expressed uncertainty about the source of their problems with computers.

Some NDErs reported noticing a relationship between their electromagnetic effects and their physical and emotional states. Examples included increased effects while tired, physically ill, stressed, and even being happier. On the other hand, five NDErs (14%) reported having positive effects on computers and other electromagnetic devices.

Some NDErs also reported problems with electromagnetic devices besides those the EMEQ addressed, including radio, satellite radio, television, videocassette recorder, intercom, vacuum cleaner, fax machine, toaster, airplane, and car battery. In addition, one NDEr (3%) reported sensitivity to other people's negative energy.

One NDEr (3%) reported a decrease in problems with watches and computers, and two (5%) reported a decrease in problems with lights, over time since their NDEs. No NDEr reported an increase in electromagnetic problems over time.

Discussion

Findings of Main Analyses

Our results replicated Ring's (1992) finding that NDErs report significantly more electromagnetic effects than do people who have not had an NDE. Whereas Ring's comparison group was nonNDErs interested in NDEs, ours were nonNDErs who had come close to death and people who had not come close to death and used their most life-changing event as a past reference point. Combining our results, it appears that neither an interest in NDEs, nor one's identified most life-changing event, nor even actually coming close to death without an NDE, is associated with significantly increased reports of electromagnetic effects, but, rather, it is specifically a reported

memory of an NDE. Whether people who have experiences apparently equivalent to NDEs but outside the context of a close brush with death report electromagnetic effects to the same extent as do NDErs remains a question for future research.

Our second finding showed that on all devices combined, as well as each separate device and the effect of emotion on electromagnetic effects, nonNDErs who reported a close brush with death and people who had not been close to death were similar in reporting no significant increase in electromagnetic effects since their respective experiences. Our findings regarding NDErs were equivocal, with NDErs showing a significantly greater change in comparison to the other two groups in some cases but not others.

Regarding this latter finding, it is noteworthy that, in every case, NDErs reported more (though not always significantly more) electromagnetic effects in the last year compared to before their NDEs than did either of the other two groups in relation to their designated events. The reason that the difference did not always reach significance may have been sample size and other confounding factors. Regarding sample size, because digital watches, cell phones, and computers have come into existence only very recently, only participants whose designated events occurred fairly recently could be included in the comparison, and statistical significance is more difficult to achieve with a smaller sample. The fact that every finding of statistical significance was matched by a medium level of practical significance strengthens the likelihood of a greater relationship between increased electromagnetic effects and NDEs than other designated events without an NDE, whether or not those events include a close brush with death. Thus, all factors considered, the findings of this study provide some, but not unequivocal, support for the idea that an increase in electromagnetic effects is related specifically to an NDE.

Our third finding indicates that among people who come close to death, those who report no NDE or very few NDE features are later likely to report no or fewer electromagnetic effects, and among those reporting NDEs, the deeper the NDE, the more electromagnetic effects one is likely to report. Among our sample, this likelihood was associated with each aspect of an NDE: cognitive, affective, paranormal, or transcendental.

NDErs had previously reported perceived changes in the functioning of their brains and entire nervous systems, as well as a decreased

need for sleep, after their NDEs (Ring, 1992; Ring & Valarino, 2000). Ring and other near-death researchers (Bonenfant, 2004; Greyson, 1993; Jourdan, 1994; Kason, 1994) had speculated that electromagnetic changes might reflect an energy shift or transformation that occurs during NDEs. If this were the case, deeper NDEs might be expected to be associated with greater energetic changes, including electromagnetic effects. However, until now, no researcher had studied the relationship between the depth of an NDE and reported incidence of electromagnetic effects. According to the findings in this study, indeed, those who reported memories of deeper NDEs also reported more post-NDE electromagnetic effects. This finding provides support for NDErs' perceptions of altered nervous system functioning and to near-death researchers' speculations of a relationship between those alterations and NDEs.

Biophysicists have extensively studied the electromagnetic properties of living organisms. Robert Becker and Gary Selden (1985), for example, produced anesthetic effects on salamanders by running electromagnetic current through their brains, suggesting a relationship between electromagnetic currents, shifts in brain waves, and body awareness. However, the mysteries of electromagnetism have yet to be solved (Becker & Selden, 1985). The human body's nervous system functioning involves electrical impulses. In addition, an electric field forms around any electric charge, and any flow of electrons sets up a combined electric and magnetic field around the current. Electromagnetic changes are a result of altering the current's field. Considering this definition of electromagnetic changes, if running electromagnetic current through the brain produces anesthetic effects on salamanders, and if the same electromagnetic laws apply to a salamander's body and the human body, then a relationship may exist between consciousness and the body's electromagnetic properties. Moreover, considering the last findings of this study on relationship between reported depth of NDEs and reported electromagnetic aftereffects of NDEs, an electromagnetic shift might occur during an NDE. The findings of this study provide qualified support that clearly justifies researchers to pursue further investigation.

Anecdotal Data and Additional Analyses

In this section, we will discuss anecdotal findings, their convergence with and divergence from quantitative findings in this study and in

the previous literature, and additional analyses. We collected anecdotal findings from participants' responses to open-ended questions at the end of the EMEQ-L and EMEQ-B regarding their frequency of problems with specific electromagnetic devices.

In response to open-ended questions about electromagnetic effects over the last year, NDErs reported a noticeably higher range, both overall and in the case of each device, than did the two comparison groups. These findings support the quantitative results of this study. They also support previous literature on anecdotes of NDErs' electromagnetic effects (Atwater, 1994; Bonenfant, 2005; Ring, 1992; Ring & Valarino, 2000).

In their anecdotal responses, some participants (8% of NDErs, 10% of nonNDErs who reported a close brush with death, and 4% of people who reportedly had not been close to death) expressed doubt as to the origin of their electromagnetic effects, especially regarding cell phone use, in which electromagnetic effects might be the result of the poor quality of the device and/or service. Similarity between the three groups' anecdotal responses about the origin of their electromagnetic effects seems to confirm the assumption of equivalence, but future researchers would still be safest to assess the dimensions of quality of service and user expertise more explicitly. These comments raised our awareness of an assumption with which we undertook this study: that several factors would be equal or equivalent between the three groups. These factors included the quality of products they use, the quality of cell phone service such as the frequency with which a call is dropped due to cell phone tower overload (Brigham Young University News, 2004), the frequency and duration with which participants used the various devices, and the level of participants' expertise in using computers. The three groups may have differed in one or more of these factors of product/service quality, frequency of use, and expertise in use.

Specifically, NDErs may have reported more electromagnetic effects simply because they used less reliable devices than the other two groups; because they used electromagnetic devices more than the other two groups (that is, greater use would lead to greater likelihood of problems); and/or because, in the case of computers, they had less expertise than did the participants in the other two groups (a factor related to frequency of operator problems), rather than because they were more prone to electromagnetic effects following their NDEs. We consider this possibility unlikely. However, to determine clearly the equivalency of these factors, future researchers should ask partici-

pants about the brand of, type of, frequency with which they use, and level of experience/competence in their use of devices, especially cell phones and computers. Of course, these responses would be subject to the same limitations as all self-reported data.

Some NDErs reported noticing a relationship between their physical and emotional states and their electromagnetic effects. For instance, they mentioned more problems with electromagnetic devices when they were tired, physically ill, stressed, and even happier than usual. This information also supports the quantitative data about effects of emotional state on the functioning of electromagnetic devices. The latter reported emotion, happier than usual, suggests it is not a specific emotion but rather emotional arousal in general – a condition often associated with a subjective sense of intensified energy – that is associated with increased electromagnetic effects. Although our scale questions in this regard approached the topic in this way (for example, “If I was emotionally aroused, there was an increase in the malfunction of electromagnetic devices such as lights, watches, computers, and cell phones in my presence”), the question of whether certain emotions and/or levels of emotional arousal are associated with varying levels of electromagnetic effects remains for future investigation.

Some NDErs reported having a positive effect on broken electromagnetic devices but did not relate that effect with their emotional state at the time. This “healing” effect on electronic devices is reminiscent of previous reports of NDErs’ increased healing effects on people. Knittweis (1977), in particular, suggested that biological healing powers and the ability to affect electromagnetic devices are related. The ability to have a reparative effect on electromagnetic devices, as well as a possible relationship between that reparative effect and biological healing ability and the possible relationship between that effect and emotional state, are all topics worthy of further investigation.

Another point that emerged from the anecdotal data involved changes in electromagnetic effects in the years following an NDE. Although we did not specifically ask participants to address this topic, a few did so of their own accord. Unlike NDErs in Ring’s (1992) study who reported an increase in electrical aftereffects over time, no NDErs in this study mentioned an increase. Instead, 3 percent reported a decrease in problems with watches and computers, and 5 percent reported a decrease in problems with lights over time since their NDEs. This question of how electromagnetic effects might change in

the long-term aftermath of an NDE clearly deserves future investigators' attention.

Upon first studying the quantitative data, we noticed what appeared to be a difference in electromagnetic effects *before* the designated event, as measured by the EMEQ-B, so we ran an ANOVA to test the significance of difference. Indeed, we found that NDErs retrospectively reported more electromagnetic effects even before their NDEs ($M = 2.68$, $SD = .73$) than did either nonNDErs who reported a close brush with death ($M = 2.16$, $SD = .69$) or people who had not been close to death ($M = 1.95$, $SD = .70$). Though the difference was not significant between the latter two groups, the differences were significant between NDErs and nonNDErs who reported a close brush with death ($p = .025$) and between NDErs and people who had not been close to death ($p < .001$). Wondering what the relationship might be between this finding and the nature of experiences respondents had had during a close brush with death, we took a step further and ran a correlation between the EMEQ-B and NDE Scale scores among the combined group of NDErs and nonNDErs who reported a close brush with death. Indeed, we found that the greater the retrospectively reported electromagnetic effects *before* the close brush with death, the reportedly deeper an NDE overall ($r = .361$, $p = .006$) and its affective ($r = .387$, $p = .003$) and transcendental ($r = .428$, $p = .001$), but not cognitive ($r = .226$, $p = .091$) or paranormal ($r = .215$, $p = .108$), components *during* a close brush with death.

Several possible dynamics might be at work regarding this finding. First, as previously discussed, NDErs might, as a group, exaggerate their reports of phenomena such as NDEs and electromagnetic effects. However, research comparing NDErs' and nonNDErs' mental health and most personality characteristics has failed to yield differences (Greyson, 2000). Nevertheless, the possibility remains that this particular study may have attracted an unrepresentative group of NDErs prone to exaggeration. We think this explanation unlikely, as we will discuss below.

Two other possible dynamics may be at work. As a result of longitudinal research with couples, Kim Buehlman, John Gottman, and Lynn Katz (1992) found that couples who became distressed later in their relationships unknowingly reconstructed their earlier relationships as more distressed than they actually reported or evidenced it to be at the earlier time. Similarly, NDErs who have been plagued with electromagnetic effects since their NDEs may unknowingly perceive and report their pre-NDE electromagnetic effects to be more

frequent than they actually were at the time. Alternatively, it may be that the more prone to electromagnetic effects a person is to begin with, if the person has a close brush with death, the more likely the person is to have an NDE and the deeper that NDE is likely to be.

This question of causal factors in the dynamics of NDEs and their aftereffects is an important one for future investigators to clarify. If the "reconstruction" hypothesis is supported, then electromagnetic effects actually are *not* greater prior to the NDE, indicating that something about the NDE itself causes the person to become more prone to electromagnetic effects. Conversely, if the "preexisting sensitivity" hypothesis is supported, then some underlying factor may be causing or contributing to all the observed phenomena: the pre-NDE electromagnetic effects, the NDE and its depth during the close brush with death, and the even greater post-NDE electromagnetic effects. In any case, only longitudinal research is likely to resolve this question, and in the case of NDEs, which are relatively rare and unpredictable, longitudinal research is challenging at best and requires substantial funding at least. An alternative might be to question NDErs' significant others whose memories of the NDErs' electromagnetic effects prior to their NDEs might (or might not) be more objective and might (or might not) support one or the other hypothesis.

Limitations of the Study

As with any research, this study involves certain limitations that may limit the validity or generalizability of the results. These factors include the self-selected nature of the participants, the self-reported nature of the data, the retrospective nature of the "before" data, the alpha levels used to test statistical significance, the exclusion of self-identified NDErs who did not meet the NDE Scale criterion and who scored similarly to self-identified nonNDErs, and the small sample size for subtest analysis of the hypothesis regarding change in electromagnetic effects before and after the designated events.

It is important to address the self-selected nature of the sample in this study. It is a possible source of two forms of bias. The surveys were made available to the public through organizations such as IANDS, as well as through physicians, university electronic bulk mail, and word of mouth. Individuals, then, participated in the survey based on personal choice. The sample that chose to participate may not be representative of the populations of which it is a part. In particular,

NDErs who are more willing to participate in research might also somehow be those who have disproportionately high electromagnetic effects. Although we have no reason to think that NDErs more willing to participate in research differ in their electromagnetic effects from those presumably less willing, the possibility remains.

In addition, announcements about the study made reference to the electromagnetic nature of the research, and some NDErs may have been informed of its nature by other participants. Therefore, a disproportionate number of NDErs who had had electromagnetic effects may have chosen to participate in the research, and a disproportionate number who had not may have chosen not to participate, a possibility that would have biased the sample and contributed unduly to the findings. The fact that 25 percent of Ring's (1992) sample reported electromagnetic effects and approximately 67 percent of our sample reported them strengthens this possibility. However, the facts that nearly one third of NDErs in our study reported no problems with electromagnetic devices and that a relationship existed in this sample between reported depth of NDE and frequency of electromagnetic effects suggest that a full and representative range of NDErs participated in the study. In addition, mention of the electromagnetic nature of the study would presumably also have attracted participants to the two comparison groups with higher electromagnetic effects, making the bias equivalent across groups. Together, these considerations indicate that differences in electromagnetic effects between the three groups probably were not the result of this form of self-selection bias. However, at this point this potential bias cannot be assessed and remains a possibility.

Another limitation is the retrospective nature of the "before" data. Quality of memory may deteriorate over time. However, at least in the case of NDErs, research indicates that memory of NDEs does not degrade over time (Greyson, 2007; van Lommel, van Wees, Meyers, & Elfferich, 2001).

Seven self-identified NDErs who did not meet the NDE Scale criterion of 7 or higher and who scored similar to self-identified nonNDErs who reported a close brush with death were eliminated from the NDE group and from the study. This phenomenon of individuals who recall an NDE but do not meet the assessment criterion represents a challenge for researchers (Greyson, 2005). Comparing the EMEQ scores of this category of participants to the scores of NDErs and of nonNDErs who reported a close brush with death, in order to determine

whether their scores most closely resemble those of the NDErs with whom they subjectively identified or those of the nonNDErs who reported a close brush with death with whom they objectively scored on the NDE Scale, presents an intriguing research possibility.

In the process of analysis, we realized that using data from participants who had their designated life-changing events before a device was in use by the general public did not make sense. As previously stated, our hypothesis regarding electromagnetic effects before and after the designated event required participants to have used the specified electromagnetic device before their designated events; therefore, we used only certain participants' data in this analysis. To establish a cutoff year for designated event, we added four years to the year the device became available for general public, and in the analysis we used only the data from participants whose designated event occurred after the cutoff year. The cutoff year for quartz watches was 1973 (Silva, 2007); for computers, 1985 (Boeree, n.d.); and for cell phones, 1995 (Keith, 2004). This process resulted in a smaller sample size that may have yielded a false negative finding of nonsignificance. Fortunately for future researchers, as lapsed time since cutoff years increases, and people continue to have NDEs, this population will increase, thereby increasing potential sample size and making any electromagnetic phenomena that do exist more detectable through statistical analysis.

As is the case with many other studies, factors such as those described in this section may limit the external validity of the findings, that is, the extent to which those findings can be generalized at large to NDErs, nonNDErs who reported a close brush with death, and people who had not been close to death. Except for the issue of small sample size in testing the hypothesis regarding electromagnetic effects before and after the designated event, we consider the other threats to validity possible but unlikely. Because of factors such as the reports of anecdotes in the previous literature and previous research on the personal and mental health characteristics of NDErs compared to nonNDErs, we believe it most likely that our research participants represented their respective populations fairly well and that the results of this study warrant generalization to the population at large.

Suggestions for Future Research

Included in our discussion above are some suggestions for future research. Following are a few other points on this topic.

In this study, we found it challenging to recruit nonNDErs who reported a close brush with death. In the process, it appeared to us that people's general anxiety about and/or denial of death seemed to make them unwilling or unable to acknowledge a close brush with death. Therefore, we learned to refer not to "a close brush with death" but rather to "any life-threatening experience." Even then, some nonNDErs who eventually recalled a life-threatening experience did so only after some conversation. We recommend that future researchers use the latter terminology to recruit nonNDErs who have come close to death. We also recommend that researchers be prepared to explore with people self-identified as never having been close to death whether those people actually might have survived some life-threatening experience.

Based on the finding in this study of a significant difference between electromagnetic effects of NDErs compared to nonNDErs both with and without a close brush with death, we recommend that future researchers hypothesize the nature of the energy NDErs appear to be emitting, identify appropriate instrumentation for measuring energy, and conduct research in which energy is directly measured. Specifically, a researcher could identify a specific number of participants in each group – people who had not been close to death, nonNDErs who reported a close brush with death, and deep NDErs – who are equivalent on imagery-related characteristics such as level of psychological absorption. Each would go to a facility where controlled measurement of the hypothesized energy could be made.

The protocol could involve a masked design, whereby participants would be coached not to discuss their NDE-related status and whereby neither the on-site research associate nor the technicians conducting the measurement would know participants' group assignment. During measurement, the participant would hear a recorded guided experience in which he or she would spend 3 minutes each in the following sequence of unaroused and aroused emotions: calm, frightened/anxious, calm, frustrated/angry, calm, excited/happy, calm. For the calm episodes, each participant could be guided to use one's own image of a "safest place." For the emotionally aroused conditions, the participant could be invited to think of a situation during the past year in which he or she felt the most intense target emotion. During these episodes, the recording would provide multisensory prompts to enhance emotional intensity, such as "Feel your [emotion] in your body; for these three minutes, seek to feel it as intensely as possible.

See and hear the images related to this situation that most strongly intensify your feeling. Think the thoughts that most intensify the feeling.”

Following the measurements, the energy emitted could be compared among the three groups. Based on the results of the study herein described, NDErs should show a higher baseline emission of energy compared to the other two groups and/or should show a proportionately higher emission during emotional arousal, and lower during emotional calm, compared to the other two groups.

Finally, we are indebted to P. M. H. Atwater for pointing out to us the irony of our using as an incentive for participation in this research MP-3 players, which are electromagnetic devices possibly likely to malfunction when NDErs use them. Obviously, we encourage future researchers to be more cognizant than we were and find a nonelectromagnetic incentive to encourage research participation, especially by NDErs.

Conclusion

The results of this study indicated that, among people who, at least a year before, had experienced a close brush with death or, in the absence of a close brush, used a most life-changing event as a past reference point, NDErs reported more problems with electromagnetic devices in the last year than did nonNDErs with or without a close brush with death. Findings were more equivocal but still generally supportive of the notion that the NDE marked the point at which NDErs' problems with electromagnetic devices increased. Moreover, the deeper an NDE, the greater were the problems with electromagnetic devices. Further research on electromagnetic effects promises to deepen human understanding of the energetic correlates of consciousness.

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