ORIGINAL ARTICLE

The Structure and Stability of Common Mental Disorders

The NEMESIS Study

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Background: We analyzed the underlying latent structure of 12-month *DSM-III-R* diagnoses of 9 common disorders for the general population in the Netherlands. In addition, we sought to establish (1) the stability of the latent structure underlying mental disorders across a 1-year period (structural stability) and (2) the stability of individual differences in mental disorders at the level of the latent dimensions (differential stability).

Methods: Data were obtained from the first and second measurement of the Netherlands Mental Health Survey and Incidence Study (NEMESIS) (response rate at baseline: 69.7%, n=7076; 1 year later, 79.4%, n=5618). Nine common *DSM-III-R* diagnoses were assessed twice with the Composite International Diagnostic Interview with a time lapse of 1 year. Using structural equation modeling, the number of latent dimensions underlying these diagnoses was determined, and the structural and differential stability were assessed.

Results: A 3-dimensional model was established as having the best fit: a first dimension underlying substance use disorders (alcohol dependence, drug dependence); a second dimension for mood disorders (major depression, dysthymia), including generalized anxiety disorder; and a third dimension underlying anxiety disorders (simple phobia, social phobia, agoraphobia, and panic disorder). The structural stability of this model during a 1-year period was substantial, and the differential stability of the 3 latent dimensions was considerable.

Conclusions: Our results confirm the 3-dimensional model for 12-month prevalence of mental disorders. Results underline the argument for focusing on core psychopathological processes rather than on their manifestation as distinguished disorders in future population studies on common mental disorders.

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EPIDEMIOLOGICAL studies on *DSM-III-R* diagnoses in the general population have often revealed strikingly high levels of comorbidity; substantial proportions of respondents meet the criteria for more than 1 psychiatric disorder.[1-6] This comorbidity represents a serious challenge to those seeking to understand the specificity of distinguished *DSM-III-R* disorders.[7-11] A recent analysis of comorbidity in the ARCHIVES identified latent dimensions underlying the different diagnoses in the National Comorbidity Survey.[10] Results of this study suggest that a 2-dimensional (D) structure of internalizing and externalizing disorders is suited to explain the comorbidity between common mental disorders in the general population. Thereby, the internalizing dimension appeared to distinguish 2 subdimensions—one referring to the combination of anxious-depressive diagnoses (depression, dysthymia, and generalized anxiety disorder [GAD]) and one referring to diagnoses of more specific anxiety disorders (simple phobia, social phobia, agoraphobia, and panic disorder). It was concluded that these latent dimensions should be interpreted in terms of core psychopathological processes underlying the different diagnoses of common mental disorders.

This analysis met some serious criticism.[12] The exclusive reliance on lifetime diagnoses, which allowed no distinction between subjects with current comorbid disorders and those with temporally separate disorders over the life span, was mentioned as a chief limitation of the study. However, Krueger[10] did report replicating his model using 12-month diagnoses, which was in accordance with his analysis on common mental disorders in an earlier article.[11] The restricted range of 10 *DSM-III-R* diagnoses and the fact that these were studied without considering subthreshold diagnostic information would further limit the interpretation of the findings. It was concluded that future studies would have to substantiate and

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SUBJECTS AND METHODS

SAMPLE

First Wave

NEMESIS is based on a multistage, stratified, random sampling procedure.[5,6] Our first step was to draw a sample of 90 Dutch municipalities. The stratification criteria were urbanization and adequate dispersion over the 12 provinces. The second step was to draw a sample of private households (addresses) from post office registers. The number of households selected in each municipality was determined by the size of its population. The selected households were sent a letter of introduction and shortly thereafter were contacted by telephone by the interviewers. Households with no telephone or with unlisted numbers (18%) were visited in person. One respondent was randomly selected in each household, the member with the most recent birthday, on the condition that he or she was between 18 and 64 years of age and sufficiently fluent in Dutch to be interviewed. Persons who were not immediately available (owing to circumstances such as hospitalization, travel, or imprisonment) were contacted later in the year. To establish contact, the interviewers made a minimum of 10 telephone calls or visits to a given address at different times of the day and week, if necessary. Respondents were interviewed in person. They received a small gift at the end of the interview.

To optimize response and to compensate for possible seasonal influences, we spread the initial data collection phase over the entire period from February through December 1996. A total of 7076 subjects were interviewed in person in the first wave. The response rate was 69.7% (of the adult persons eligible for interviewing). Compared with the Dutch population (figures of Statistics Netherlands), the participants in the survey are representative of the population in terms of sex, civil status, and degree of urbanization of place of residence. Only the 18- to 24-year-old age group was underrepresented. Poststratification weighting factors were used to approximate the distribution of major demographic variables in the Dutch population.[5,6]

Second Wave

All persons who took part in the first interview were approached for follow-up. As in the first wave, to make contact the interviewers made a minimum of 10 telephone calls or visits at various times of the day and week. A tracing process involving mail, telephone, field tracing, and municipality records was used to locate the original sample. The fieldwork in the second wave took place from February 1997 through January 1998. The mean (SD) interval between the first and second interview was 379 (35) days. Of the 7076 subjects who participated in the first interview, 5618 were reinterviewed in the second wave (79.4%). Psychopathology did not have a strong impact on attrition. Of all investigated disorders presented here, only 12-month agoraphobia (odds ratio [OR], 1.96) and social phobia (OR, 1.37), adjusted for demographic factors, was associated with an increased likelihood to be lost to follow-up.[13]

ASSESSMENT OF *DSM-III-R* DIAGNOSES

The analyses in this article were based on 12-month diagnoses in NEMESIS. Diagnoses were made using the Composite International Diagnostic Interview (CIDI).[14] The CIDI is a structured interview developed by the World Health Organization[15,16] on the basis of the Diagnostic Interview Schedule and the Present State Examination. It was designed for use by trained interviewers who are not clinicians. The CIDI version 1.1 has 2 diagnostic programs to compute diagnoses according to the criteria and definitions of both *DSM-III-R* and *International Classification of Diseases, 10th Revision*. The CIDI is now being used worldwide, and World Health Organization research has found

replicate the findings of Krueger before the implications of these findings could be fully evaluated. In addition, more conclusive evidence would have to be provided by, for example, prospective longitudinal or age-cohort studies that allow for more systematic evaluation of the system and its properties.[12]

In this article we want to replicate and extend the findings of Krueger for the general population in the Netherlands, using data from a survey that resembles the National Comorbidity Study, the Netherlands Mental Health and Incidence Study (NEMESIS). Because NEMESIS was organized as a longitudinal population study, we were able to substantiate and extend the findings in 2 ways. First, by assessing the stability of the underlying latent structure of mental disorders across a 1-year period by testing whether the structural model found at baseline was the same as that found 1 year later (we denote this as structural stability). Second, by assessing the stability of individuals' scores on the latent dimensions in the structural model over time (we denote this as differential stability).

RESULTS

Tetrachoric correlations among these disorders were computed for the entire sample at T0, the entire sample at T1, and between T0 and T1 in the sample that participated twice (the entire sample at T1). (The resulting correlation matrices are available from W.A.M.V.) Inspection of these matrices revealed a comparable pattern of comorbidity between 12-month diagnoses and that found in the National Comorbidity Survey on lifetime diagnoses, with relatively high correlations between the disorders represented within the same factors, while correlations between disorders in different factors were lower. In addition, correlations between disorders at T0 and T1 were substantial, ranging from 0.48 (agoraphobia) to 0.84 (drug dependence).

LATENT DIMENSIONS AT T0

Fit indices were computed for each of the tested models in the entire sample at T0 (**Table**). Results revealed the

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high interrater reliability,[17,18] high test-retest reliability,[19,20] and acceptable validity for practically all diagnoses.[21,22] Diagnoses examined were made without the imposition of hierarchical exclusion rules.

STATISTICAL ANALYSIS

Our analysis focused on a subset of *DSM-III-R* disorders assessed in NEMESIS. Because we wanted to ensure reliable, stable estimates of covariation between disorders, we excluded disorders with a very low base rate (schizophrenia, mania, obsessive-compulsive disorder, eating disorders). In addition, alcohol abuse and drug abuse were excluded because more severe variants (alcohol dependence, drug dependence) were included. For 9 *DSM-III-R* disorders, the prevalence rates were high enough to be used in further analysis: major depression, dysthymia, agoraphobia, social phobia, simple phobia, GAD, panic disorder, alcohol dependence, and drug dependence. The Prelis computer program[23] was used to create a tetrachoric correlation matrix and an asymptotic covariance matrix from the 12-month diagnostic variables, which was used as input for the confirmatory factor analysis. The following 4 models were put to the test: (1) the 1-D model, in which comorbidity between diagnoses is assumed to reflect one common factor of vulnerability, (2) the 2-D model that is most in accordance with child psychiatric epidemiology and assumes that 2 underlying dimensions of internalizing and externalizing pathological processes are able to explain the comorbidity between diagnoses,[24,25] and (3) a 3-D model in which patterns of comorbidity are assumed to be in accordance with higher order categories of the *DSM-III-R* spectrum (mood disorders, anxiety disorders, and substance use disorders).[26] (4) In addition, we put the alternative 3-D model of Krueger[10] to the test, in which GAD is assumed to belong to the mood disorders (the "anxious-misery" dimension), while the specific phobias are assumed to be united in a separate dimension (the "fear" dimension).[12] Owing to the absence of antisocial personality disorder in our data set, we were not able to test a 4-D model.

The confirmatory factor analysis models were tested using the Lisrel computer program,[27] version 827, with the weighted least squares procedure. The fit of the models was evaluated with the Z2 and corresponding *P* value (owing to large sample size, $\alpha = .01$), the goodness of fit index, the adjusted goodness of fit index, the root mean square residual (RMR), and the Bayesian information criterion (BIC).[27] Compared with the other indexes, the BIC emphasizes the selection of parsimonious models.[9] Differences in BIC greater than 10 represent strong evidence in favor of the model with the smaller BIC value.[28] In addition, as most of the factor models are nested, the models can be tested directly against each other to find the superior model. A model can be considered a significant improvement in comparison to another model if the resulting χ^2 differs significantly from the χ^2 of the other model (with $\alpha = .01$, this is the case when the change in χ^2 exceeds the critical value of $\chi^2_1 = 6.635$, and $\chi^2_2 = 9.210$).

In our analysis, we first tested the 4 models for all respondents in the first wave (n = 7076) and repeated this for the second wave (n = 5618). To determine the differential stability of the first order latent dimensions during a 1-year period, we estimated the confirmatory factor analysis models simultaneously, thereby positing paths linking the latent factors measured at both times of measurement. To determine the structural stability of the latent structure underlying mental disorders during a 1-year period, we tested the fit of the last 3-factor model, thereby making the restriction that the indicator paths were the same for both waves, and assessed whether the fit of this model was not worse than the fit of the unrestricted model (in which indicator paths were set free, and thus could diverge between baseline and follow-up). If the fit of the restricted model is not worse, this indicates that a comparable structure is found at both times of measurement.

best fit for the alternative 3-factor model, which achieved the only nonsignificant χ^2 value, the lowest BIC value, and was superior to the other models at reproducing the observed sample correlations (smallest RMR). Direct factor model comparisons (Table, last 4 columns) showed that the alternative 3-factor model fitted significantly better than the other factor models. Although the 3-factor model could not directly be compared with the 3_{DSM}-factor model (these models are not nested), it fitted significantly better than the 2-factor model, while the 3_{DSM}-factor model did not. Furthermore, it can be noted that the 2-factor model fitted significantly better than the 1-factor model and did not fit significantly worse than the 3_{DSM}-factor model.

Because of the high correlation between the anxious-misery and fear factors, like Krueger[10] we reparameterized the alternative 3-factor model by defining those 2 factors as latent indicators of a higher-order internalizing factor (**Figure 1**). The large loadings of the higher-order internalizing factor on these subfactors (0.96 and 0.85) reveal that this is a good way of expressing the 3-factor model. All factor loadings in Figure 1 are very large, with the exception of alcohol dependence (0.47 vs loadings ≥0.69 for all other disorders). Thus, comorbidity between disorders belonging to the other 2 (sub) dimensions is stronger than that between the substance use disorders.

LATENT DIMENSIONS AT T1

Fit indices were computed for each of the tested models for the entire sample at T1. Again, the alternative 3-factor model achieved the best fit. As in the first measurement, this model achieved the only nonsignificant χ^2 value, achieved the lowest BIC value, the lowest RMR, and beat all competing models in direct model comparisons (Table). Again the second-order factor of internalizing disorders seems to be a reasonable way of expressing the underlying processes with loadings of 0.92 and 0.94 of the internalizing dimension on its subfactors (**Figure 2**). In contrast to the first measurement, all loadings in Figure 2 are uniformly large (lowest loading, 0.71), indi-

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Fit Indices for and Model Comparisons Between 1-, 2-, and 3-Factor Models of 9 *DSM-III-R* Diagnoses in 2 Waves of NEMESIS*

Factor Models	Fit Indices					Factor Model Comparisons			
	χ^2	*df*	*P*	RMR	BIC	Models	χ^2 Difference	*df* Difference	*P*
Wave 1 (n = 7076)									
1	129.33	27	<.001	0.11	−110				
2	105.31	26	<.001	0.10	−125	2 vs 1	24.02	1	<.001
3_{DSM}†	101.44	24	<.001	0.10	−111	3_{DSM} vs 2	3.87	2	NS
3	42.38	24	.01	0.10	−170	3 vs 2	62.93	2	<.001
Wave 2 (n = 5618)									
1	84.97	27	<.001	0.14	−148				
2	57.45	26	<.001	0.11	−167	2 vs 1	27.52	1	<.001
3_{DSM}†	55.17	24	<.001	0.11	−152	3_{DSM} vs 2	2.28	2	NS
3	39.22	24	.03	0.10	−168	3 vs 2	18.23	2	<.001
Wave 1 and wave 2 (n = 5618)									
1	327.50	128	<.001	0.16	−778				
2	325.16	128	<.001	0.12	−780	2 vs 1	2.34	1	NS
3_{DSM}†	327.96	125	<.001	0.12	−751	3_{DSM} vs 2	2.80	3	NS
3	258.03	125	<.001	0.10	−821	3 vs 2	67.13	3	<.001

**NEMESIS indicates Netherlands Mental Health Survey and Incidence Study; χ^2, χ^2 goodness of fit index;* df, *degrees of freedom;* P, P *value for χ^2; RMR, standardized root mean squared residual; BIC, Bayesian information criterion; and NS, not significant (P>.05). All (adjusted) goodness of fit indices are ≥.99. All (non-) normed fit indices are ≥.95. The fit of factor models with second-order variables is the same as those without them.*

†The 3-dimensional model according to the DSM-III-R *distinguishes 3 latent dimensions: mood disorders, anxiety disorders, and substance use disorders. In the other 3-dimensional model, mood disorders are combined with the generalized anxiety disorder, the other anxiety disorders constitute the second latent dimension, and substance use disorders the third.*

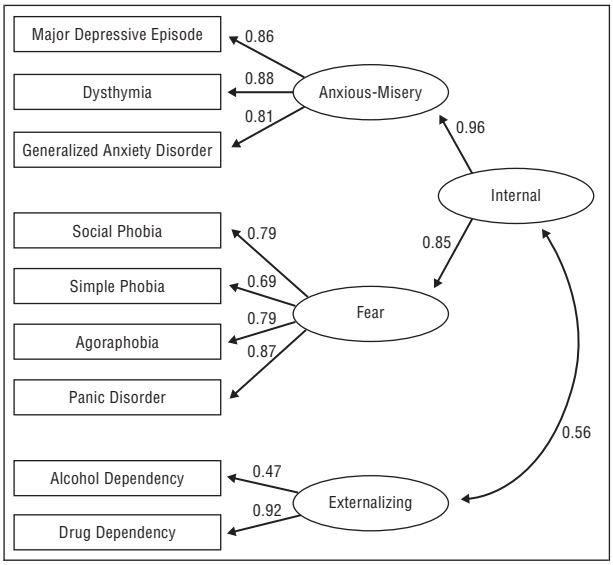

Figure 1. *Best-fitting 3-dimensional model displaying underlying structure for common mental disorders at first measurement of the Netherlands Mental Health Survey and Incidence Study (NEMESIS). All parameter estimates are standardized and significant at* P<.01.

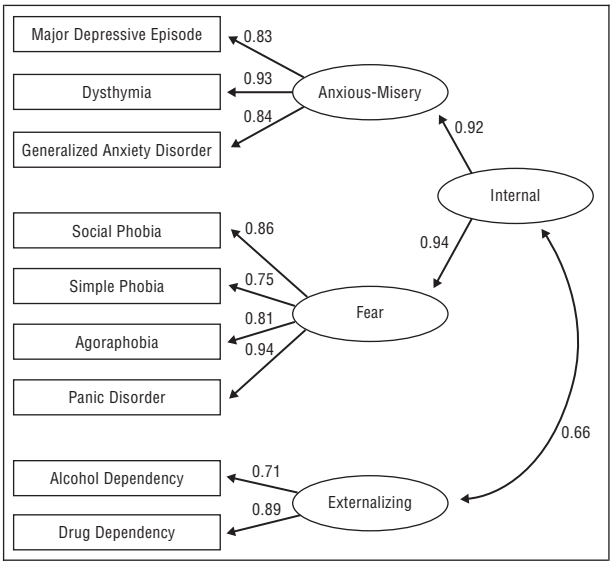

Figure 2. *Best-fitting 3-dimensional model displaying underlying structure for common mental disorders at second measurement of the Netherlands Mental Health Survey and Incidence Study (NEMESIS). All parameter estimates are standardized and significant at* P<.01.

cating that all disorders can be interpreted as a good indicator of the corresponding factor, including substance use disorders.

DIFFERENTIAL STABILITY OF LATENT DIMENSIONS ACROSS A 1-YEAR INTERVAL

Fit indices were computed for each of the tested models and the longitudinal sample that took part in both measurements. In line with results at T0 and T1, the 3-factor model achieved the best fit for the longitudinal data, revealed by the lowest χ^2 value, the lowest BIC value, and the lowest RMR (**Figure 3**) and again beat all competing models in direct model comparisons. The differential stability of the 3 factors proved to be substantial (0.85 for the anxious-misery factor, 0.89 for the fear factor, and 0.96 for the addiction factor), confirming the structural character of the underlying processes revealed in the latent dimensions.

To determine whether the differential stability was the same for the anxious-misery factor as for the fear factor, we reran this analysis, forcing both paths to be equal. Results showed that this model fitted significantly worse (χ^2_1=11.73, P<.001). Therefore, the differential stabil-

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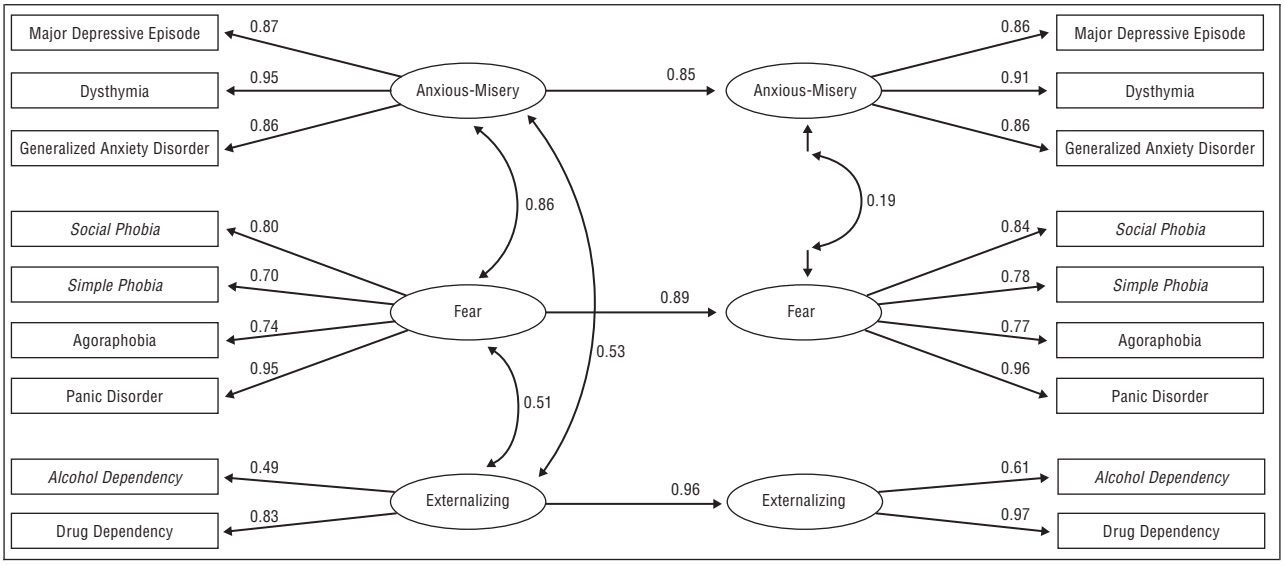

Figure 3. *Best-fitting 3-dimensional model displaying underlying structure for common mental disorders at first and second measurement of the Netherlands Mental Health Survey and Incidence Study (NEMESIS). All parameter estimates are standardized and significant at* P<*.01. Errors in indicators with italicized names were allowed to covary across the 2 waves.*

ity of the fear factor is slightly higher than that of the anxious-misery factor. Similar tests showed that the stability of the externalizing factor was higher than that of either the anxious-misery factor (χ^2_1=28.91, P<.001) or the fear factor (χ^2_1=13.10, P<.001).

STRUCTURAL STABILITY ACROSS A 1-YEAR INTERVAL

Next we checked whether the underlying latent structure of mental disorders was comparable at both waves. We reran the 3-factor model for the longitudinal data, thereby making the restriction that the indicator paths were the same for both waves. The fit of this model was χ^2_{131}=263.37; P<.001; RMR, 0.09; and BIC, –868. The restricted model did not fit worse than the unrestricted model (χ^2_6=5.34, P>.05). According to the lower BIC, the restricted model is even preferable as it is more parsimonious. In conclusion, the indicator paths of wave 1 are similar to those of wave 2 or, in other words, the underlying latent structure of mental disorders is the same at both waves.

COMMENT

This article examined the factor structure of 9 mental disorders in the general population in the Netherlands and sought to establish the model that provided the best fit for comorbidity between 12-month prevalences of *DSM-III-R* diagnoses. The alternative 3-D model achieved the best fit, revealing a dimension of substance use disorders resembling the externalizing factor found by Krueger[10] and a broad internalizing factor that further distinguished between an anxious-misery subdimension and a fear subdimension. The structural stability of this model was adequate, and the differential stability of the latent dimensions was substantial.

The strengths and weaknesses of our study should be kept in mind when interpreting these results. Like the National Comorbidity Survey, NEMESIS is a strong survey because of its large sample size and its representativeness. Results from NEMESIS can therefore be generalized to the population of the Netherlands. An additional strength of the NEMESIS survey is its longitudinal design, which enabled us to study the structural and differential stability of latent dimensions in the general population. Weaknesses of the NEMESIS study resemble those in the National Comorbidity Survey. Diagnoses were based on interviews by trained nonclinicians and are likely to be less accurate as diagnoses made by professional clinicians. Furthermore, we had to restrict ourselves to 9 common mental disorders (antisocial personality disorder was not included in NEMESIS), whereas in the National Comorbidity Survey, data on 10 common disorders were available. The absence of antisocial personality disorder has implications for the interpretation of the externalizing factor found in our study. In NEMESIS this factor was restricted to the substance dependence disorders and it should therefore be interpreted as such. In general, restricting ourselves to the most common mental disorders is a weakness in the sense that the generalization of our findings cannot be extended beyond these disorders. On the other hand, population studies may not be the best tool for studying less common disorders, as the number of respondents meeting criteria for other diagnoses is too small to enable reliable and valid results.

The main extension of Krueger's findings presented in this article lies in the fact that our analysis was based on longitudinal data from 2 measurements with a 1-year interval. We were able to analyze whether the main findings of the first measurement were replicated for the data of the second measurement and thus asses the structural stability of the models, and we were also able to model the stability of underlying factors during this 1-year interval. These extended analyses led to results that were strikingly in accordance with those of Krueger. We replicated the fit of the alternative 3-D model for 12-month prevalence in common mental disorders at both times of

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measurement with substantial longitudinal stability of underlying dimensions throughout a 1-year interval, stability coefficients being greater than or equal to 0.85 for all factors.

However, there are some difficulties in the interpretation of these findings. Analyses were based on a relatively small number of common *DSM-III-R* diagnoses. Criteria for diagnosis of these disorders are quite frequently met in population studies, and the clinical relevance of this fact has often been questioned.[29,30] We should consider the possibility that meeting criteria for these *DSM-III-R* diagnoses in a population study, without consideration of severity of disorders or of related functional impairments, need not indicate the presence of a complete, clinically relevant psychiatric syndrome.[30] If so, comorbidity of diagnoses in our study may reflect co-occurrence of symptoms at subthreshold level that—as Wittchen et al[12] have rightly pointed out—are shared to a substantial degree by the disorders studied here. As we had to rely on categorical classifications, our approach is furthermore not able to address the different diagnoses in more detail on the symptom level. In future research we therefore plan to make more detailed analysis of patterns of co-occurrence between symptoms to address subthreshold manifestations of different psychiatric syndromes. In doing so, focusing on underlying common factors in the manifestation of psychopathological symptoms and syndromes seems to be a promising approach.[11,31]

Notwithstanding these shortcomings, we consider the dimensional approach an important tool for analyzing comorbidity between common mental disorders for the following reasons. First, our final dimensional model illustrates in a simple and elegant way that within dimensions there is probably no strong line to be drawn between different disorders, as comorbidity between diagnoses is the rule rather than the exception. Future research could benefit from searching for core psychological features of these disorders rather than searching to further differentiate between subtypes of disorders. This comorbidity between common *DSM-III-R* diagnoses tends to follow the classification of disorders in the *DSM-III-R* with one major exception: GAD seems to co-occur more frequently with mood disorders and not with other anxiety disorders. This finding is in accordance with prior studies and seriously questions the conventional distinction between mood and anxiety disorders in *DSM-III-R*.[11,31-35] The suggestion that depressive disorders and GAD may be mused by the same genetic factors and can be interpreted as different manifestations of the same vulnerability[10,31,32] is clearly enhanced by our results.

In addition, using structural equation modeling or dimensional models offers considerable methodological and analytical advantages in the analysis of comorbidity between common mental disorders[10] as it is no longer necessary to resort to common but problematic research strategies like analyzing atypical samples (eg, analyzing "pure cases") to avoid confounding, or disregarding, comorbidity when analyzing particular disorders. We think that further research may greatly benefit from using a dimensional approach. We hope that our work will be regarded as a further stimulation of such efforts.

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