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ORIGINAL ARTICLE

Prevalence and psychiatric comorbidity of self-reported electromagnetic field sensitivity in Taiwan: A population-based study

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Background/Purpose: Psychological factors have been implicated in the etiology of idiopathic environmental illness in many studies. Few studies have ever reported psychiatric morbidity among individuals with electromagnetic hypersensitivity. We aimed to estimate the prevalence and identify the associated factors of self-reported electromagnetic field sensitivity (SREMFS) in adults of Taiwan.

Methods: A total of 1251 adults selected from a nationwide Computer-Assisted Telephone Interviewing system received a telephone survey about the perception of risk from various environmental agents and their effects on health and well-being.

Results: The estimated prevalence of people with SREMFS was 13.3 % (95% confidence interval: 11.2–15.3). People aged >65 years were associated with a lower risk of reporting sensitivity to electromagnetic fields, whereas people with a very poor self-reported health status, those who were unable to work, and those who had psychiatric morbidity were associated with a higher risk of having SREMFS.

Conclusion: The prevalence of SREMFS in the general population of Taiwan is higher than that reported in western countries. People with psychiatric morbidity are more likely to report sensitivity to electromagnetic fields. The cross-sectional design precludes the causal inference of all identified correlates and electromagnetic field sensitivity.

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Sensitivity of humans to environmental electromagnetic fields (EMFs) has been reported for more than 20 years. Earlier studies described clinical manifestations of skin symptoms in workers using video display units in the 1980s.^{1–4} In later studies, more diverse symptoms, which include neurasthenic symptoms (dizziness, fatigue, headache, sleep disturbance, difficulties in concentrating), ocular, gastrointestinal, respiratory, and even pain symptoms, were reported by people who allege sensitivity to various sources of EMFs.^{5,6} The ill health of people with neurovegetative symptoms can lead to an inability to work and to social withdrawal due to an increase in avoidance behavior.⁵ Despite several definitions having been given for such diverse designations,^{5,7} there are no clear diagnostic criteria for this potential health problem, and no established diagnostic tests have been consistently used to demonstrate abnormal findings in these patients. Diagnosis is mainly dependent on subjects' self-reported symptoms and the ill health effects from environmental EMFs alleged by the patients.

Several published studies have reported that prevalence of electromagnetic hypersensitivity (EHS) ranges from 1.5% to 10% in western countries.^{6–12} The characteristics of people with EHS among the general population have remained ill-defined, mostly because of using different case definitions and recruitment methods. Female sex,^{6,13} age 60–69 years old⁶ or working age,¹³ born outside Nordic countries,⁶ race/ethnicity other than White, Black or Hispanic,¹⁴ immigrants,¹³ multiple chemical sensitivity reported by self or diagnosed by a doctor,¹⁴ low income,^{6,14} impaired physical and mental well-being,¹³ and unable to work¹⁴ or perform daily function¹³ have been identified as correlates of sensitivity to EMFs in previous population-based studies.

The literature has indicated the existence of an overlap between different environmental illnesses (EIs).^{6,14–16} Similar to other EIs, that is, multiple chemical sensitivity and amalgam-related sensitivity, no relationship between presence of EMFs and EHS has ever been robustly demonstrated.^{11,17} The term "idiopathic environmental intolerance (IEI) with attribution to EMF", or IEI-EMF, was thus proposed to replace EHS by the World Health Organization EHS Working Group.⁷ Psychological factors (such as mental distress, coping strategy, dysfunctional cognition, and personality) have been implicated in the etiology of EHS.^{18–25} Increased symptom scores of anxiety, depression, or somatization have been found among individuals with abnormal sensitivity to EMFs compared to normal controls.^{19,20,23–26} Compared with many studies investigating the relationship between mental illness and EI among individuals with multiple chemical sensitivity, few studies have ever reported psychiatric morbidity among individuals with EHS.^{21–23} Moreover, only one published study has ever reported impaired mental well-being among people with annoyance attributed to electrical equipment and smells in a population-based survey.¹³ Participants with EHS in previous studies were mostly sensitive individuals visiting occupational medicine clinics or subjects referred from public authorities or self-referred, and selection bias was inevitable in these studies.

The aims of the present study were to estimate the prevalence of self-reported electromagnetic field sensitivity (SREMFS) in the adult Taiwanese population, and to describe the characteristics of people with SREMFS and the associated psychiatric morbidity.

Materials and methods

Participants and procedure

This study was based on questions posed in a telephone survey about the perception of risk from various environmental agents, and their effects on health and well-being; it was conducted over 2 weeks during August 2007. Participants were adults selected from nationwide households registered in the database of the Computer-Assisted Telephone Interviewing system via two-stage, geographically stratified systematic sampling. Households were randomly selected from each of 25 geographical areas of Taiwan according to proportional population size. One respondent was selected randomly from eligible persons (>18 years old) according to age and sex per household.²⁷ In total, 10,800 telephone numbers were selected; of those, 5643 households could be reached, but only 1251 individuals completed the interview. The average time spent on each successful interview was 12 minutes and 34 seconds. The 95% confidence interval (CI) of sampling error for this survey was within 3% ($\pm 2.83\%$). Contact rate and cooperation rate, as defined by the American Association for Public Opinion Research,²⁸ was 52.3% and 32.5%, respectively.

In order to examine the consistency of the screening questionnaire for psychiatric morbidity conducted by telephone interview and self-administration, a pencil-and-paper questionnaire was mailed within 1 week of the telephone survey to a sub-sample of study participants who had agreed to participate in the reliability study.

Questionnaire

The interview consisted of questions regarding demographic variables, presence of catastrophic illness, self-reported health condition, and risk perception of various environmental agents, impairment of daily activities, and medical utilization. A group of chronic illnesses that are severe, irreversible, and often incur great medical cost are defined by the Health Insurance Bureau of Taiwan as catastrophic illnesses.²⁹ Patients with catastrophic illness might have their medical expenses waived at visits. Examples of chronic illness include all kinds of cancer; diseases of organ failure, for example, chronic renal diseases with dialysis, chronic lung diseases with artificial ventilation; some neurological and mental disorders, for example, dementia, schizophrenia, and affective disorders. Self-rated health status was rated using a five-point Likert scale. Risk perception of 13 kinds of environmental agents on health was rated using a three-point Likert scale; these environmental agents included outdoor air, indoor air, drinking water, noise, food, chemicals, waste, sunburn, the housing environment, cellular phones, electrical appliances, power lines, and base stations.

Three questions regarding EMFs and a five-item screening questionnaire for psychiatric morbidity (Brief Symptom Rating Scale-5, BSRS-5) were added into the 25-item questionnaire. EHS was defined as self-reporting of "allergic to or very sensitive to being near any EMF". Degree of allergy or sensitivity was rated on a four-point Likert scale, and the origins of the hypersensitivity from a list of predetermined

12 EMF sources were further investigated if the subject had a positive response to SREMFS.

The BSRS-5 comprises five items selected from the BSRS-50, which was originally modified from Derogatis' Symptom Check List-90-R.³⁰ The BSRS-50 was developed to measure 10 dimensions of psychiatric symptoms, that is, somatization, obsessive and compulsive disorder, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism, and additional symptoms in the Symptom Check List-90-R, and was demonstrated to be a satisfactory global measure and case-finding screening instrument for psychopathology in both psychiatric and non-psychiatric medical settings.³¹ The BSRS-5 contains five individual items that have the highest correlation with the respective symptom dimension in the BSRS-50, that is, anxiety, depression, hostility, interpersonal sensitivity and additional symptoms (sleep difficulties) in medically ill inpatients. Items of somatization, paranoia and psychoticism were excluded to prevent confounding effects of underlying physical disease and less-common occurrence of major psychotic disorders in the community. The respondents were asked how much discomfort each item had caused them over the past week, including during the current day, and to rate each item on a five-point Likert scale as follows: 0, not at all; 1, a little bit; 2, moderately; 3, quite a bit; and 4, extremely. Internal consistency coefficients and the test-retest reliability coefficient of the BSRS-5 were demonstrated to be good. At the cut-off score of 6, the BSRS-5 had a 76.3% accurate rate for classification of psychiatric cases, with a sensitivity of 78.9%, specificity of 74.3%, positive predictive value of 69.9%, and negative predictive value of 82.3% among various groups of subjects.³² The degree of agreement between the BSRS-5 interview form and the BSRS-5 paper form was moderate ($\kappa = 0.45$) among a subgroup of the survey sample ($n = 42$).

To understand the associated behavioral manifestations, we asked two questions regarding impairment of daily activities and occupational functioning, and one question regarding the frequency of medical visits in the past 6 months. Impairment in daily activities and occupational functioning were assessed using questions as follows. "In the past 6 months, have you had impairment of daily activities (e.g. reading, eating, walking, bathing, or talking to others) due to health-related reasons?" and "In the past 6 months, have you ever stopped working due to health-related reasons?" Days of impairment and not working were counted by self-report if they had a positive response to the preceding questions.

The study was approved by the Institutional Review Board of the College of Public Health, National Taiwan University.

Data analysis

Descriptive statistics for each study variable were generated to characterize individuals with SREMFS and the entire survey population, using χ^2 tests to compare categorical variables and Student's *t* test to compare nominal variables.

Sample weights adjusted for age, sex and education derived from the nationwide population at the end of 2007

were used to calculate estimates for the general population of Taiwan.³³ The Taylor series method was chosen as the variance estimation method for population-weighted point estimates in making all of the statistical comparisons. The weighted prevalence and its 95% CI of SREMFS were calculated using the survey command SVYMEAN of the software package STATA 10.0.³⁴ The strength of association between all variables and SREMFS was estimated from the odds ratio (OR) and the 95% CI using weighted logistic regression analyses by the survey command SVYLOGIT. Two-sided $p \leq 0.05$ was considered statistically significant.

Results

Among the 1251 adults who completed the interview, in 1197 cases, the data were complete for analysis. The study sample contained equal sex proportions, but more middle-aged and more highly educated participants as compared with the 2007 general population of Taiwan.³³

Among the 1197 participants, 170 persons reported hypersensitivity to EMFs, resulting in a crude prevalence of 14.2%. The three most commonly reported EMF sources among these hypersensitive people were base stations (22.4%), power lines (16.5%), and cellular phones (15.9%). The general characteristics and psychiatric comorbidity rates for people with SREMFS and for the survey population are shown in Table 1, from which it can be seen that a higher percentage of people with SREMFS reported poor perceived health, inability to work, impairment in daily activities, and psychiatric morbidity than those without SREMFS.

The weighted prevalence of SREMFS in terms of severity among the adult population of Taiwan is shown in Table 2. For those with SREMFS, the estimated prevalence was 13.3% (95% CI: 11.2–15.3). The prevalence of SREMFS in terms of severity, from extremely severe to mild, was 1.3% (95% CI: 0.6–2.0), 3.2% (95% CI: 2.1–4.3), 7.5% (95% CI: 6.0–9.1), and 1.2% (95% CI: 0.6–1.9), respectively.

The weighted percentages of various variables among individuals with SREMFS and the whole survey population are shown in Table 3. In addition to the four variables (poor perceived health status, inability to work, impairment in daily activities, and psychiatric morbidity) that were found to be significantly associated with a higher risk of SREMFS in the crude analyses, we also found that elderly people were significantly associated with a lower risk of reporting hypersensitivity to EMFs, in the estimated analyses. No statistically significant differences existed in sex, education, marital status, having catastrophic illness, or medical visits between individuals with SREMFS and those without SREMFS. The psychiatric comorbidity rate among people with SREMFS was 30.7% (95% CI: 23.6–38.9). A dose-response relationship was found to exist between prevalence of psychiatric morbidity and severity of SREMFS (Fig. 1).

When all the variables in the univariate analyses were included for multiple logistic regression analysis, age >65 years [odds ratio (OR): 0.34, 95% CI: 0.14–0.83], very poor self-reported health condition (OR: 4.94, 95% CI: 1.59–15.38), inability to work (OR: 2.15, 95% CI: 1.26–3.69), and psychiatric morbidity (OR: 2.55, 95% CI: 1.63–3.99)

Table 1 Crude data of individuals with self-reported electromagnetic field sensitivity and the entire survey population

Variables	SREMFS (<i>n</i> = 170)	Non-SREMF (<i>n</i> = 1027)	Survey population (<i>n</i> = 1197)
Sex			
Female	91 (53.3)	528 (51.4)	619 (51.7)
Male	79 (46.5)	499 (48.6)	578 (48.3)
Age group (yr)	43.1 ± 12.0	44.1 ± 14.8	43.9 ± 14.4
18–34	48 (28.2)	291 (28.3)	339 (28.3)
35–49	71 (41.8)	374 (36.4)	445 (37.2)
50–64	44 (25.9)	258 (25.1)	302 (25.2)
≥65	7 (4.1)	104 (10.1)	111 (9.3)
Education*			
Middle school and below	35 (20.7)	244 (23.8)	279 (23.3)
High school	52 (30.8)	286 (27.9)	338 (28.3)
College and above	82 (48.5)	496 (48.3)	578 (48.4)
Catastrophic illness	9 (5.3)	27 (2.6)	36 (3.0)
Perceived health [¶]			
Excellent	41 (24.1)	256 (24.9)	297 (24.8)
Good	61 (35.9)	389 (37.9)	450 (37.6)
Fair	37 (21.8)	269 (26.2)	306 (25.6)
Poor	22 (12.9)	105 (10.2)	127 (10.6)
Very poor	9 (5.3)	8 (0.8)	17 (1.4)
Employment status [¶]			
Employed	122 (71.8)	835 (81.3)	957 (79.9)
Not working	18 (10.5)	108 (10.5)	126 (10.6)
Unable to work	30 (17.6)	84 (8.2)	114 (9.5)
Days not working [†]	35.6 ± 53.5	24.1 ± 44.2	27.3 ± 47.0
Impairment in daily activities	43 (25.3)	150 (14.6)	193 (16.1)
Days of impairment [‡]	43.5 ± 62.6	34.8 ± 57.9	36.8 ± 58.9
Medical visits	92 (54.1)	577 (56.2)	669 (55.9)
Number of visits [§]	4.8 ± 4.5	5.3 ± 10.2	5.2 ± 9.6
Psychiatric morbidity [¶]	49 (28.8)	141 (13.7)	190 (15.9)

Data are expressed as *n* (%) or mean ± standard deviation.

^{||}*p* < 0.01.

[¶]*p* < 0.001 indicate comparison between individuals with SREMFS and those without.

SREMFS = self-reported electromagnetic field sensitivity.

* Data missing for one person with SREMFS and without SREMFS, respectively.

[†] For subjects with employment.

[‡] For subjects with impairment in daily activities.

[§] For subjects having medical visits.

Table 2 Weighted prevalence of SREMFS among the general population of Taiwan

	Estimated prevalence (95% CI)
SREMFS (<i>n</i> = 170)	13.3 (11.2–15.3)
Degree of severity	
Extremely severe (<i>n</i> = 16)	1.3 (0.6–2.0)
Severe (<i>n</i> = 41)	3.2 (2.1–4.3)
Moderate (<i>n</i> = 97)	7.5 (6.0–9.1)
Mild (<i>n</i> = 16)	1.2 (0.6–1.9)

CI = confidence interval; SREMFS = self-reported electromagnetic field sensitivity.

remained significantly associated with the presence of SREMFS (Table 4). We further restricted the analyses to people with SREMFS at the severe end, and found that only inability to work (OR: 2.34, 95% CI: 1.07–5.15) and psychiatric morbidity (OR: 5.29, 95% CI: 2.69–10.41) remained statistically significantly related to SREMFS after controlling for all other factors (data not shown).

Risk perceptions for EMF sources have been implicated as influencing the reporting of EMF-related symptoms.²⁶ The effects of perception of risk from base stations, power lines, and cellular phones were therefore included separately in the model. Among those studied, perception of risk from base stations (grouped into concerned or not concerned) was found to be the most strongly associated with SREMFS (OR: 4.43, 95% CI: 2.04–9.60). Age, a very poor self-reported health condition, inability to work, and psychiatric morbidity remained significantly associated with SREMFS after the incorporation of risk perception of

Table 3 Weighted percentages of various variables among individuals with self-reported electromagnetic field sensitivity and the whole survey population

Variables	% SREMFS (95% CI)	% Survey population (95% CI)
Sex		
Female	46.8 (38.8–54.9)	49.8 (46.7–53.0)
Male	53.2 (45.1–61.2)	50.2 (47.1–53.3)
Age group [‡] (yr)		
18–34	31.5 (24.3–39.7)	31.9 (29.0–34.9)
35–49	40.0 (32.3–48.2)	33.3 (30.5–36.2)
50–64	23.0 (17.1–30.1)	22.3 (19.9–24.9)
≥65	5.6 (2.6–11.7)	12.6 (10.4–15.1)
Education*		
Middle school and below	30.3 (22.8–39.1)	34.1 (31.0–37.3)
High school	32.4 (25.2–40.5)	30.0 (27.3–33.0)
College and above	37.3 (30.2–45.0)	35.9 (33.2–38.7)
Marital status [†]		
Single	31.3 (24.2–39.5)	35.7 (32.7–38.8)
Married	68.7 (60.6–75.8)	64.3 (61.3–67.3)
Catastrophic illness	6.0 (3.0–11.5)	3.3 (2.3–4.76)
Perceived health		
Excellent	24.5 (18.1–32.3)	24.4 (21.8–27.1)
Good	35.0 (27.5–42.7)	37.0 (34.1–40.0)
Fair	21.3 (15.3–28.8)	25.8 (23.2–28.6)
Poor	12.2 (7.9–18.6)	11.0 (9.2–13.3)
Very poor	7.3 (3.7–13.9)	1.8 (1.1–2.9)
Employment status		
Employed	68.7 (60.35–75.9)	77.7 (74.9–80.3)
Not working	11.4 (7.0–18.0)	12.3 (10.2–14.7)
Unable to work	20.0 (14.0–27.7)	10.0 (8.3–12.1)
Impairment in daily activities [§]	23.8 (17.7–31.1)	15.6 (13.5–17.9)
Medical visits	52.2 (44.0–60.2)	55.3 (52.2–58.4)
Psychiatric morbidity	30.7 (23.6–38.9)	15.1 (13.1–17.4)

[‡] $p < 0.05$.[§] $p < 0.01$.^{||} $p < 0.001$ indicate comparison between individuals with SREMFS and those without.

CI = confidence interval; SREMFS = self-reported electromagnetic field sensitivity.

* Data missing for one person with SREMFS and two people among the whole survey population.

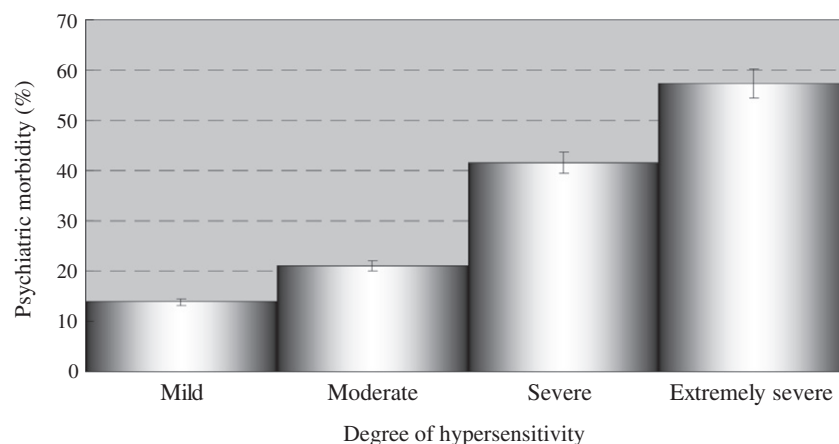
[†] Data missing for two people with SREMFS and five people among the whole survey population.**Figure 1** Weighted prevalence of psychiatric morbidity among people with self-reported electric and magnetic field sensitivity (SREMFS) in terms of degree of severity.

Table 4 Weighted multiple logistic regression analysis for self-reported electromagnetic field sensitivity

Variables	Univariate analysis	Multivariate analysis	Multivariate analysis*
sex			
Female	1.00	1.00	1.00
Male	1.15 (0.81–1.64)	1.18 (0.81–1.71)	0.99 (0.70–1.41)
Age group (yr)			
18–34	1.00	1.00	1.00
35–49	1.25 (0.82–1.93)	1.30 (0.85–1.99)	1.17 (0.77–1.78)
50–64	1.05 (0.65–1.68)	1.05 (0.62–1.78)	1.09 (0.66–1.80)
≥65	0.41 (0.17–1.00) [‡]	0.34 (0.14–0.83) [‡]	0.37 (0.14–0.98) [‡]
Education [†]			
Middle school and below	1.00	1.00	1.00
High school	1.25 (0.77–2.03)	1.08 (0.62–1.89)	1.06 (0.63–1.79)
College and above	1.20 (0.77–1.86)	1.20 (0.71–2.02)	1.07 (0.65–1.77)
Catastrophic illness			
No	1.00	1.00	1.00
Yes	2.13 (0.92–4.93)	1.60 (0.65–3.97)	1.40 (0.59–3.13)
Perceived health			
Excellent	1.00	1.00	1.00
Good	0.92 (0.58–1.47)	0.85 (0.53–1.37)	0.90 (0.58–1.39)
Fair	0.80 (0.47–1.35)	0.67 (0.39–1.15)	0.72 (0.44–1.20)
Poor	1.12 (0.60–2.09)	0.72 (0.35–1.50)	0.82 (0.43–1.56)
Very poor	7.88 (2.67–23.26)	4.94 (1.59–15.38) [§]	4.90 (1.58–15.19) [§]
Employment status			
Employed	1.00	1.00	1.00
Out of work/not working	1.06 (0.59–1.90)	1.67 (0.87–3.19)	1.57 (0.83–2.97)
Unable to work	2.71 (1.65–4.46)	2.15 (1.26–3.69) [§]	1.84 (1.05–3.22) [‡]
Impairment in daily activities			
No	1.00	1.00	1.00
Yes	1.83 (1.20–2.77) [§]	1.08 (0.66–1.78)	1.27 (0.79–2.05)
Psychiatric morbidity			
No	1.00	1.00	1.00
Yes	3.04 (2.02–4.57)	2.55 (1.63–3.99)	2.08 (1.38–3.13)

[‡] $p = 0.05$.

[§] $p < 0.01$.

^{||} $p < 0.001$.

* Odds ratio adjusted by perception of risk from base station.

[†] Data missing for one person with self-reported electromagnetic field sensitivity and two people among the whole survey population.

base stations into the model (OR: 3.76, 95% CI: 1.70–8.29) (Table 4). We incorporated the interaction term between risk perception of base stations and psychiatric morbidity in further multivariate analyses and found that this had no statistical significance, indicating that risk perception had no differential effect on the relationship between psychiatric morbidity and SREMFS.

Discussion

This study found that the prevalence of SREMFS among the adult population of Taiwan was 13.3%. People aged > 65 years old were associated with a lower risk of reporting hypersensitivity to EMFs, whereas people with a very poor self-reported health status, those who were unable to work, and those who had psychiatric morbidity were associated

with a higher risk of SREMFS. The psychiatric comorbidity rate among people with SREMFS was 30.7%. People with psychiatric morbidity had twice as high a risk of association with EMF hypersensitivity than those without, and the risk was even higher among patients with severe SREMFS.

It has been reported that it is becoming more difficult to attain good response rates to telephone surveys, particularly in random-digit-dial surveys.^{35,36} To discuss the effects of a low response rate on the results of survey studies, we benchmarked the data registered with the Bureau of National Health Insurance (3.3%) in August 2007³⁷ for the percentage of people with catastrophic illness in the general population, and found that this was comparable with the results of our study (3.3% in our sample). The error in the estimation of prevalence of SREMFS resulting from the selection bias in survey respondents was therefore thought to be minimal. Low education or low income has

been previously found to be associated with hypersensitivity to EMFs.^{6,14} The characteristics of our survey sample were comparable with the general population in age, sex and education after weight adjustments. Possible underestimation of the prevalence of SREMFS resulting from over-represented highly-educated and middle-aged women, as is commonly seen in telephone survey samples, did not occur in the present study.

The prevalence of SREMFS in the general population of Taiwan (13.3%) was higher than that reported in western countries. EMF-related complaints have been shown to be dependent on social environment.^{38,39} Possible explanations for the high prevalence of hypersensitivity to EMFs in Taiwan are discussed below. There has been rapid growth in the use of telecommunication devices worldwide since the previous studies were conducted. The hazardous effects of EMFs on human health have become a more popular concern nowadays; furthermore, Taiwan has been one of the leading countries in the manufacture of telecommunication devices over the past 10 years. The promotion of the establishment of infrastructures using wireless net telecommunication is a national policy, which has led to rapid growth in the number of base stations located in the cities and towns of Taiwan. EHS-related news often attracts the attention of the media. Our findings are also consistent with those of Levallois et al.,⁹ who reported that Asian ethnicity is associated with a higher risk of SREMFS. Our results supported the hypothesis that sociocultural factors might be risk factors for SREMFS. Age and sex were not reported as being associated with SREMFS in the study of Levallois et al. In contrast to our findings, Hillert et al. have found that people with hypersensitivity to EMFs were more commonly women and aged 60–80 years,⁶ and the effects of age and sex were not examined further in multivariate analyses to determine whether they remained statistically significant after controlling for other factors. Potential bias caused by the representativeness of people among some groups (e.g. age and sex) were also not discussed in the previous study.⁶

A poor subjective health status and impairment in work performance have been reported to be associated with SREMFS or other EI in previous studies.^{13,14,40} Our study also demonstrated that people with psychiatric morbidity were associated with a higher risk of reporting hypersensitivity to EMFs, independent of risk perception of EMF sources. However, the relationship between psychiatric morbidity and EHS needs to be interpreted carefully. First, people with psychiatric morbidity as screened by the BSRS-5 are mainly those at risk for minor mental disorders. The somatic symptoms manifested in many psychiatric disorders, which often overlap in symptomatology with physical symptoms caused by physical disorders, were not included in our questionnaire. Given that somatic symptoms usually inflate scores in tests of psychopathology, psychometric instruments that avoid questions about somatic symptoms seem better choices for studying the psychopathology of people with unexplained medical conditions.⁴¹ People presenting with somatization without acknowledgment of anxiety or depression would not have been identified as people with psychiatric morbidity in the present study. Second, psychological factors are thought to be responsible for the emergence of health problems because provocation studies have failed to reproduce the symptoms of EHS

patients.^{14,17} However, physical symptoms when there is no clear medical explanation do not necessarily prove a psychogenic causality.^{42–44} Instead, some psychobiological mechanisms might be responsible for mind–body communication that has been demonstrated by new findings in functional neural imaging and psychoneuroimmunology studies.^{45,46} Future research on the effects of psychiatric morbidity on people with SREMFS might focus on the mediating psychobiological mechanisms between dysfunctional cognition, emotion, and somatic symptoms.

The present study had the following limitations. First, EHS was identified by one question and self-reporting instead of using a questionnaire that assessed EHS-associated physical symptoms.¹² People with SREMFS were not interviewed and did not receive any physical examination, and the resemblance of these self-identified EHS cases to those fulfilling the working criteria of EHS is not clear. Second, this was a cross-sectional study, and the temporal relationship between some identified risk factors (psychiatric morbidity, inability to work, and self-reported health status) and EHS is not clear. A prospective study design is required to delineate this relationship.

In conclusion, the results of the present study support the hypothesis that sociocultural factors are risk factors for people with self-reported EMF sensitivity. People with psychiatric morbidity were found to be associated with a higher risk of reporting EHS. The psychobiological mechanisms responsible for the effect of psychiatric morbidity on electromagnetic sensitivity need to be studied further.

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