

**Symptoms experienced by people living in the vicinity of cellular phone base stations:  
Influence of distance and sex**

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The symptoms that result from the use of a mobile cellular phone are relatively well known (1,2,3). By contrast, no investigation exists concerning the health of those living in the vicinity of mobile phone base stations.

The results presented below analyze, in their entirety, 530 questionnaires received from people in France living in proximity to base stations. The participants in the investigation specified their distance from the base stations as: 19.6 % of the subjects lived less than 10 meters away; 26.2% lived between 10 and 50 meters away; 13.8% lived between 50 and 100 meters away; 9.6% lived between 100 and 200 meters away; 10.1% lived between 200 and 300 meters away, and 20.7% lived at more than 300 meters away or were not exposed to base stations. They estimated the intensity of their symptoms using this scale: Never = 0; Sometimes = 1; Often = 2; Very Often = 3.

The statistical study (CHI SQUARE test with YATES correction) shows the frequency of symptoms of an intensity of 2 and 3 as a function of distance from the base station. As frame of reference, the comparison was made with the group of participants farthest away (distance >300m) or found beyond the operation of base stations (no base stations or non-operational base stations).

The table clearly shows:

- a. The existence of certain complaints (nausea, loss of appetite, visual disturbances, movement difficulties) of significant differences ( $p < 0.05$ ) solely within a zone very close to base stations (less than **10 m**) and not beyond that.
- b. The fact that for other symptoms, a significant rise in the frequency of complaints ( $p < 0.05$ ) was observed up to a distance of **100 m** (irritability, depressive tendency, loss of memory, dizziness) – **200 m** (headaches, sleep disturbance, feeling of discomfort, skin problems) – indeed **300 m** (fatigue).

In terms of these results and in application of the precautionary principle, it is recommended that base stations not be sited less than 300 meters from residences, particularly in the case of locations where populations are found that are physiologically more fragile (day care centers, schools, retirement homes, hospitals . . .).

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- (2) SANTINI R. et al. Symptômes rapportés par des utilisateurs de téléphones mobiles cellulaires. *Pathol. Biol.* 2001. 49 : 222-226. [English – Symptoms reported by mobile cellular phone users.]

- (3) SANTINI R. Les téléphones cellulaires et leurs stations relais : risques pour la santé ?  
Presse Med. 1999. 28 : 1884-1886. [English – Cellular telephones and their base stations:  
risks for health?]

**ENGLISH TITLE:** - Symptoms experienced by people in vicinity of cellular phone base stations.

**KEY WORDS** :- Base station – Bioeffects.

Symptoms	Distances from base stations in meters (m)											
	< 10 m		10 à 50 m		50 à 100 m		100 à 200 m		200 à 300 m		> 300 m ...	
	2	3	2	3	2	3	2	3	2	3	2	3
Fatigue	76 *	72 *	63.5*	50.9*	60.6	56.6*	64.2	41.1	66.6*	43.7	40.7	27.2
Irritability	32.8	23.2*	41.7*	25.7*	47.2*	44.1*	25.8	4.1	25	9	18	3.3
Headaches	51 *	47.8*	40 *	26.1*	40.6*	36.7*	60.7*	31.2*	19.3	0	15.6	1.8
Nausea	14.5*	6.9	8.4	3	5.7	3.8	2.4	4,6	0	2.3	2,1	1.1
Loss of Appetite	20.4*	8.3	8	5.5	5	5	6.9	0	4.2	0	3.3	3.3
Sleep Disturbance	41.3*	57.1*	41.4*	57.5*	46.9*	58.5*	45.8*	50*	33.3	35.5	13.8	21.1
Depressive Tendency	16,9	26.8*	21.6	19.7*	11.6	24 *	16.2	3.1	13.6	2.5	10.3	3.7
Feeling of Discomfort	28 *	45.4*	25.2*	18.9	30.6*	12.8	15.7*	0	9.7	5.1	2.4	8.1
Difficulty in concentration	39.3	28.8*	37.5	16.6	34.2	26.4*	25	12.5	43.3	5.5	26.7	7.1
Loss of Memory	27.8	25.4*	29.4	26.6*	37.1*	29 *	25	15.6	17.2	11.1	17.9	5.8
Skin Problems	18.1*	17.1*	6.6	10.8	11.1*	11.1	13.9*	7.5	8.7	0	1.2	4.6
Visual Disruptions	14.5	24.3*	23	13.5	22	7.1	2.5	4.9	15	2.8	13.6	4.1
Hearing Disruptions	33.3*	17.4	17.7*	12	8.3	15.5	7.7	7.7	11.6	9.5	5.6	8.7
Dizziness	10	12.5*	17.3*	7,5*	9.6	9.6*	12.2	2.7	7.7	5.2	6.2	0
Movement Difficulties	5.6	7.7*	8.2	1.7	3	3	0	0	2	0	2.9	1
Cardio-vascular Problems	10.1*	13 *	15.3*	9.6	12.3*	7.4	8.7	0	8.5	6.5	1	3

**Table 1** : - Percentages of complaints reported by those living in the vicinity of base stations as a function of their distance away for the base station..

\* = Significant difference ( $p < 0.05$ ) in comparison to reference (control) subjects found at > 300 m or not exposed, for the reponses 2 = « often » and 3 = « very often»

<b>Symptoms</b>	<b>Men (%)</b>	<b>Women (%)</b>
<b>Fatigue</b>	41.4	57.5
<b>Irritability</b>	17.9	28.3
<b>Headaches</b>	14.4	45.6 *
<b>Nausea</b>	0	5.9 *
<b>Loss of appetite</b>	1.9	8 *
<b>Sleep disturbance</b>	45.4	61 *
<b>Depreswsive tendencies</b>	9.8	26.7 *
<b>Feeling of discomfort</b>	15	25.4 *
<b>Difficulties in concentration</b>	18.4	21.6
<b>Memory loss</b>	18	27.7
<b>Skin problems</b>	8	13.1
<b>Visual disturbances</b>	12.2	22 *
<b>Hearing disturbances</b>	9.6	19
<b>Dizziness</b>	6	9.8
<b>Movement difficulties</b>	3.3	2.7
<b>Cardio-vascular problems</b>	8.3	8.8
<b>Lowering of libido</b>	18	12

**Table 2** : - Influence of sex on the frequency of reported symptoms by subjects (270 men, 260 women) living in the vicinity (all distances less than 300 m) of mobile phone base stations..

\* =  $p < 0.05$

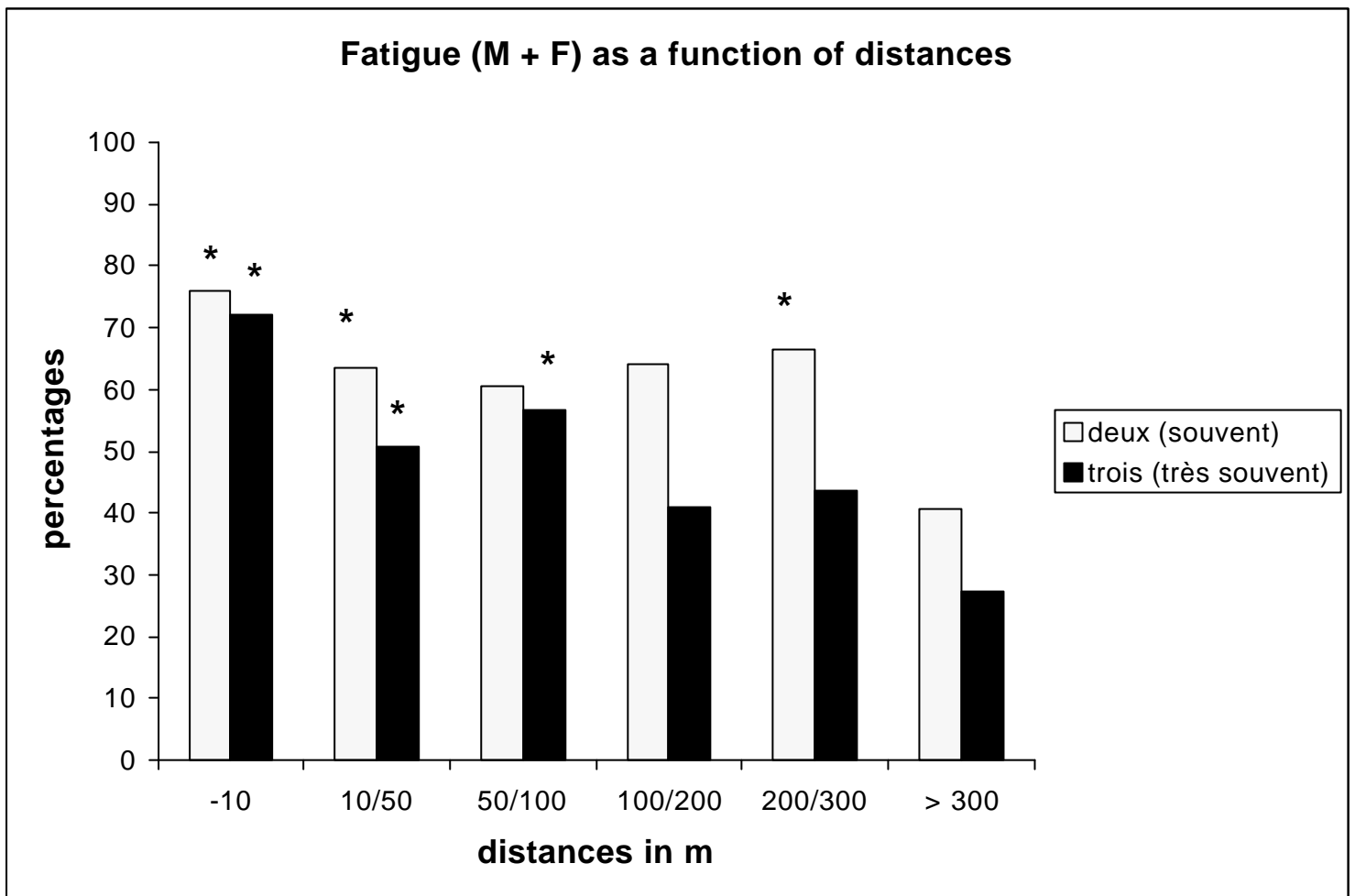


Figure 1: - frequency of complaints of fatigue, in people living in the vicinity of mobile phone base stations as a function of their distance from base stations.

M = Males - F = Females - m = meters

deux (souvent) = two (often) - trois (tres souvent) = three (very often)

\* = p < 0.05 (comparison with the subjects at a distance > 300 m or not exposed)

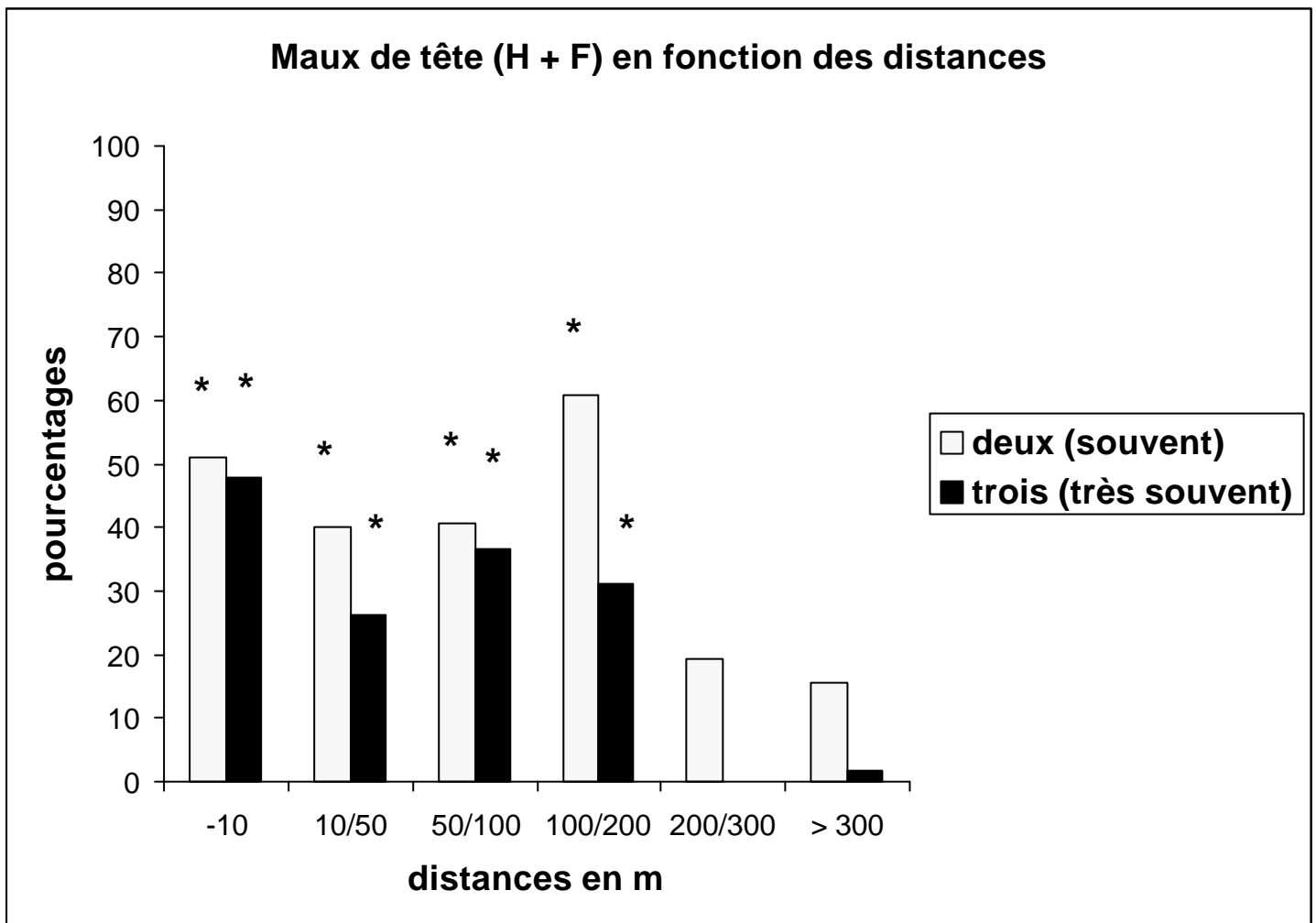


Figure 2 : - Frequency of headache complaints experienced by subjects as a function of their distance from base stations.

H = hommes = Men    F = femmes = Women    m = mètres = meters

\* =  $p < 0.05$  (comparison with subjects at distance  $> 300$  m or not exposed).

## **SYMPTOMS EXPERIENCED BY PEOPLE IN VICINITY OF BASE STATION: INFLUENCE OF DISTANCE AND SEX**

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### **SUMMARY**

A survey study, using a questionnaire, was conducted on 530 people (270 men, 260 women) living or not in vicinity of cellular phone base stations, on 18 Non-Specific Health Symptoms. Comparisons of frequency of complaints (CHI-SQUARE test with Yates correction) in relation to distance from base station and sex, show significant ( $p < 0.05$ ) increases as compared to people living  $> 300$  m or not exposed to base station, up to a distance of 300 m for fatigue, 200 m for headache, sleep disturbance, discomfort, ... 100 m for irritability, depression, loss of memory, dizziness, libido decrease, ...

Women complained significantly more often than men ( $p < 0.05$ ) of headache, nausea, loss of appetite, sleep disturbances, depression, discomfort and visual disturbances.

This first study of symptoms experienced by people living in vicinity of base stations shows that, in view of radiofrequency radiation protection, minimal distance of residences from cellular phone base stations should not be  $< 300$  m.

**KEY WORDS:** - Base station – Cellular phone – Bioeffects.