3B.1 PREVALENCE OF WEATHER SENSITIVITY IN GERMANY

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1. INTRODUCTION

The often used term "weather sensitivity" (WS) has never been defined scientifically and is used colloquially with many different meanings. Generally it describes weather related incidences of symptoms and diseases. For some decades the syndrome of WS can be found in biometeorological publications (e.g. Jendritzky, 1993), many of them published in German language and often not peer reviewed journals. During the last ten years there seems to be an increase of interest in the topic of WS on an international level (Jamisom et al., 1995; Aikmann, 1997; Schienle et al., 1998; Falkenbach et al., 1998; Ranner and Egger, 1998).
By now most of the studies on weather effects on humans are descriptive. They are limited to calculations of correlations between meteorological parameters and physiological or pathological end points. Through these studies, it is certainly proved, that at definite weather situations, there are significant effects on well-being (Jendritzky, 1992; Bucher und Haase, 1993), measurable changes of blood pressure (Höppe, 1982), increases of postoperative complications (Eberhart et al., 2000) and even of mortality (Jendritzky, 1998; Kalkstein, 1991; Danet et al.,1998). In general 5 to 25 % of the variance in health endpoints can be explained by weather factors, in subjective complaints sometimes more than 50 % (Jendritzky, 1992).

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There are also some studies, which show strong non trivial associations (e.g. not caused by icy roads or storm) between weather and industrial and traffic accidents (Rauschhofer et al., 1981; Jendritzky, 1978). Until now, however, there is a lack of studies, that can prove causal relations. As basis for such studies it is helpful to first collect comprehensive information on the prevalence and symptom patterns of WS in a whole population. To fill this gap we carried out a representative WS census in January 2001 in Germany.

2. METHODS

We developed a questionnaire with six questions on the subjectively perceived prevalence of WS, its most common symptoms and the associated weather patterns. These questions were integrated into a routine multi-topic questionnaire of a census agency (Institut für Demoskopie Allensbach). The sample consisted of 1,064 German citizens older than 16 years. The results were weighted representatively for the whole German population in respect to age, gender, residential characteristics, professional status, marital status and family size. The trained interviewers were instructed to read the questions literally and always in the same order. The interviews were made between January 5th and 16th, 2001.

3. RESULTS

19.2% of the interviewed persons report a "strong influence" of weather on their health, 35.3% a "slight influence". Hence, 54.5% see some kind of association between weather and health. In the following, both groups (slight influence and strong influence) are called

“weather sensitive”. Women are significantly overrepresented in the group of „strong weather influence“ (28.0 %) compared to men (9.6%). The prevalence of strong WS increases with age from 11% in the group 16-29 years to 32% in the group >60 years. The largest relative difference between men and women is found in the youngest group with only 2% of the male but 21% of the female subjects.

The following results only refer to those subjects, who have stated to be weather sensitive (n=583). Overall the highest frequencies of weather related symptoms are reported for days with stormy weather (30%) and, when it gets colder (29%). A striking difference between Southern and Northern Germans was, that in Bavaria 30.1% of the WS subjects have symptoms on days with advection of warm air (only 18.8 % at cold air advection) while in Northern Germany this fraction only is about 10 %. This points to the important role of Foehn weather in Bavaria for WS. As to be expected, the least rates of WS complaints are found for days with nice weather (5.5%). One quarter (25.4%) of the interviewed people stated to have experienced their WS for the first time in the age range between 20 to 30 years.

In one question we asked the subjects for the kind of WS symptoms they predominantly develop. The question listed 20 different symptoms and health disorder, which have been been mentioned in scientific publications in connection with weather changes. The most frequent symptoms reported by the weather sensitive subjects are headache/migraine (61%), exhaustion (47%), sleep disturbances (46%), fatigue (43%), joint pain (40%), irritation (31%), depression (27%), vertigo (26%) and scar pain (23%). While for headache the highest prevalence is reported in the age group 30-44 years for joint pain there is a steady increase with age reaching more than double the values in the group >60 years (66%) compared to all other age groups.

In order to get more information on the severity of a potentially weather related influence on health and its socio-economic meaning, we asked the subjects if they suffered that much from their weather sensitivity at least once during the last year that they were incapable to do their regular work (for example job or household). For 32% of the WS subjects this was the case, 22% of them even reported that they could not do their regular work on more than one occasion. On average 10.2 days of temporary disablement due to weather effects was stated.

In the next question we asked the subjects, if they had one or more chronic diseases listed in the questionnaire. The most prevalent chronic diseases were heart/circulatory disturbances (24.4%) and allergies (20.5%). 11.5% reported hay fever, 10.9% rheumatism. 10.5% of the individuals had chronic diseases of the respiratory tract, 9.3% heart diseases and chronic pain. The prevalence of allergies showed a clear difference between West (22.1%) and East Germany (14.2%). Circulatory disturbances were mostly reported by subjects in the age group >60 years (42.6%), whereas allergies were most frequent in the age group between 30 and 44 years.

Comparing the co-morbidities of weather sensitive subjects with those not being weather sensitive, shows clearly, that chronic diseases are significantly more prevalent in the group of the weather sensitive subjects. For almost all diseases listed in the questionnaire with only one exception (throat-nose-ear diseases) the prevalence is much higher in the WS group (see tab. 1). The largest differences are found for circulatory diseases and rheumatism (ORs 7.1 resp. 2.9, adjusted for age). These results back the hypothesis, that weather associated symptoms especially concern people with pre-morbidity. This also seems to be the reason why the group of elderly show the highest WS prevalence rates.

4. DISCUSSION AND OUTLOOK

The results from the German WS survey have demonstrated the high prevalence of subjectively perceived influences of weather on health. The comparison of the results for the whole collective with data from a Federal Health Survey (Hermann-Kunz, 1999; Thefeld,1999) provides good corresponding results for the prevalences of allergies (20.7%), hay fever (15.4%), asthma (5.6%) and diabetes (5.5%). This can be taken as a

hint that the results of our interviews can be really considered as representative.
There are many studies which have also proven that besides such subjective assessments there objectively are associations between the incidence of a multitude of WS symptoms and certain weather situations (e.g. Bucher and Haase, 1993). The still missing links are the determination of the causal agents and the understanding of the physiological processes.

Two years ago an interdisciplinary working group was founded by our institute to develop research projects on causal agents of WS. The data of the questionnaire presented above are an important basis for these studies. The first activity of the working group was to define the new term ARS (Atmosphere Related Syndrome) to replace the never properly defined colloquial term WS.

Comorbidity in %	Total (n=1064)	Weather sensitive (n=581)	Not weather sensitive (n=483)	Odds Ratio (95%-CI)
Circulatory disturbances	24.4	38.8	6.9	**7.12 (4.81-10.53)**
Allergies	20.5	26.2	13.6	**2.70 (1.94-3.77)**
Hay fever	11.5	12.7	10.0	**1.67 (1.12-2.48)**
Rheumatism	10.9	16.3	4.4	**2.87 (1.73-4.77)**
Diseases of the respiratory tract	10.5	13.1	7.3	**1.79 (1.17-2.74)**
Heart diseases	9.3	12.9	4.9	**1.87 (1.13-3.10)**
Chronic pain	9.3	13.4	4.3	**2.68 (1.62-4.43)**
Skin diseases	9.2	10.8	7.3	**1.67 (1.07-2.59)**
Vascular diseases	8.5	11.5	4.9	**1.87 (1.13-3.11)**
Gastrointestinal diseases	7.2	8.7	5.4	1.48 (0.90-2.44)
Diabetes	6.6	8.3	4.5	1.30 (0.76-2.23)
Renal - bladder-inflammation	6.1	7.2	4.8	1.26 (0.74-2.16)
Ear, nose and throat inflammation	4.7	3.6	6.0	**0.54 (0.30-0.98)**
Liver-gall bladder diseases	4.1	6.0	1.8	**2.71 (1.27-5.80)**
Asthma	3.4	4.0	2.7	1.20 (0.59-2.42)
Other diseases	12.7	16.1	8.6	**1.93 (1.30-2.85)**

Table 1: frequencies of co-morbidities of the whole population and the weather sensitive and not weather sensitive in comparison.

The definition of ARS is: “Changes of the physical, mental, emotional or social well-being and increases of the incidence or exacerbations of diseases, if they are related to changes of weather dependent atmospheric factors. Etiologically already known effects of air pollutants (for example irritation of the respiratory tract with ozone), UV-radiation (e.g. erythema) and of solely thermal genesis (e.g. cardio-circulatory insufficiency due to heat stress), are not regarded as ARS.

Two atmospheric factors are in the focus of the new studies, i.e. atmospheric impulse radiation (sferics) and low frequency air pressure oscillations (APO). Both already fulfil most of the presuppositions to be causal agents for ARS. They have distinct weather associated patterns, they intrude into houses and there are first results of controlled exposure studies (with artificially generated sferics resp. APO) showing effects in humans (Delyukov and Didyk, 1999). In the case of APO there also already exists a hypothesis for the receptor, which could be the baroreceptor in the carotid sinus.

5. LITERATURE

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