Eur Arch Psychiatr Neurol Sci (1989) 239:113–124

European Archives of Psychiatry and Neurological Sciences

The Zurich Study

VIII. Insomnia: Association with Depression, Anxiety, Somatic Syndromes, and Course of Insomnia*

Margarete Vollrath, Werner Wicki, and Jules Angst

Psychiatric University Hospital, Zurich, Research Department, P.O.Box 68, CH-8029 Zurich, Switzerland

Summary. The association of three subtypes of insomnia with psychic and functional syndromes, and the course of insomnia over 7 years were examined in a Swiss cohort of young adults interviewed three times. Specific associations were found between repeated brief insomnia (RBI) and recurrent brief depression (RBD). Continued insomnia (CI) was associated with major depression. All three subtypes of insomnia were associated with anxiety disorders; 52% of insomniacs were free of concurrent anxiety and depression. Insomnia – especially RBI and CI – was also associated with a number of functional complaints, but not with the consumption of alcohol, medicine, or illegal drugs. Insomniacs with RBI and occasional insomnia (OI) experienced more life events and interpersonal conflicts than controls. These findings support the subdivision of insomnia into different subtypes. The longitudinal analysis showed that insomnia tends to reoccur. For subjects with insomnia either at age 21 or 23 years, there was a higher risk of further insomnia at follow-ups. The specific subtype of insomnia at the first occurrence was not predictive for the outcome: all subtypes of insomnia enhance the risk of relapses in a similar way. Insomnia at age 21 is no precursor of the first onset of a depressive or anxiety disorder within a 2-year follow-up. With respect to the course of insomnia over 7 years, the subtypes did not differentiate.

Key words: Insomnia – Epidemiology – Anxiety – Depression – Course – Follow-up

* Project supported by grant 3.948.0.85 from the Swiss National Science Foundation
Offprint requests to: M. Vollrath

Introduction

In a first paper (Angst et al. 1989a), three subtypes of insomnia were described: continued insomnia (CI), repeated brief insomnia (RBI) and occasional insomnia (OI). In this second paper we analyze the association of these subtypes of insomnia with other complaints and describe their course over 7 years in a cohort of young adults from the Canton of Zurich.

There is much clinical- and research-based evidence that insomnia is strongly associated with both anxiety and depression. Indeed, insomnia is an important item in all instruments measuring anxiety or depression and, for instance, a criterion symptom for the diagnosis of major depression. Elevated scores for anxiety and depression scales have not only been found in samples of insomnia patients (Kales et al. 1983; ASDC 1979), but also for insomniacs in healthy populations, as for instance in nurses (Tsoi and Tay 1986) and in epidemiological samples from the general population (Mellinger et al. 1985).

There is also ample evidence that insomnia can be linked to physical disorders. Mellinger et al. (1985) found in their sample from the general population that serious cases of insomnia tend to complain more often about multiple, otherwise unspecified health problems. An epidemiological study of 3201 Swedish men 30–69 years of age reported higher prevalence rates of insomnia among hypertensives, among men with obstructive pulmonary disease, with rheumatic disease, and with obesity (Gislason and Almqvist 1987). Furthermore, it is known from practical work with patients that insomnia frequently accompanies functional complaints and pains.

The use of drugs, alcohol, and caffeine can cause and maintain sleep disturbances. In a study on 279

outpatients with chronic insomnia and 100 controls, 66% of the insomniacs also used drugs and alcohol. However, the authors noted, that many of the drug/alcohol users took relatively moderate doses of drugs or amounts of alcohol (Kales et al. 1983). The intake of beverages containing caffeine like coffee, tea and cola-like drinks was found to be associated with disturbed sleeping patterns in an epidemiological study carried out on 4558 Australians (Shirlow and Mathers 1985).

Apart from psychic or functional disorders, insomnia is also influenced by environmental factors such as problems in the family (small children, sick family members) and negative influences in the living environment (noise, traffic, neighbors; Partinen et al. 1985). There is evidence that insomnia is more likely to occur with an increase in life events that require an effort to adapt. The study of Healey et al. (1981) carried out on 31 chronic insomniacs and 31 good sleepers demonstrated that the onset of insomnia was preceded by a greater number of stressful life events. Those events were particularly related to losses or ill health. Insomniacs furthermore showed a poorer self-concept, had greater difficulties in interpersonal relationships, and had had more problems in childhood.

All reported studies are cross-sectional. From general practice it is well known that insomnia tends to become chronic, lasting over years, especially among elderly people (Hay et al. 1986). Very little is known, however, about the "natural" course of insomnia in a basically untreated sample of younger age. The only longitudinal study on healthy subjects known to us was carried out on 190 teenage pupils of a high-school in the Federal Republic of Germany (Strauch et al. 1987). Within 10 years this sample was questioned six times about difficulty in falling asleep (early insomnia). Only 39% of the adolescents never had early insomnia over the years. There was no tendency toward an increase in early insomnia across time, but insomnia tended to switch on and off, and te individual stability was smaller than could be expected. Thus, at this age, insomnia seems to be a transitional phenomenon.

Method

Sample and Procedure. The Zurich Cohort Study sample consists of young adults from the Canton of Zurich in Switzerland, who so far have been interviewed three times: 1979 at age 21 ($n = 591$), 1981 at age 23 ($n = 456$), and 1986 at age 28 ($n = 457$).

They were interviewed with a psychiatric interview that assessed any psychic or functional syndromes which had occurred in the previous 12 months (for further details, see Angst et al. 1989a). The age of onset was assessed for each syndrome independently in the 1986 interview. In addition, in the course of the interview, life events were assessed with a modified inventory based on Tennant and Andrews (1976; 1977) and with additional items from Holmes and Rahe (1967). Furthermore, conflicts in relationships with parents, spouse, friends, and at work were recorded with different direct questions. For the measurement of self-concept and mastery, two scales developed by Pearlin and Schooler (1978) were used. Life events were weighted according to their stress potential, which was determined earlier in a cross-sectional study on a Swiss population (Bischofberger and Thomaier 1982), and added up to a total score. The scores for conflicts, mastery and self-esteem consist of the sum of the respective single items.

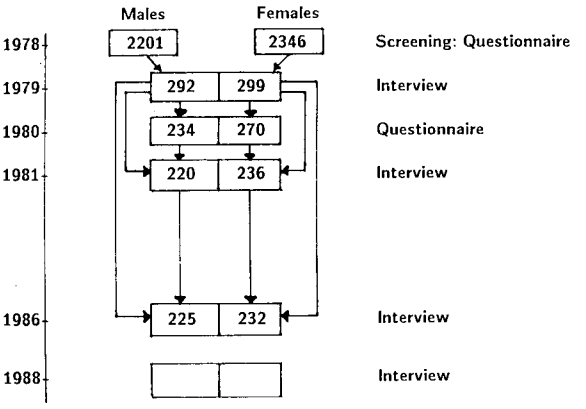

Fig. 1. Design of the Zurich Study

Definition of Diagnoses. Based on the frequency and length of insomnia, three subtypes of insomnia were defined: continued insomnia, lasting at least 2 weeks; repeated brief insomnia, occurring at least monthly, but lasting shorter than 2 weeks; occasional insomnia, an infrequent and shorter subtype.

Within the depressive disorders three diagnoses were distinguished: DSM-III major depression, recurrent brief depression (RBD), and DSM-III dysthymia. The diagnoses of major depression and dysthymia follow the operational criteria of DSM-III and do not need further explanation. The diagnosis of recurrent brief depression (RBD) is assigned to subjects with: (1) the same symptomatology as DSM-III major depression: (2) the presence of subjective impairment at work; (3) an at least monthly occurrence of depressive symptoms lasting less than 2 weeks. There is by definition no overlap between major depression and RBD, but some overlap between RBD and DSM-III dysthymia (Angst 1988).

The group of anxiety disorders, which are assessed independently in different sections of the interview, consists of panic disorder, "mild panic", generalized anxiety disorder (GAD), agoraphobia, social phobia and simple phobia. Again, DSM-III criteria were applied, except for the category of "mild panic". The diagnosis of mild panic is based on the same symptoms as DSM-III panic disorder, but only requires a minimum of four panic attacks over the past 12 months. DSM-III panic disorder and mild panic are mutually exclusive by definition. For the purpose of our analysis the three types of phobias were unified into one category. The overlap between DSM-III panic, mild panic, DSM-III generalized anxiety disorder (GAD) and all phobias is small and statistically not significant (Angst et al. 1989b).

Table 1. Association of subtypes of insomnia with depressive and anxiety disorders

	Subtypes of insomnia			Controls	Four-group contingency coefficient	Three-group comparison
	OI $n = 84$ (%)	RBI $n = 69$ (%)	CI $n = 59$ (%)	$n = 245$ (%)	C	OI-RBI-CI Chi^2 P
DSM-III major depression	13.1	7.2	25.4	7.3	0.19 **	0.013
Recurrent brief depression	16.7	27.5	8.5	7.8	0.21 ***	0.018
DSM-III dysthymia	5.9	10.1	6.8	1.2	0.17 *	NS
DSM-III generalized anxiety	2.4	4.4	10.2	1.2	0.17 *	NS
DSM-III panic and mild panic	3.6	7.3	15.3	2.5	0.19 **	0.05
All DSM-III phobias	17.9	11.6	13.6	5.7	0.16 *	NS
All depressions (including dysthymia)	30.9	39.1	35.6	15.1	0.23 ***	NS
All anxiety disorders	22.6	21.7	32.2	8.9	0.22 ***	NS
All depressive and anxiety disorders	41.7	47.8	49.1	22.0	0.25 ***	NS

OI, Occasional insomnia; RBI, repeated brief insomnia; CI, continued insomnia
Four-group Chi^2: * $P = 0.01$; ** $P = 0.001$; *** $P = 0.000$

Statistical Analyses. As a measure of association the contingency coefficient C was used, together with Chi^2-statistics. For dichotomous data, the Phi-coefficient was applied together with Fisher's exact test. To control for the effects of confounding, a multivariate analysis of variance for categorical data based on the weighted least-square method was carried out (PROC CATMOD, SAS 1985). Continuous data were subjected to nonparametric ANOVA (Kruskal-Wallis) as the distributions were different from normal in all scales. For the analysis of longitudinal patterns, we used the configuration frequency analysis with a program developed by Schallberger (1976). This is a multivariate nonparametric statistical method for the discovery of "types" and syndromes (Krauth and Lienert 1973). It analyzes data on subjects with the form of a matrix with n subjects in m variables. The observed frequencies are compared to the expected frequencies under the hypothesis of a total independence of the variables. The results are types or configurations. A type or configuration is given when the difference between the expected and observed frequency is significant in a Chi^2-test with one degree of freedom (Schallberger 1976).

Results

Association of Insomnia with Depressive and Anxiety Disorders

In Table 1, the overall contingency coefficients C for the association of the subtypes of insomnia with the depressive and anxiety disorders in the 1986 interview are listed. In addition, the overlap of the three subtypes of insomnia with the depressive and anxiety disorders is compared with Chi^2-statistics. The overall association of insomnia with major depression is 0.19 (contingency coefficient C; $p = 0.001$). The strongest overlap is between CI on the one hand and major depression on the other. This preponderance of major depression among subjects with CI is significant (χ^2, 2 *df*, $P < 0.02$). Insomnia is also associated with RBD and dysthymia. The strongest overlap is found between RBI on the one hand and recurrent brief depression (RBD) on the other ($P < 0.02$).

Furthermore, there is a significant overall association ($C = 0.17$) between the subtypes of insomnia and GAD. Although the greatest overlap is found for CI, the differences between the three subtypes remain nonsignificant. Panic disorder and mild panic overlap most strongly with CI ($P = 0.05$). The phobias are significantly associated with the three subtypes of insomnia without specific preponderance.

When all depressive disorders are unified and associated with the subtypes of insomnia, similar proportions of cases with depression are observed among subjects with either OI, RBI, or CI. None of the subtypes of insomnia is more likely than another to be associated with depression. The same is true for the unified anxiety disorders. However, there is a nonsignificant tendency for the anxiety disorders to prevail among insomniacs with CI.

In the 1986 interview, 46% of the insomniacs ($n = 212$) had suffered from anxiety or depression during the 12 months preceding the interview. The remaining 114 subjects could be termed "pure" insomniacs. What are the differences between these pure insomniacs and the insomniacs with additional depressive or anxiety disorders? When comparing the ten symptoms of insomnia for these two groups, three significant differences emerge: pure insomniacs complain less frequently about "anxiety states at night" (Fisher's exact test, $P < 0.001$), "awakenings from nightmares" ($P < 0.05$), and an "exaggerated need for sleep during the day time" ($P < 0.01$). The remaining

Table 2. Association of functional syndromes in the 1986 interview

	Back pain	Head-ache	Stom-ach	Intes-tines	Appe-tite	Respi-ration	Heart	Cardio-vascu-lar	Ex-haus-tion	Sexual prob-lems	Men-strua-tion
Back pain											
Headache	0.15										
Stomach	0.18	0.21									
Intestines	–	–	0.36								
Appetite	–	0.15	–	–							
Respiration	–	–	0.14	–	–						
Heart	–	–	–	–	–	–					
Cardiovascular	–	–	–	–	–	–	–				
Exhaustion	–	–	–	–	–	–	–	–			
Sexual problems	–	–	–	–	–	0.14	–	–	–		
Menstruation	–	–	–	–	–	–	–	–	–	0.21	

Phi-coefficients with $P < 0.05$

symptoms, e.g., difficulty in falling asleep or awakening early in the morning do not significantly discriminate between the two groups.

A comparison of the self-reported causal attributions of pure insomniacs versus insomniacs with associated anxiety and depression reveals that pure insomniacs give more external causal attributions, e.g., stress in the environment (work, study, examination), or personal relationships (to be worried about others), while depressive/anxious insomniacs give more internal attributions (such as fear of being alone, rumination, dissatisfaction, or unpleasant dreams).

Association of Subtypes of Insomnia with Functional Syndromes

Before we analyze the associations of insomnia with functional syndromes, we will examine the associations within the functional syndromes. Is there a sort of cluster with high associations between all kinds of functional complaints or are the syndromes independent? For this analysis only those complaints were included that had occurred at least monthly over the past 12 months in 1986. In Table 2, the Phi-coefficients between the functional syndromes are reproduced. Only coefficients with $P < 0.05$ (Fisher's exact test) are given. Very few significant associations between the functional syndromes are found. Stomach complaints are associated mostly with intestinal problems (Phi = 0.36) and also with back pain, headache, and respiratory troubles. Most of the functional syndromes are independent of each other within a 12-month period and can therefore be independently associated with insomnia.

Which functional syndromes are associated with the three subtypes of insomnia? In Table 3 the proportions of functional problems among each subtype of insomnia are presented. In the fourth column the 4×2-contingency coefficient C (OI-RBI-CI controls) are given.

The greatest associations were found between insomnia, on the one hand, and stomach problems, eating problems, exhaustion, sexual problems, respiratory troubles, and heart complaints on the other. Stomach symptoms are pain, heartburn, feelings of pressure, and nausea. Among subjects with both insomnia and eating problems, nearly an equal number complain about having too much or too little appetite. The typical symptoms of exhaustion are feelings of exhaustion, oversensitivity, nervousness, and tiredness. The sexual problems of insomniacs most often consist in a reduction of sexual interest. Respiratory troubles consist predominantly of shortness of breath, restlessness, and anxiety. Among the heart complaints, chest pain and palpitation are most frequently mentioned.

Are there more specific associations between the subtypes of insomnia and the functional problems? Potential differences between the three subtypes of insomnia were tested with the 3×2 Chi^2-test. The results are presented in the fifth column of Table 3. The subtypes of insomnia differ only in three of six significant associations: respiratory troubles are closely linked to RBI and CI, but not to OI; heart problems are more strongly associated with RBI than with OI and CI, and sexual problems with RBI and CI rather than with OI.

Two potential confounders may have an effect on these associations: depressive disorders are associ-

Table 3. Association of subtypes of insomnia with functional syndromes

Syndromes	Subtypes of insomnia			Controls	Overall contingency coefficient	Three-group comparison OI-RBI-CI Chi^2
	OI $n = 84$ (%)	RBI $n = 69$ (%)	CI $n = 59$ (%)	$n = 245$ (%)	C	P
Back pain	35	32	41	32	0.06	NS
Headache	35	32	32	22	0.12	NS
Stomach	19	26	29	14	0.14 *	NS
Intestines	20	23	19	13	0.11	NS
Appetite problems	46	41	44	25	0.20 ***	NS
Respiration	2	12	14	2	0.20 ***	0.05
Heart	8	20	5	6	0.18 **	0.01
Cardiovascular	11	13	15	8	0.09	NS
Exhaustion	14	22	19	9	0.14 *	NS
Sexual problems	19	35	36	15	0.21 ***	0.04
Menstrual problems[a]	37	55	43	32	0.15	NS

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$
[a] OI, $n = 43$; RBI, $n = 31$; CI, $n = 35$

Table 4. Association of depression, appetite problems, exhaustion, and sexual problems and insomnia. Analysis of variance[a]

Source	df	Chi^2	P
Appetite	1	10.81	0.001
Sexual problems	1	9.06	0.003
Exhaustion	1	3.32	0.068
Depression	1	7.53	0.006

[a] PROC CATMOD, maximum likelihood model, SAS 1985

Table 5. Effects of anxiety disorders, respiratory problems, and heart problems on insomnia. Analysis of variance[a]

Source	df	Chi^2	P
Heart problems	1	1.97	0.160
Respiration problems	1	4.01	0.045
Anxiety disorders	1	8.36	0.004

[a] PROC CATMOD, maximum likelihood model, SAS 1985

ated with eating problems, loss of sexual interest, and exhaustion; anxiety disorders, on the other hand, are associated with respiratory troubles and heart problems. In order to control for these effects, the three subtypes of insomnia were unified and submitted to a multivariate analysis of variance. The results are shown in Table 4.

Appetite problems, reduced sexual interest, and depression emerge as independent, highly significant main effects on insomnia, while the effect of exhaustion is no longer significant. These results indicate that the association between insomnia and appetite problems, as well as sexual problems, cannot be explained by an underlying depressive disorder. As to the effects of heart problems on insomnia, the analysis of variance demonstrates that these effects are due to confounding with GAD and panic disorder. After controlling for the latter, heart complaints no longer explain a significant part of the variance in insomnia. The effect of respiratory troubles on insomnia is weaker than that of anxiety disorders, but it remains significant ($P < 0.05$).

Consumption of Illegal Drugs, Alcohol, Caffeine, and Tobacco by subtypes of Insomnia

Concerning the consumption of illegal drugs, alcohol, caffeine, and tobacco, the interview assessed the weekly quantity of consumption and secondary problems as required for the abuse definitions of DSM-III. Abuse of illegal drugs like marijuana, opiates, speed, cocaine, and medications fulfilling DSM-III criteria was extremely rare in our sample. For this reason, the association could not be assessed.

DSM-III abuse of alcohol was also rare and not associated with insomnia either. A purely quantitative measure of consumption of alcohol, caffeine and tobacco may be more appropriate for our nonpatient sample. In Table 6 the mean weekly consumption of alcoholic beverages (glasses), coffee (cups) or coke (glasses), and of tobacco (number of cigarettes and cigars) is compared for the three subtypes of insomnia and the controls.

Insomniacs tended to drink a little more alcohol than controls (7.4 vs 5.6 glasses), but this difference

Table 6. Consumption of alcohol, caffeine, and cigarettes by subtypes of insomnia

	Subtypes of insomnia			All insomniacs	Controls	All insomnias vs controls: two-sample Wilcoxon-test	Four-group Kruskal-Wallis ANOVA
	OI $n=84$ Mean	RBI $n=69$ Mean	CI $n=59$ Mean	$n=212$ Mean	$n=245$ Mean	P	P
Glasses of alcoholic beverages per week	6.3	6.5	8.8	7.4	5.6	NS	NS
Cups of coffee and tea; glasses of coke per week	24.9	20.9	22.9	23.1	27.1	0.03	0.06
Number of cigarettes or cigars per day	9.4	10.3	12.3	10.5	7.6	0.05	NS

Table 7. Life-events, conflicts, mastery, and self-esteem by subtypes of insomnia

		Subtypes of insomnia			Controls	Four-group comparison
	All subjects Depressives excluded	OI $n=84$ $n=59$ Mean	RBI $n=69$ $n=45$ Mean	CI $n=59$ $n=39$ Mean	$n=245$ $n=208$ Mean	P^a
Life-event score	– All subjects	172.4	165.8	143.9	133.9	0.001
	– Depressives excluded	169.5	151.6	124.8	125.7	0.003
Conflict score	– All subjects	1.37	1.50	1.34	1.27	0.006
	– Depressives excluded	1.29	1.37	1.30	1.22	NS
Mastery	– All subjects	14.9	13.8	14.6	15.6	0.000
	– Depressives excluded	15.3	14.3	15.3	15.8	0.012
Self-esteem	– All subjects	15.1	14.7	14.8	15.5	0.007
	– Depressives excluded	15.6	15.1	14.9	15.7	NS

[a] Kruskal-Wallis ANOVA

was not significant. All insomniacs consumed significantly fewer beverages containing caffeine than the controls (23.1 vs 27.1 cups per week, $P=0.03$). Among the subtypes of insomnia, the consumption of subjects with RBI was the lowest ($P=0.06$). Finally, the consumption of cigarettes was higher among insomniacs as well: they smoked 10.5 cigarettes per day while the controls restricted themselves to 7.6 cigarettes a day (nonsmokers included; ($P=0.05$). However, the percentage of daily smokers was similar among subtypes of insomnia and controls. Among the insomniacs, subjects with CI appeared to be the strongest smokers (12.3 cigarettes a day), but this tendency is not statistically significant.

Association of Insomnia with Life Events, Conflicts, Self-Esteem, and Mastery

The scores for life events, interpersonal conflicts, mastery, and self-esteem are compared among the subtypes of insomnia and the controls. The results of the nonparametric Kruskal-Wallis ANOVA are shown in Table 7. As depression is a possible confounder in the association of insomnia with life events, interpersonal conflicts, mastery, and self-esteem, each analysis was repeated separately for subjects without depression (Table 7).

Insomniacs with OI manifested the highest score on the life-event inventory, followed by insomniacs with RBI in the second place, while the score of insomniacs with CI was similar to that of controls. The higher life-event scores of insomniacs with either OI or RBI cannot be attributed to the presence of a depressive episode; the differences remained significant when depressives were excluded from the analysis ($P=0.003$).

Do insomniacs with elevated life-event scores experience a greater number of events, or rather a special kind of events? OI and RBI reported a higher mean number of life events compared with insomniacs with CI and controls (OI 7.8, RBI 7.3 vs CI 6.4 and controls 6.5, $P<0.01$). For a qualitative comparison of events, two raters extracted a list of undesirable life events out of the whole catalogue and

classified them into four categories: work, finances, personal matters, interpersonal relationship. A Kruskal-Wallis test was applied to the mean number of events reported in each category. Significant differences were only found for the category of interpersonal relationship (OI 1.5, RBI 1.6 vs CI 1.2 and controls 1.2, $P < 0.001$).

All three groups of insomniacs exhibited higher interpersonal conflict scores than controls (Table 7). The conflict score was particularly elevated in the group with RBI. When subjects with depression were excluded from the analysis, the conflict scores decreased considerably and the differences between subtypes of insomnia and controls were not significant anymore.

The feeling of mastery, measured by a coping scale, was lower among all subtypes of insomnia than among controls. The lowest score was found among subjects with RBI, while the scores of insomniacs with OI and CI were similar. When depressives were excluded from the analysis, the mastery scores for all groups increased, but the differences between OI, RBI, CI, and controls were still significant.

Insomniacs with RBI and with CI scored lower on the self-esteem scale than insomniacs with OI or controls. When subjects with depression were excluded, the differences in self-esteem were reduced and no longer significant any more.

Course of Insomnia

Frequency and Pattern of Insomnia Across Time

Is insomnia between the age 20 and 28 years a relatively stable phenomenon with a tendency to chronicity or is it intermittent? For the purpose of the following longitudinal analyses, only those subjects were included who participated in all three interviews in 1979, 1981, and 1986 ($n = 395$). A diagnosis of insomnia was given up to three times in three interviews. Table 8 shows the rates of subjects that were given the diagnosis of insomnia once, twice or three times at the three interviews in two variants. The left column gives the figures for the unified subtypes OI, RBI and CI, the right column gives the rates of RBI and CI only without the milder OI.

The rate of subjects who never complained about any kind of insomnia only amounted to 25%. Twenty-nine percent of the subjects received a diagnosis of insomnia once, another 30% twice, and 16% three times. These rates shifted considerably when only the more severe types of insomnia (RBI and CI) were taken into account: then 42% of all subjects were free of insomnia at the three interviews, while 34% manifested RBI or CI once, 19% of the subjects twice, and only 5% at all three times.

Table 8. Frequency of diagnosis of insomnia over three interviews in 1979, 1981, and 1986

Frequency of diagnosis	RBI, CI, and OI $n = 395$ (%)	RBI and CI alone $n = 395$ (%)
Never insomnia	25.1	41.8
Insomnia once	28.9	34.4
Insomnia twice	30.4	19.0
Insomnia three times	15.7	4.8

What are the individual patterns of the course of insomnia? Table 9 gives the patterns of insomnia over time with RBI and CI combined into one category. According to the descriptive approach of Strauch et al. (1987), the individual courses of insomnia are classified as "stable", "increasing", "decreasing", and "unstable". An increase in insomnia is assumed when subjects without insomnia or with OI in 1979 display RBI/CI at one of the follow-ups. A decrease in insomnia, on the other hand, is assumed when subjects with initial RBI/CI do not have relapses at follow-up or only exhibit OI. Subjects with the same subtype of insomnia at all three interviews were classified as stable. Subjects with mixed, unsystematic patterns of insomnia were assigned to the unstable group. For example, they switched from RBI or CI to OI and back, or from "no insomnia" to OI and to "no insomnia" again. An equal rate of subjects were classified as increasing and decreasing (27% vs 25% of the sample). Another 17% was typed as unstable, 25% were never insomniacs and only 6% consistently had the same type of insomnia.

Stability of Presence or Absence of Insomnia Across Three Interviews

To examine the stability of insomnia across time, the individual patterns were submitted to the configuration frequency analysis of Lienert. To avoid too small cells, the three subtypes of insomnia were combined. Table 10 shows the resulting patterns and significant configurations.

Three configurations emerge as differing significantly from chance expectations. The first configuration is the "no-no-no" pattern. To have no insomnia at all three interviews occurred significantly more frequently than expected. The second configuration is complementary to the first: subjects with a diagnosis of insomnia at all three interviews were also more frequent than expected. The third configuration "no

Table 9. Individual patterns of course of insomnia (n = 395)

	n	%	1979	1981	1986
Never	99	25	No	No	No
Stable	22	6	OI	OI	OI
			RBI/CI	RBI/CI	RBI/CI
Decrease of insomnia	101	26	RBI/CI	No	No
			RBI/CI	OI	No
			RBI/CI	RBI/CI	No
			RBI/CI	No	OI
			RBI/CI	OI	OI
			RBI/CI	RBI/CI	OI
			OI	No	No
Increase of insomnia	106	27	No	RBI/CI	RBI/CI
			No	OI	RBI/CI
			No	RBI/CI	OI
			No	No	RBI/CI
			No	No	OI
			No	OI	OI
			OI	No	RBI/CI
			OI	OI	RBI/CI
			OI	RBI/CI	RBI/CI
Unstable	67	17	No	OI	No
			No	RBI/CI	No
			OI	OI	No
			OI	RBI/CI	No
			OI	No	OI
			OI	RBI/CI	OI
			RBI/CI	No	RBI/CI
			RBI/CI	OI	RBI/CI

Table 10. Longitudinal configurations of absence and presence of insomnia (OI, RBI or CI) over three interviews (n = 395). Configuration frequency analysis

Interviews			Observed frequency (n)	Expected frequency (n)	Chi^2	Significance of configuration P
1979	1981	1986				
Configurations						
No	No	No	99	63	20.0	0.001
No	No	In	42	53	2.3	–
No	In	No	23	45	11.1	0.001
No	In	In	36	38	0.1	–
In	No	No	49	62	2.6	–
In	No	In	40	52	2.6	–
In	In	No	44	44	0.0	–
In	In	In	62	37	16.7	0.001

No, No insomnia; In, insomnia (OI, RBI, CI)

insomnia (1979)" – "insomnia (1981)" – "no insomnia (1986)" was less frequent than expected. This third configuration matches the two first: sleeping well in 1979 predicts good sleeping at both follow-ups; insomnia in 1979 enhances the risk for insomnia in both 1981 and 1986. And for those with a first diagnosis of insomnia in 1981, the chance of sleeping well in 1986 is also reduced.

Predictive Value of OI for RBI and CI

It can be hypothesized that occasional insomnia is a precursor of more severe forms of insomnia. In order to test this hypothesis, the outcome after the initial diagnosis of insomnia at the 1979 interview was analyzed. As the multitude of possible patterns of outcome produces too many cells with expected counts of less than five, the diagnostic information for insomnia in 1981 and 1986 was unified according to the following rules: subjects without insomnia at either of the follow-up interviews were assigned to the category "no diagnosis", subjects with OI once or twice but never RBI or CI to the category "OI." Subjects with a combination of OI and either RBI or CI at follow-up were assigned to the category "RBI or CI", as well as subjects with pure RBI or CI either once or twice. Table 11 presents the outcome at follow-ups.

Table 11. Predictive value of occasional insomnia in 1979 for repeated brief and continued insomnia in 1981 and 1986

Subtypes of insomnia in 1981/1986	Subtypes of insomnia in 1979		
	OI $n = 77$ (%)	RBI/CI $n = 118$ (%)	Controls $n = 200$ (%)
OI	15.6	17.8	16.5
RBI or CI	57.1	58.5	34.0
No insomnia	27.2	23.7	49.5

Total Chi^2 28.3; $df = 4$; $P < 0.001$; contingency coefficient: $C = 0.26$

Insomnia in 1979 was significantly associated with insomnia at follow-up (3×3 contingency coefficient $C = 0.26$, $P < 0.001$). Controls, insomniacs with OI and with RBI/CI in 1979 had a similar chance of manifesting only OI at one of the follow-up interviews. About 58% of the insomniacs with RBI or CI in 1979 were again diagnosed as having RBI or CI at the follow-ups, compared to 34% of the controls and 57% of OI. Nearly 24% of the initial RBI/CI were free of insomnia at follow-up, compared with 27% of OI, but nearly 50% of controls. While the proportions of OI, RBI/CI or "no insomnia" at follow-up were very similar for insomniacs with either OI or with RBI and CI, the prognosis for controls in 1979 was more favorable: half of them stayed free of insomnia later on. Thus, the prognosis for insomniacs with OI in 1979 was similar to that of insomniacs with RBI or CI: all three subtypes of insomnia tended to precede

RBI and CI at follow-up with similar rates. The chance of developing OI at follow-up, however, was similar for all subtypes of insomnia and for the controls.

Prediction of Middle and Late Insomnia at Follow-up by Early Insomnia in 1979

In all three subtypes of insomnia, the difficulty in falling asleep (early insomnia) was the most frequent symptom (see Angst et al. 1989a). It may be that this mild insomnia symptom is a precursor of middle (awakening in the night) or late (early morning awakening) insomnia or of any of the combinations of early, middle, and late insomnia. To address this issue longitudinally we distinguish between three possibilities: pure early insomnia, middle or late insomnia (isolated or in combination with the early form), and "no insomnia", and analyze the longitudinal course with a configuration frequency analysis. We do not reproduce the full table with 27 configurations, but only those "types" that differ significantly from chance expectations (Table 12).

Table 12. Predictive value of early insomnia in 1979 for middle or late insomnia in 1981 and 1986. Configuration frequency analysis[a]

Significant configurations			Observed (*n*)	Expected (*n*)	Chi^2	*P*
1979	1981	1986				
No	No	No	143	111	9.2	0.01
No	No	ML	19	30	3.8	0.05
No	Er	No	3	12	6.9	0.01
No	ML	No	17	28	4.3	0.05
ML	ML	ML	12	4	13.3	0.001

[a] Only significant configurations with $P < 0.05$ are reproduced
No, No insomnia; Er, early insomnia; ML, middle insomnia or late insomnia

Only five significant configurations emerged from the analysis. Four of these five configurations referred to the course of subjects without insomnia in 1979 (controls): controls in 1979 were more likely to be free of insomnia again both in 1981 and in 1986 and, consistently, were less likely to develop either early or middle or late insomnia at the follow-up interviews. Only one specific pattern was found for insomniacs in 1979: subjects with middle or late insomnia in 1979 had an enhanced chance of continuing with this symptom of insomnia in 1981 as well as in 1986. Early insomnia in 1979, however, did not predict middle or late insomnia in 1981 and 1986.

Longitudinal Association

Predictive Value of Insomnia for Depression and Anxiety

Clinical observations show that insomnia is often an early symptom of a depressive episode. Perhaps early episodes of insomnia are also a first sign of a later onset of depression? Our study makes it possible to address this question with prospective data.

To determine the true incidence of cases of depression after 1979, subjects with a diagnosis of depression in 1978 (questionnaire) or in 1979 (interview) were excluded from the analysis. Furthermore, subjects who reported depression in childhood or adolescence were excluded. Age of onset was assessed separately for insomnia and depression in the interview 1986. For our analysis, depression was only considered when the first onset was within a period of 2 years after 1979. For this period information from a mailed questionnaire (1980) and the second direct interview (1981) was available. Table 13 presents the rates of depression at follow-up (1980 or 1981) by subtype of insomnia in 1979.

Although the rates of depression are elevated in subjects with occasional insomnia and continued insomnia, the results of a Chi^2-test indicate nonsignificance. There is no higher chance of insomniacs in 1979 developing depression for the first time within the next 2 years than for controls.

The same is true with respect to the onset of anxiety disorders, namely, generalized anxiety disorders or panic disorders. Again, when all cases with earlier anxiety disorders are excluded, insomnia does not seem to be a long-term precursor of a subsequent onset of GAD or panic. Because of their similarity to the above results, we will not reproduce the data.

Table 13. Incidence of depression, within a 2-year follow-up by subtype of insomnia in 1979

Insomnia in 1979	Incidence of depression in 1980–1981	
	(*n*)	(%)
No insomnia ($n = 99$)	29	29.3
Occasional insomnia ($n = 24$)	10	41.7
Repeated brief insomnia ($n = 25$)	6	24.0
Continued insomnia ($n = 14$)	7	50.0

4×2 Chi^2-test; $P = 0.24$

Discussion

In a previous article (Angst et al. 1989a) an attempt was made to classify insomnia into three subtypes

according to patterns of frequency and duration: continued insomnia (CI), which lasts 2 weeks or more; repeated brief insomnia (RBI) with episodes of insomnia lasting one or more nights, but less than 2 weeks, and repeated at least monthly throughout 1 year; occasional insomnia (OI), which lasts less than 2 weeks and occurs at lower frequency.

First, the association of these subtypes of insomnia with depressive disorders, anxiety disorders, and various functional syndromes was examined in a cohort of 457 young adults from the normal population. Specificity of associations of these disorders with the subtypes of insomnia can be interpreted as validators of these concepts. Indeed, there is some specificity of the association of depression with respect to RBI and CI. RBI was strongly associated with recurrent brief depression (RBD), and CI was specifically associated with major depression (DSM-III). These findings support the existence of different episode patterns in insomnia and depression with an extended, long-lasting type of depression and insomnia, on the one hand, and a shorter-lasting but frequently recurrent type on the other. Understanding RBI might only be possible by a closer examination of RBD (Angst 1988). As for the anxiety disorders, highly significant associations with insomnia are found, but there is no significantly specific association with any subtype of insomnia. The overall association between insomnia and depression, as well as with anxiety, is in line with the results of other studies using other instruments and the general population (Mellinger et al. 1985), patients (Kales et al. 1983; ASDC 1979), or nurses (Tsoi and Tay 1986). Still, the most impressive finding was that the majority of insomniacs (52%) did not suffer from a depressive or anxiety disorder during the year their insomnia occurred. Consequently, insomnia is considered to constitute an independent syndrome.

Insomnia is associated with a number of other functional syndromes. Significant associations were observed between insomnia and stomach problems, eating/appetite problems, heart complaints, respiratory problems, sexual problems, and exhaustion. However, insomnia was not associated with syndromes causing physical pain, as for instance, back pain or headache. The observed associations could not be explained by coexisting anxiety or depression in a multivariate analysis of variance, except for the heart complaints: the latter are confounded with anxiety disorders. Specifically high associations were observed between both RBI and CI and respiratory troubles, between RBI and heart complaints, and between sexual problems and both RBI and CI.

The abuse (according to DSM-III) of illegal drugs like heroin, cocaine, LSD, and marijuana was too rare in this cohort to be associated with insomnia. Neither was there an association between the weekly intake of alcoholic beverages and insomnia, a finding which is at variance with results of clinical studies, which show a higher consumption of alcohol among patients with insomnia (Kales et al. 1983). Furthermore, the low caffeine consumption of the insomniacs in our study was in contrast to the results of other studies, where high caffeine consumption was associated with insomnia (Shirlow and Mathers 1985; Hicks et al. 1983). This can be interpreted as an attempt to avoid insomnia by consuming less of a substance that is known to cause sleeping problems. Insomniacs, however, have one "vice": on the average they smoke three cigarettes per day more than noninsomniacs.

Insomniacs score higher on the life events schedule of Tennant and Andrews (1976) than controls. This score comprises pleasant and unpleasant life events, which are weighted differentially. The higher scores of insomniacs are not due to specific, highly weighted dramatic events that occurred in the year of their insomnia, but to a higher mean number of events. Among the unpleasant events, insomniacs more often experienced problems concerning interpersonal relationships than controls, but had the same amount of working, financial or private problems. The significance of the interpersonal relationships for insomnia is supported by a conflict score, which is higher for OI and RBI, than for CI and controls. With respect to mastery and self-esteem, insomniacs display a pattern that is similar to that of depressives: they score lower on self-esteem and mastery than controls. The low self-esteem is explained by associated depression: insomniacs without depression have a self-esteem similar to controls. After controlling for depression, the difference in the mastery scores of insomniacs and controls diminishes. Still there remains a significant tendency for lower mastery in subjects with RBI. However, our results do not support a clear lack of coping abilities, as found in insomniacs of other studies (Healey et al. 1981; Kales et al. 1983). Their lower rate of "mastery" is at least partly due to the coexisting depression, which had not been controlled for in either of these studies. At the same time, the elevated life event and conflict scores suggest that insomnia may frequently be triggered by stress in interpersonal relationships. It should be noted that elevated scores are found among insomniacs with OI and RBI, but not with CI. This suggests a more reactive origin of OI and RBI.

Several analyses were carried out with respect to the course of insomnia across the three interviews over 7 years. A simple count of diagnoses across the interviews showed that nearly equal rates of subjects

were free of insomnia (25%), had insomnia once (29%), or twice (30%), while insomnia at all three interviews was less frequent (16%). Obviously, there is a tendency for insomnia to recur. A descriptive classification of patterns of subtypes of insomnia across time into four categories, namely, "increasing", "decreasing", "stable", and "unstable" gives the impression of little stability of subjects as to their subtype of insomnia and shows equal amounts of "increasing" or "decreasing" patterns. These results are very similar to those described by Strauch et al. (1987) among young adolescents.

However, when the distinction between subtypes of insomnia is given up and the patterns of insomnia across time are analyzed with a configuration frequency analysis, there is highly significant evidence for the stability of absence or presence of insomnia across time: those without insomnia in 1979 have a better chance of remaining free of insomnia later on than those with insomnia at the first interview. A further statistical analysis, taking into account subtypes of insomnia, demonstrates that the presence of any subtype of insomnia in 1979 enhances the risk for RBI or CI at the later interviews. OI is a precursor of RBI and CI, but the same is true for RBI or CI as well.

The occurrence of early insomnia (difficulty in falling asleep) is considered to be milder than middle or late insomnia. We examined whether the manifestation of early insomnia in 1979 enhances the risk for middle or late insomnia at follow-up, but no such tendency was found. Instead, there is a tendency for the symptoms of insomnia to be stable over time: subjects with middle or late insomnia in the first interview tend to display middle and late insomnia in 1981 and 1986 as well.

Finally, we addressed the question of whether primary insomnia in 1979 could be a first sign, an early and perhaps disguised precursor of the subsequent onset of a depressive, or an anxiety disorder. For this analysis, only disorders with the first onset within 2 years after the diagnosis in 1979 were considered. Insomnia in 1979 neither predicts the subsequent incidence of depressive disorders nor of anxiety disorders: the relationship between insomnia and depressive and anxiety disorders seems to be based on a pattern of co-occurrence, not on a pattern of time sequence.

In conclusion, with respect to epidemiological and clinical issues, it may be useful to distinguish between a milder type of insomnia, OI, and the two more severe and persistent subtypes, RBI and CI, which are associated differentially with depressive disorders and functional syndromes. Apart from these differences between the subtypes of insomnia, our results show that insomnia is a preponderantly independent syndrome, but accompanies a multitude of functional syndromes, which are – in this young cohort – rather psychic than functional. OI is, as well as RBI, associated with life events and interpersonal conflicts. In a longitudinal perspective, however, the distinction between the three subtypes of insomnia is of no predicitve value. For the 7 years, subjects exhibited little stability with respect to "their" subtypes of insomnia, and all three subtypes of insomnia enhance the risk for further insomnia similarly, but unspecifically. Therefore, the mild type of OI should also not be neglected therapeutically, because our data indicate that insomnia is a recurrent disorder.

References

Angst J (1988) Recurrent brief depression. A new concept of mild depression. In: Abstracts of the XVIth CINP Congress, Munich, 1988. Psychopharmacology [Suppl] 96:123

Angst J, Vollrath M, Koch R, Dobler-Mikola A (1989a) The Zurich Study. VII. Insomnia: symptoms, classification and prevalence. Eur Arch Psychiatry Neurol Sci 238:285–293

Angst J, Vollrath M, Merikangas KR, Ernst C (1989b) Comorbidity of anxiety and depression in the Zurich Cohort Study of Young Adults. In: Maser JD, Cloninger CR (eds) Comorbidity of mood and anxiety disorders. American Psychiatric Press, Washington, DC (in press)

Association of Sleep Disorders Centers (ASDC), Sleep Disorders Classification Committee, Association for the Psychophysiological Study of Sleep (1979) DIMS: Disorders of initiating and maintaining sleep (insomnias). In: Sleep, vol 2, no 1. Raven Press, New York, pp 21–27

Bischofberger A, Thomaier K (1982) Normierung einer Life-Event-Skala. Unveröffentlichte Lizentiatsarbeit, Psychologisches Institut der Universität Zürich

Gislason T, Almqvist M (1987) Somatic diseases and sleep complaints. An epidemiological study of 3201 Swedish men. Acta Med Scand 221:475–481

Hay D, Milne RM, Gilleard CJ (1986) Hypnotic drugs, old people and their habits: a general practice study. Health Bull (Edinb) 44:218–222

Healey ES, Kales A, Monroe LJ, Bixler EO, Chamberlin K, Soldatos CR (1981) Onset of insomnia: role of life-stress events. Psychosom Med 43:439–451

Hicks RA, Kilcourse J, Sinnott MA (1983) Type A-B behavior and caffeine use in college students. Psychol Rep 52:338

Holmes TH, Rahe RH (1967) The social readjustment rating scale. J Psychosom Res 11:213–218

Kales A, Caldwell AB, Soldatos CR, Bixler EO, Kales JD (1983) Psychobehavioral correlates of insomnia. II. Pattern specificity and consistency with the Minnesota Multiphasic Personality Inventory. Psychosom Med 45:341–356

Krauth J, Lienert GA (1973) Die Konfigurationsfrequenzanalyse (KFA) und ihre Anwendung in Psychologie und Medizin. Ein multivariates nicht-parametrisches Verfahren zur Aufdeckung von Typen und Syndromen. Karl Alber, Freiburg, München

Mellinger GD, Balter MB, Uhlenhuth EH (1985) Insomnia and its treatment. Prevalence and correlates. Arch Gen Psychiatry 42:225–232

Partinen M, Eskelinen L, Tuomi K (1985) Epidemiology of insomnia: environmental factors. In: Koella WP, Rüther E, Schulz H (eds) Sleep '84. Gustav Fischer, Stuttgart New York, pp 42–44

Pearlin LI, Schooler C (1978) The structure of coping. J Health Soc Behav 19:2–21

SAS (1985) User's Guide: Statistics, 5th edn. SAS Institute, Cary, NC

Schallberger U (1976) Die hierarchische Konfigurationsfrequenzanalyse. Eine Einführung in die Methode und ihre Anwendung, mit einem Computerprogram und Datenbeispielen. Psychologisches Institut der Universität, Zürich

Shirlow MJ, Mathers CD (1985) A study of caffeine consumption and symptoms: indigestion, palpitations, tremor, headache and insomnia. Int J Epidemiol 14:239–248

Strauch I, Meier B, Steiger B (1987) Einschlafstörungen in der Adoleszenz – Ergebnisse einer Längsschnittbefragung. Schweiz Z Psychol 46:115–121

Tennant C, Andrews G (1976) A scale to measure the stress of life events. Aust NZ J Psychiatry 10:27–32

Tennant C, Andrews G (1977) A scale to measure the stress of life events. Aust NZ J Psychiatry 11:163–167

Tsoi WF, Tay GE (1986) Sleep, personality and mental health. Singapore Med J 27:49–53

Received December 22, 1988