ELF-MF EXPOSURE, ACTUAL AND PERCEIVED, AND NON-SPECIFIC HEALTH SYMPTOMS AMONG EMFPLOYEES IN A LARGE OFFICE BUILDING IN TEL AVIV, ISRAEL

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History of EMF Research

1930's – Discovery of electrical interference with radio reception (Gill & Whitehead 1938).

1940's – Discovery of electromagnetic interference with electronic devices (Hunter 1949).

1950's – EMF effects on TV picture flickering (Fowler 1951).

1960's - First concerns about EMF effects on human health, incl. response reaction time (Friedman 1967).

1970's - First heath study among USSR utility workers (Korobkova 1972); first evidence of leukemia in children exposed to EMF (Werhemer & Leeper 1979).

1980's - Warnings about positive connections between EMF and health (WHO, 1987)

1990's - Reports on the increased risk of leukemia (Feychting, 1993); EMF exposure warnings to the governments (UNEP/WHO/IRPA 1993).

2000's - Classification of the EMF 50Hz exposure by IARC (2002) as a 2B risk factor (possibility carcinogenic); WHO recognizes electro-hypersensitivity (EHS) as a new syndrome (2004) associated with a functional impairment of exposure sensitive people to EMF); ICNIRP issued guidelines for limiting EMF exposure (ICNIRP 2010); symptoms (such as fatigue/tiredness, headache, concentration, memory, and thinking difficulty) are documented (Kato & Johansson (2012).

Case Study: Office Building in Tel Aviv

- 15 floors of offices located in the building since 1997; 700+ employees.
- 10-m distance from a 160 KWh power line.
- High EMF exposures in building's 2nd-10th floors, especially on the west side.

תל אביב-יפו

mynet המקומי שלי

עובדי משרד החינוך: אנו חשופים לקרינה מסוכנת

תכתובות בהולות, 22 עובדים שחלו בסרטן, משרדים שפונו וקירות שמוגנו בלוחות מתכת. עובדי מחוז תל אביב במשרד החינוך מודאגים מרמות הקרינה בבניין וחוששים לחייהם. חברת החשמל מנגד: קו המתח הגבוה לא גרם לתחלואה

מירב שלמה מלמד

פורסם: 25.01.12, 08:00

שתף

ישיבה רבת משתתפים התקיימה בשבוע שעבר במשרדו של רחמים לניאדו, מ"מ יו"ר הסתדרות עובדי המדינה. על הפרק: הקרינה בבניין מוסקוביץ' — שבו שוכנים משרדי עובדי משרד החינוך במחוז תל אביב. למחרת הדיון הסוער כתבה יוכי גמליאל נגר, יו"ר ועד עובדי המחוזות, מכתב סיכום פגישה ללניאדו. "למעלה משש שנים אנו מתריעים בפני הנהלת המשרד כי קיימת קרינה מסכנת חיים בבניין", כתבה.

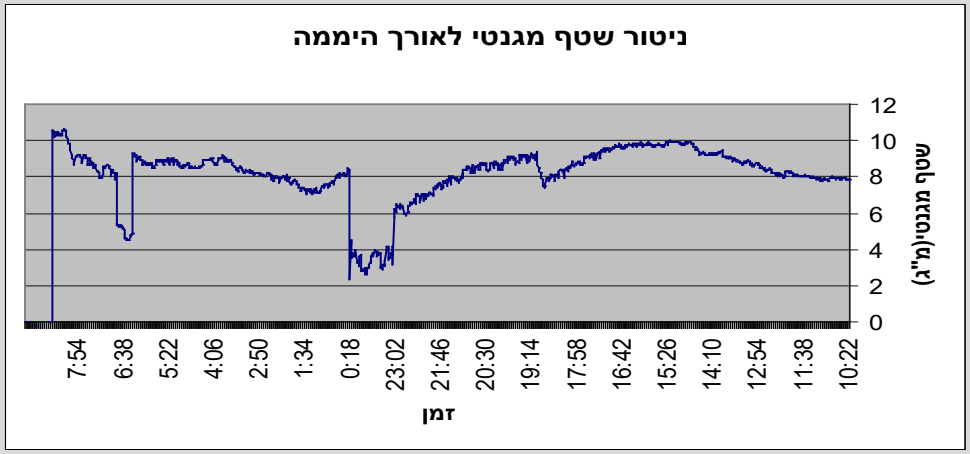
Study Goals:

- To estimate are differences between actual and perceived EMF exposures among the employees.

- To determine what affects QOL and health complains more - measured or perceived EMF exposures?

Methodology (I)

Actual EMF exposure (average exposure during the work hours) was measured by 24h monitoring at 745 points in 426 offices in the building



Perceived EMF exposure, QoL perceptions and health symptoms were recorded using a specially designed questionnaire, with 520 questionnaire collected and 487 valid questionnaires processed.

The association between actual (measured) and perceived EMF exposure (estimated via questionnaires) and their effects on the frequency of health complaints was investigated using statistical tools.

The EMF equipment and measurements:

Actual exposure was measured using a 3 dimensional (3D) isotropic sensor that gauges the vector component of magnetic field next to the sensor area.

Sensor specifications:

- SPECTRAN - NF-5035, (Aaronia, Germany)
- TM-192D (Tenmars electronics, Taiwan)
- Pre-Compliance EMC/EMI
- 50Hz broadband , True RMS Measurement Method
- 3D sensor, Dynamic range of 0.1–1000 mG
- Résolution 0.1 mG (0.01 µT)
- 1-3% accuracy data logger.

Measurement process

- Measurements were performed by a certified engineer licensed by the Israeli Ministry of Environmental Protection
- 40 measurement devices were used simultaneously.
- Each morning of the working week (Sun-Thr) the instruments were moved to a new location.
- The measurement devices were placed as close as possible to the work station of each employee, as far away as possible from electric appliances, such as radios, UPSs, electric transmission equipment, internal power lines, microwave ovens, speakers, air conditioners, refrigerators, monitors, video/audio devices and so forth, in order to avoid external MF effects else then the high voltage power line.
- Twenty-four hour recordings were made at each working place at time intervals of 1s.
- 24h measurements were recorded by the data logger and total exposures were evaluated for the duration of the working hours of each employee.

Research questionnaire

The questionnaire, used in the study, contained 75 questions divided into 6 sections on:

- Work place location (floor, office, desk #);
- Evolutions of perceived radiation (2 questions);
- General feeling and health symptoms (31 questions);
- Quality of life assessment (13 questions sourced from WHOQOL);
- Lifestyle and consumption (20 questions).
- Socioeconomic attributes (sex, age, education level, income etc.).

The respondent's answers were limited to a fixed set of responses: either yes/no or to a 1 to 10 Likert scale.

Dependent Variables: The Quality of Life (QoL) index and health symptoms variables.

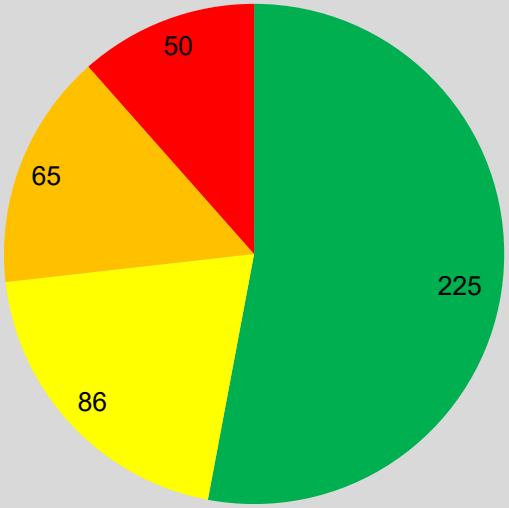
Explanatory variables: measured and perceived EMF exposure**,** seniority, personal attributes.

Results

Actual EMF Exposures

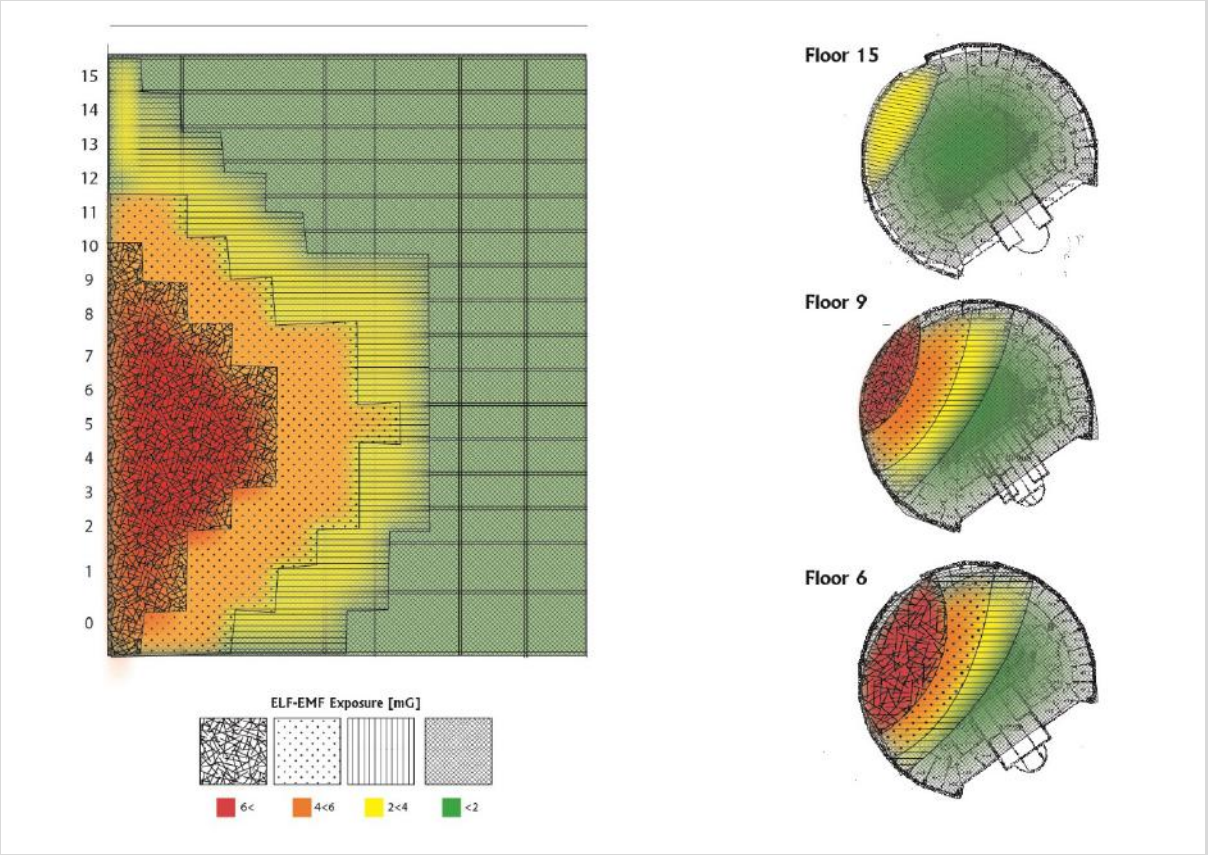
Out of total 745 measurements in 426 rooms:

225 rooms - 53% of employees with magnetic flux level bellow 2 mG
86 rooms - 20% of employees with magnetic flux level between 2 and 4 mG
65 rooms - 15% of employees with magnetic flux level between 4and 6mG
50 rooms - 12% of employees with magnetic flux level above 6mG



Actual EMF Exposure

- Offices with magnetic flux level below 2
- Offices with magnetic flux level between 2 and 4
- Offices with magnetic flux level between 4and 6mG
- Offices with magnetic flux level above 6mG



Measured and perceived radiation exposures

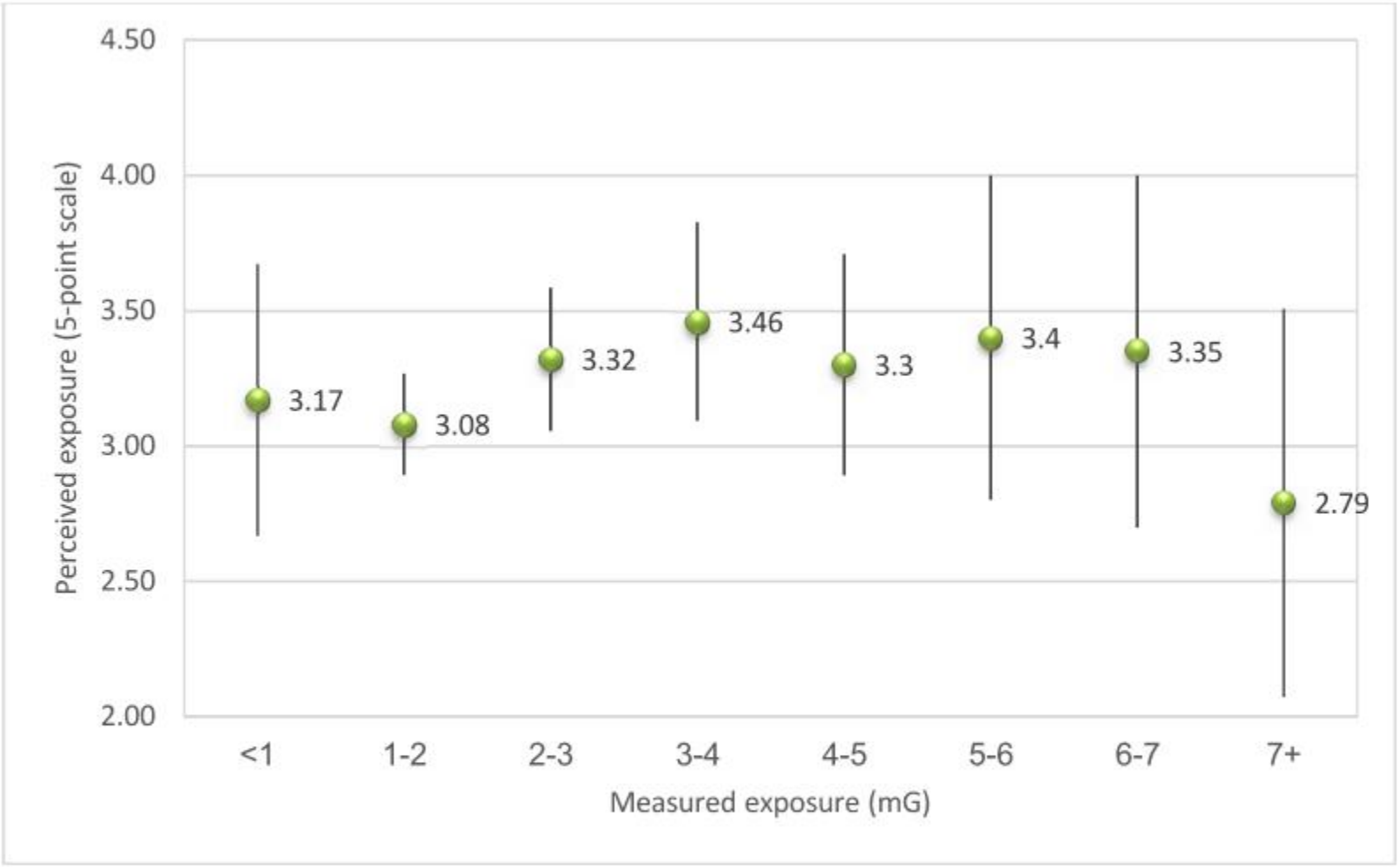
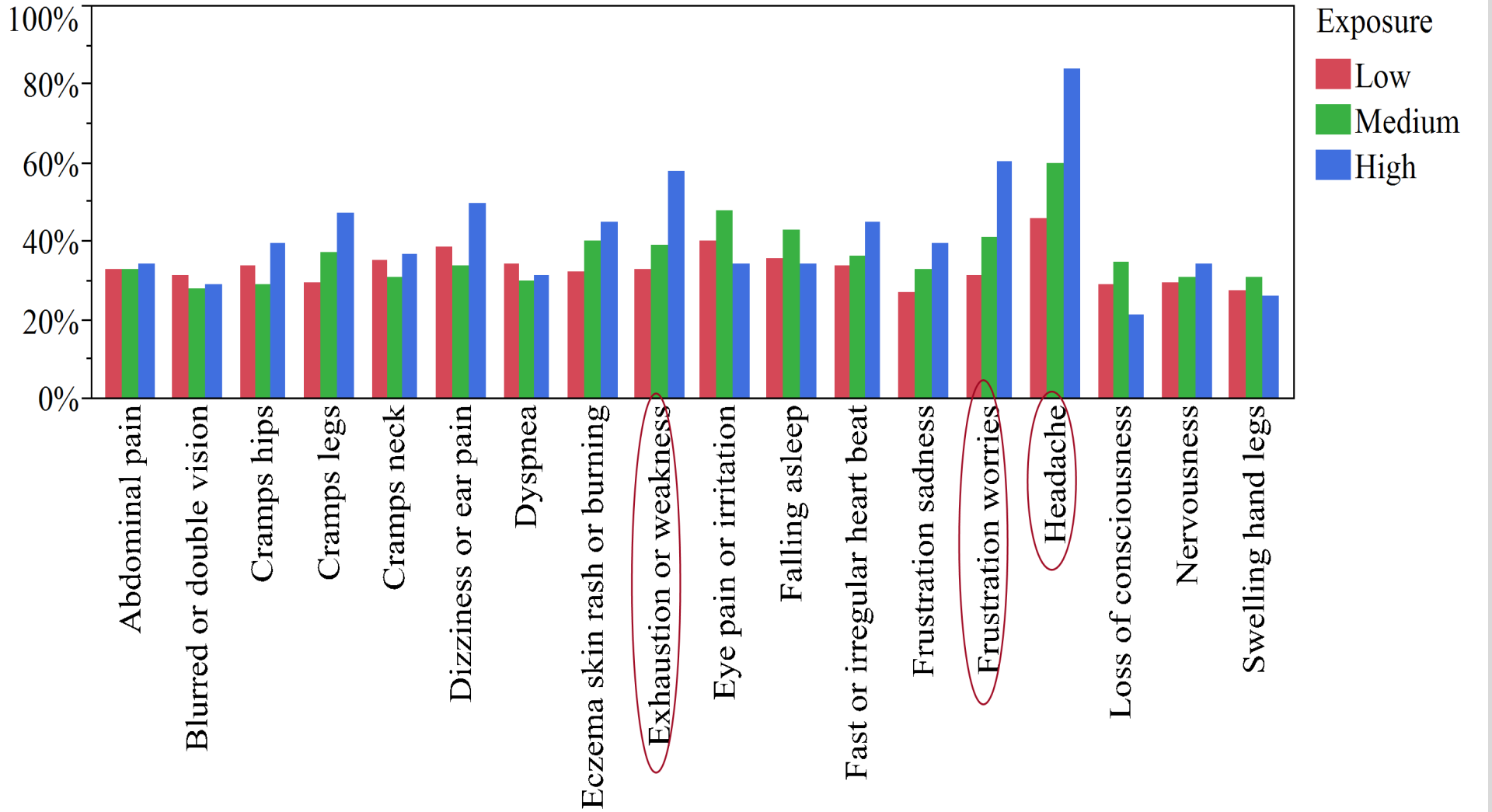


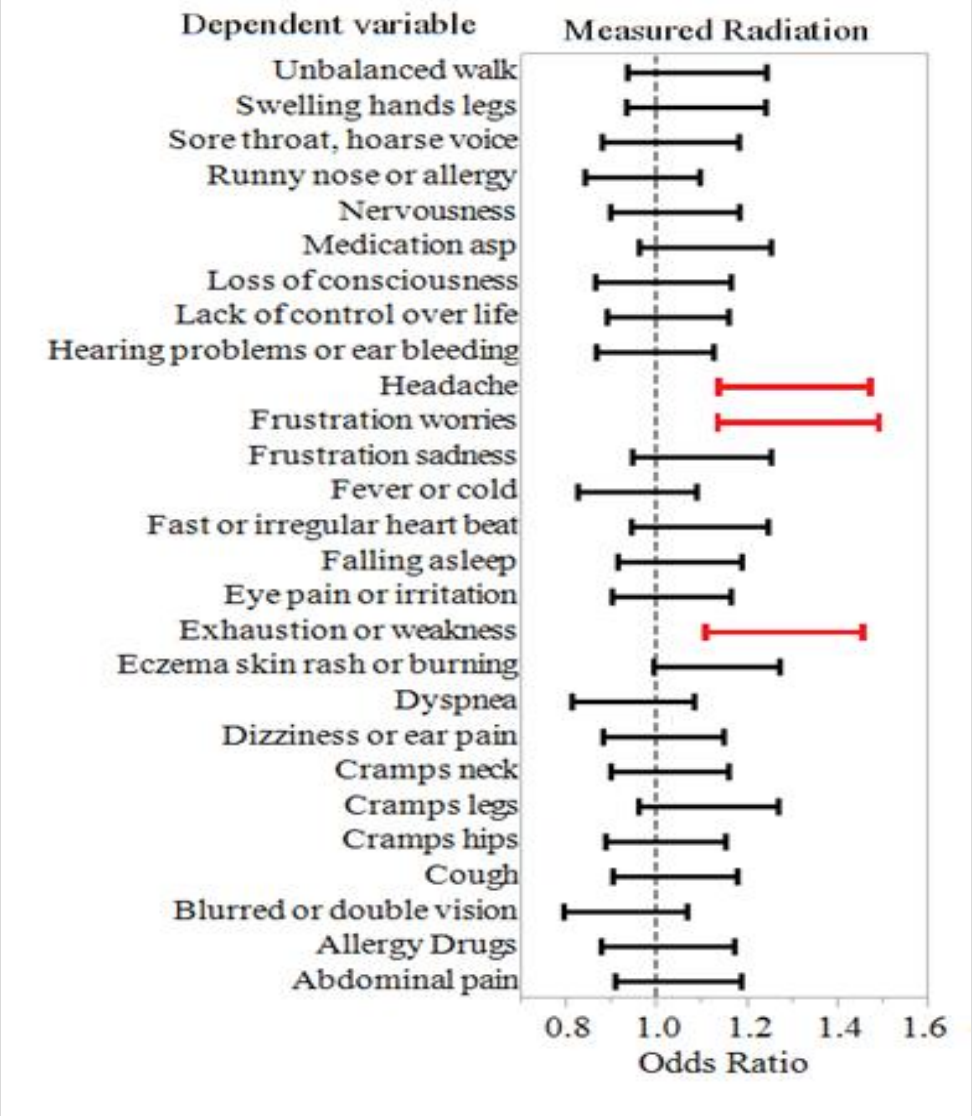
Figure 3: Average levels of perceived exposure and their 95% confidence intervals by different levels of measured exposure (mG)

Frequency of Symptoms by Actual Exposure levels



Association between health symptoms and measured radiation

Odds ratios (method: controlled logit regression)



The association between health symptoms and perceived radiation

Odds ratios (method: controlled logit regression)

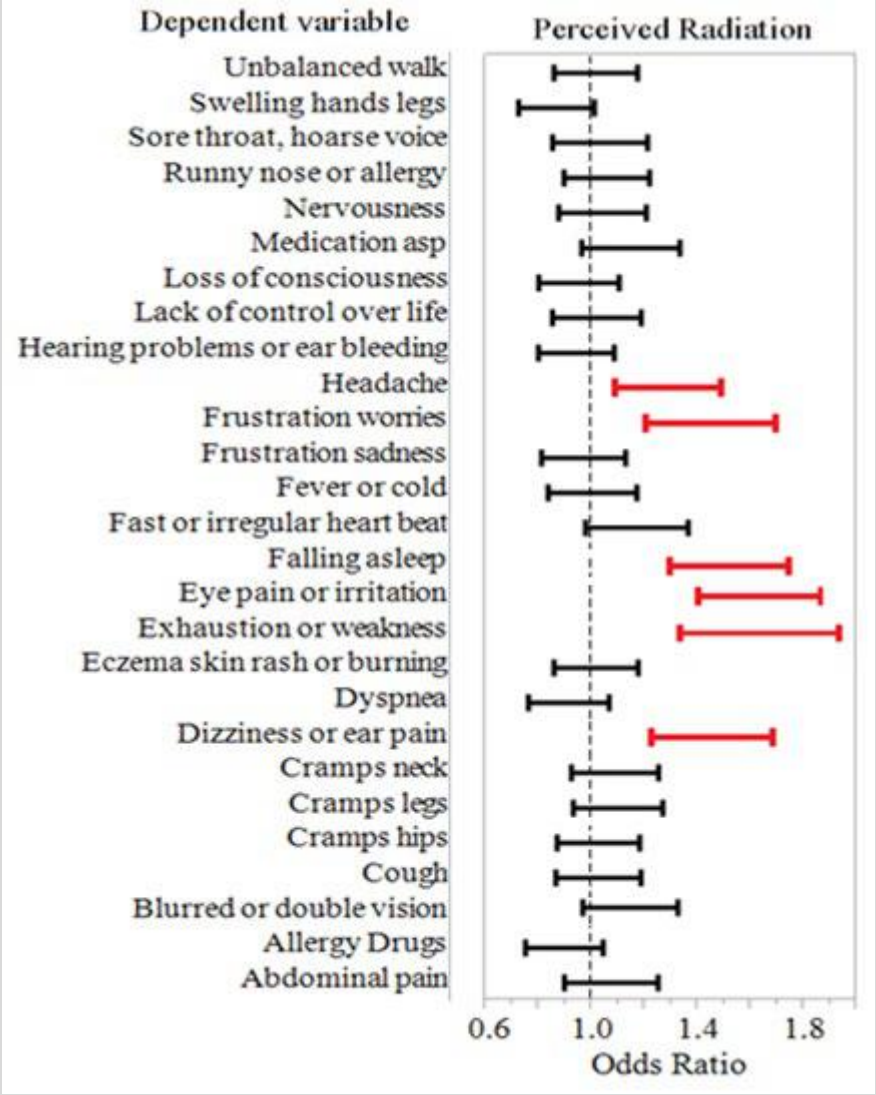


Table 3: Regression estimates of measured and perceived ELF-MF exposure variables for different health symptoms (method – multiple logistic regression)

Symptom	Measured exposure			Perceived exposure		
	OR	95% CI		OR	95% CI	
Abdominal pain	1.005	0.897	1.125	1.097	0.950	1.267
Blurred or double vision	0.956	0.849	1.076	1.108	0.958	1.280
Cough	1.069	0.956	1.194	0.950	0.823	1.095
Cramps – hips	1.024	0.916	1.145	1.007	0.875	1.159
Cramps – legs	1.111	0.994	1.241	1.074	0.931	1.239
Cramps – neck	1.012	0.906	1.130	1.067	0.928	1.226
Dizziness or ear pain	1.009	0.905	1.125	1.185*	1.032	1.361
Dyspnea	0.960	0.856	1.077	1.049	0.911	1.208
Eczema skin rash or burning	1.097	0.984	1.224	0.972	0.846	1.117
Exhaustion and weakness	1.201**	1.076	1.341	1.323**	1.146	1.528
Eye pain or irritation	1.002	0.900	1.116	1.381**	1.199	1.591
Fast or irregular heart beat	1.085	0.972	1.210	1.140	0.990	1.313
Feeling of lack of control over life	1.005	0.895	1.129	1.149	0.990	1.333
Fever or cold	0.972	0.865	1.092	1.019	0.883	1.176
Frustration–sadness	1.095	0.977	1.226	1.003	0.868	1.159
Frustration–worries	1.236**	1.107	1.380	1.318**	1.142	1.520
Headache	1.288**	1.149	1.443	1.288**	1.124	1.475
Hearing problems or ear bleeding	0.998	0.895	1.114	0.980	0.854	1.124
Loss of consciousness	0.996	0.885	1.120	1.053	0.909	1.220
Nervousness	1.028	0.918	1.152	1.130	0.977	1.306
Runny nose or allergy	0.944	0.844	1.056	0.957	0.834	1.099
Sleepiness	1.029	0.922	1.147	1.282**	1.114	1.476
Sore throat, hoarse voice	1.034	0.915	1.168	1.113	0.953	1.300
Swelling of hand and/or legs	1.045	0.931	1.173	0.943	0.814	1.093
Taking allergy drugs	1.032	0.920	1.159	0.887	0.767	1.026
Unbalanced walk	1.102	0.983	1.236	0.994	0.859	1.151

*$p<0.05$, **$p<0.01$.

Study summary

- Empirical studies link EMF exposure to several health dysfunctions. However, the relationship between EMF exposures, measured and perceived, and reported health symptoms have not been investigated to date in sufficient depth. This study attempts to bridge this gap, by studying health complains among the employees in a large office building, located near a major high voltage power line in the City of Tel Aviv in Israel.
- In this study, ELF-EMF measurements were performed in situ in all 15 floors of the building, using a 3D miniature sensor coil device. In addition, questionnaires were distributed among the employees, aimed to evaluate the prevalence of health and psychological complains. Parametric and non-parametric tests and multivariate logistic regressions were then used to quantify the relationship between actual and perceived EMF exposures, and health complains among the employees, controlling for duration of work in the building, total number of work-hours, age, gender, smoking, and other potential confounders and socio-demographic attributes.

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Main Findings

Results:

Feeling of weakness, headache, frustration and worries were found to be positively and significantly associated with both *measured* and *perceived* exposure ($p<0.01$). In addition, *perceived* ELF-MF exposure was found to be a significant predictor of eye pain and irritation (OR=1.4, 95% CI=1.2-1.6), sleepiness (OR=1.3, 95% CI=1.1-1.5), dizziness and ear pain (OR=1.2, 95% CI=1.0-1.4).

Conclusions:

This study is one of few studies which reveals that several health symptoms are associated with *both* measured and perceived ELF-MF exposures. Our conclusion is that working near a high voltage power line may produce both physiological and psychological effects and should be considered a public health concern.

תודות וברכות

- בורא עולם, הוריי ואשתי
פרופ' סטילאן
פרופ' פורטנוב
פרופ' חרדים
ד"ר נאמן, משה נצר, ד"ר פקר
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