Pathological forms of dental anxiety : aetiology, prevalence and fear evoking aspects

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CHAPTER 3

THE STRUCTURE OF COMMON FEARS[1]

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Introduction

Fears are fairly widespread in the normal population, with fear of animals as one of the most frequently reported fears (2-4). Several attempts have been undertaken to classify fears in categories or hierarchical structures to provide a descriptive framework for classification (5, 6). Studies which have examined the factor structure of common fears demonstrated discrepant findings, with the number of fear factors or clusters which were derived varying between two and five (1, 5, 7-14).

A significant drawback of a number of these studies is that they relied mainly on fear inventories like the Fear Survey Schedule (FSS: 5, 7, 10, 11). The usefulness of the FSS in the classification of fears can be questioned as the FSS does not seem to assess specific or circumscribed objects or situations *per se*. For example, fear of germs or fear of getting a serious illness may be connected to the subtype blood-injection-injury fear, but also to obsessive-compulsive disorder (15, 16) or hypochondrias. In addition, some of the fears included in the FSS can be considered irrational and dysfunctional (e.g. fear of vacuum cleaners), while others are not (e.g. fear of dead bodies).

Other limitations of the studies which investigated the structure of fears are the following: the use of student samples (7, 13), the use of samples covering a limited age range (10) and the use of model-fitting procedures such as confirmatory factor analysis (7, 13, 14). Only one study used both explorative and confirmative factor analyses (8). In the latter study, using data from the National Comorbidity Survey, five different fear factors from a set of 19 common fears could be identified, of which ten fears are included as specific phobia subtypes in the current DSM version (8). The fears were classified into one of the following categories: agoraphobia, speaking fears, fears of being observed, fears of heights or water, and a last category (defined as 'threat fears') that appeared a broad constellation of fears (i.e. snakes/animals, storm/thunder, blood/needles, being alone, closed spaces).

Another approach to study the structure of feared situations is to explore the extent to which the patterns of findings generally correspond to the phobic divisions retained in the DSM-IV-TR. The current version of the DSM specifies five main categories or subtypes of specific phobia: animal type (e.g. phobias of spiders and dogs), natural-environment type (e.g. phobias of heights and water), situational type (phobias of enclosed spaces and flying), blood-injury-injection type (e.g. phobias of receiving an injection or seeing blood) and a miscellaneous category named 'other type' (e.g. phobias of choking and vomiting). Until now, only one study has attempted to determine specifically whether the structure of fears possesses commonalities with the DSM-IV-TR division of specific phobias (1). This study, using data from a randomly selected sample of about 700 subjects of the Swedish city of Stockholm, found support for a classification of fears comprising of three factors: a situational factor (lightning, enclosed spaces, darkness, flying and heights) an animal factor (spiders and snakes) and a mutilation factor (injections, dental treatment, injuries). The findings of other studies which investigated the structure of fears lend only partial support to a DSM-based five factor model. Almost all studies found corroboration for the existence of some kind of blood-injury-injection fears cluster (1, 5, 7-9, 11-14). Some less conclusive evidence has also been found for a category of situational fears (1, 9, 12-14) and natural-environment fears (8-10).

In view of the discrepant findings regarding the factor structure of fears, the purpose of the current study was to expand on the previous studies aimed to contribute to the development of a framework describing the structure of common fears. This was done by delineating the multidimensional structure of 11 common fears, by means of an exploratory factor analysis performed on data from the Dutch general population. Subsequently, the newly derived model was tested against two other models the DSM-IV-TR model, (distinguishing four factors excluding the subtype 'other type'), and the one found by Fredrikson and his colleagues (consisting of three discernable factors: a situational, animal, and mutilation type), using the data of a second, independent sample of the Dutch population. It was determined which of these three models would provide the best fit of the data.

Method

Assessment A questionnaire booklet was used, containing a number of self-report measures. In the first part, data on demographic variables (i.e. age, gender, marital status and country of birth) were collected. The second part of the questionnaire consisted of 11 questions pertaining to the presence or absence of 11 common fears (i.e. fear of injections, snakes, spiders, thunder, enclosed spaces, physical injuries, darkness, flying, heights, blood and dental treatment). Each of these fears, with the exception of the blood fear, was adopted from an earlier study conducted by FREDRIKSON *et al.* (1). When the participants responded in the affirmative to one or more of these fears, they were invited to complete the last part of the questionnaire in which the severity of present fears was assessed using a visual analogue scale (VAS) with 0 indicating 'no fear at all' and 100 indicating 'terrified'.

Sample selection Two independent samples were taken from the Dutch population, which consists of about 16.3 million people (17). To obtain a geographically diverse sample (e.g. urban as well as rural areas) and to have sufficient opportunity to complete the questionnaire, exact locations were selected in advance. All potential participants (N=1,522) of Sample I were travelling by means of public transport (trains and intercity buses) covering tracks between most major cities across the Netherlands (i.e. Den Helder, Meppel, Zwolle, Groningen, Amsterdam, Leiden, Den Haag, Rotterdam, Dordrecht, Roermond, Arnhem, Nijmegen and Vlissingen). Of the 1,522 persons approached, 965 agreed to participate. Four questionnaires were incomplete, leaving 961 questionnaires for subsequent analyses. Reported reasons for refusal were: not feeling like it (N=165), being busy with something else (N=103), insufficient command of the Dutch language (N=92), leaving the train or intercity bus in a moment (N=60), being too tired (N=49), age under 18 (N=48) or claiming not to be scared (N=40).

All potential participants (N=1,446) of Sample II were visitors of a wide range of public places (supermarkets, cafés with terraces, parks and shopping malls, etc.) in several parts of the Netherlands. Of the 1,446 approached, 1,002 people agreed to participate, three questionnaires were completed by subjects under 18 and one was incomplete, leaving 998 questionnaires for subsequent analyses. Reported reasons for refusal participation were: being busy with something else (N=243), not feeling like it (N=116), insufficient command of the Dutch language (N=39), age under 18 (N=37), claiming not to be scared (N=6), feeling ill (N=2) or forgot reading glasses (N=1).

Procedure For both samples, identical procedures were used. That is, in both samples potential participants were approached by a female advanced graduate student and invited to participate in a study on fears. After this introduction, participants were invited to complete the questionnaire booklet if they had reached the age of 18 and had sufficient command of the written Dutch language. Verbal informed consent was obtained in all cases. The decision to use face-to-face administration, rather than telephone, mail or internet administration was based on considerations related to coverage properties, accuracy of the screening, response rate and length of the survey/respondent burden (18). This study was approved by and carried out under the auspices of The Netherlands Institute for Dental Sciences (IOT) and performed according to the ethical principles described in the Helsinki Declaration.

Data analyses The distributions of the demographic variables, prevalence of fears and severity ratings of fears of the participants in the two samples were compared using Chi-square analyses for nominal data and Student's t-tests for numerical data. A principal component analysis (PCA), with promax rotation (19), was conducted to assess the factor structure in the severity of fears in Sample I. Promax rotation was chosen as a procedure for rotation because this oblique method allows the natural intercorrelation of the underlying factors and is specifically suitable for large datasets (20). In addition, Promax has advantages over alternative oblique methods in terms of the general robustness of the solution it provides (21). The analysis was conducted on the severity ratings of the 774 subjects who had indicated being fearful of at least one of the stimuli in order to reduce the loss of variance in severity scores. For any specific fear the respondent indicated that it was absent, a VAS score of zero was imputed. Subsequently, the three models, (a) the DSM-IV model (Model I), (b) the FREDRIKSON *et al.* (1) model (Model II), and (c) the model which resulted from the current study (i.e. the model which resulted from the PCA: Model III), were fitted on Sample II by means of confirmatory factor analysis (CFA) using Lisrel version 8.80. In Table 1 a detailed description of the models is presented. These CFAs were conducted on the severity ratings of the 804 subjects who had indicated being fearful of at least one of the situations. To determine which model fitted the data best, a number of indices were used. The χ^2 to degrees of freedom (χ^2/df) ratio statistic was used to test the closeness of fit of the hypothesised models. For a good model fit, the ratio χ^2/df should be as small as possible. A ratio between 2 and 3 is indicative of an 'acceptable' model fit, and a ratio between 0 and 2 is indicative of a 'good' model fit (22). The χ^2/df ratio statistic was used rather than the χ^2 test statistic because it is less sensitive to sample size (22). Two additional fit indices were used: the root mean square error of approximation (RMSEA) and the goodness of fit index (GFI). RMSEA values ranging between 0 and 0.05 indicate a good fit (22). GFI values range between 0 and 1.00, with values near 1.00 indicating an acceptable to good fit. Both indices are less sensitive to large sample sizes than the other indices. Finally, Model I was compared with Model II and Model III, by means of the log-likelihood difference test ($\Delta\chi^2$) to compare the fit of two models, which are nested.

Table 1 *Clusters of fears as proposed by DSM-IV-TR and as obtained in different studies*

Source	Cluster I	Cluster II	Cluster III	Cluster IV
DSM-IV-TR (Model I)	Blood-injection-injury Injections, dentists, injuries, blood	Situational Enclosed spaces, flying	Natural- environment Lightening, darkness, heights	Animal Snakes, spiders
FREDRIKSON *et al.* (1) (Model II)	Blood-injection-injury Injections, dentists, injuries.	Situational Enclosed spaces, flying, lightening, heights, darkness		Animal Snakes, spiders
OOSTERINK *et al.* (Model III)	Blood-injection-injury Injections, dentists, injuries, blood	Situational - Animal Enclosed spaces, darkness, lightening, snakes, spiders	Heights Heights, flying	

Results

Participants In Sample I (N=965), women represented 50.9% (N=489) of the sample. Age of the participants varied from 18 - 93 yr (Mean=32.0, standard deviation, (SD)=15.4). The marital status of the participants revealed that 34.2% was not involved, 32.3% was married or cohabiting, 28.6% was dating, and 4.9% was either divorced or widowed. The distribution of origin showed that 84.7% was Dutch, 2.7% was Surinamese, 1.9% was Turkish, 1.2% was Antillean, 1.2% was Moroccan and 8.3% was from another country of origin.

Women represented 48.3% (N=482) of sample II (N=1,002). Age of the participants varied from 18.0 - 89.0 yr (Mean=39.5, SD=15.4). The marital status of the participants revealed that 64.3% was married or cohabiting, 16.9% was not involved, 13.0% was dating, and 5.8% was either divorced or widowed. The distribution of origin showed that 91.7% was Dutch, 1.4% was Surinamese, 1.3% was Moroccan, 0.8% was Turkish, 0.5% was Antillean and 4.3% was from another country of origin.

Comparison of the two samples Firstly, the demographic distributions of the two samples were analysed. It appeared that the samples differed significantly on marital status [$\chi^2(4)=220.29$, $P<0.001$], country of birth [$\chi^2(1)=26.04$, $P<0.001$] and age [$t(1954)= -11.0$, $P<0.001$], but not on the distribution of gender [$\chi^2(1)=2.16$, $P=0.142$]. The next step involved the assessment and comparison of the prevalence rates of fears in both samples. Chi-square analyses did not detect any significant difference in the prevalence rates of the 11 fears between Samples I and II, the only exception being fear of physical injuries $\chi^2(1)=18.24$, $P<0.001$. With regard to the severity of the fears only one significant difference was found for fear of dental treatment [$t(475)=-3.09$, $P=0.002$)] between Sample I and Sample II. This means that apart from some of the demographic characteristics, overall the two samples could be considered similar in terms of prevalence of fears and severity of fears.

Principal Component Analysis (PCA) on the severity ratings of the fears in Sample I Subsequent analyses were conducted on severity data of the 11 fears on the 774 subjects in Sample I who had indicated to have at least one fear. A PCA with promax rotation was conducted to explore the factor structure of the current data. Barlett's test of sphericity in Sample I was significant ($\chi^2=916.71$, d.f.=55, $P<0.001$) and the Kaiser-Meyer-Olkin measure of sample was 0.73, both indicating that the data was appropriate for a factor analysis. This PCA resulted initially in 4 factors with eigenvalues $\geq$1.00 (2.48, 1.23, 1.01, and 1.00) explaining 52.2% of the variance. Subsequent inspection of the content of the four factors revealed that these were hard to interpret (see Table 2) and, therefore, a three-factor solution was chosen as most appropriate. This three-factor solution accounted for 43.0% of the variance. Furthermore, a factor loading of $\geq$ 0.30 was defined as salient (23). This three-factor solution had a good simple structure, as there were no items without a salient loading on any factor, no items loading on more than one factor, and each factor was well represented (i.e. two or more items on each factor). The first factor (situational-animal factor) was a factor with high factor loadings on fears of darkness, thunder, enclosed spaces and fears of spiders, and a moderate loading on snakes. The second factor (blood-injection-injury factor) had high factor loadings on the fears of injections, blood, dental treatment and physical injuries. The third factor (heights factor) showed high loadings on fears of heights and flying (see Table 3).

Confirmatory Factor Analysis (CFA) on the severity ratings of the fears in Sample II The CFAs were conducted on the severity data (Visual Analogue Scale data) of the 11 fears of the 804 subjects in Sample II who had indicated having at least one fear. Three models were fitted: (a) the DSM-IV model (Model I), (b) the FREDRIKSON *et al.* model (Model II), and (c) the model which resulted from the PCA in the current study (Model III). The CFA showed that each of the fears had significant factor loadings. Furthermore, the fit statistics showed that each of the three models had an acceptable to good fit (see Table 4).

Comparison of the three models Results indicated that each of the three models fitted the data well. However, closer inspection of Model I showed two factors with very high intercorrelations (0.91 and 0.94), pointing to the possibility that a three-factor solution is more parsimonious and, therefore, more preferable. Next, both three-factor models (model II and III) were compared with the four-factor model

(Model I) by using the log-likelihood difference test to examine the $\chi2$ differences ($\Delta\chi2$) between the models. Firstly, Model I (χ^2=81.37, d.f.=38) was compared with Model II (χ^2 =91.02, d.f.=41), yielding a statistically significant difference of $\Delta\chi^2$=9.65, d.f.=3.

Table 2 *Four factor solution resulting from the PCA on the severity rating of fears as determined by Promax rotation*

Items	1	2	3	4
Blood	0.75			
Physical injuries	0.56			
Injections	0.56			
Spiders		0.81		
Darkness		0.54		
Thunder		0.42		
Enclosed spaces		0.39		
Flying			0.78	
Heights			0.67	
Dental treatment				0.74
Snakes				-0.42

Table 3 *Three factor structure of severity of fears determined by Promax rotation*

Items	**Situational-animal**	**blood-injection-**	**Height related**
Spiders	0.66		
Darkness	0.59		
Snakes	0.55		
Enclosed spaces	0.47		
Thunder	0.48		
Injections		0.75	
Blood		0.68	
Dental treatment		0.52	
Physical injuries		0.33	
Flying			0.74
Heights			0.61

Table 4 *Fit indices of the three models on specific phobias*

Model	χ^2/df	RMSEA	GFI
DSM-IV	81.37 / 38	0.037	0.98
Fredrikson	91.02 / 41	0.039	0.98
Current study	85.93/ 41	0.038	0.98

Thus, Model II, albeit more parsimonious, fitted the data less perfectly than Model I. Therefore, Model I was favoured. Secondly, Model I (DSM-IV-TR model) (χ^2=81.37, d.f.=38) was compared with Model III (χ^2=85.93, d.f.=41), which yielded a non significant statistical difference ($\Delta\chi^2$=4.56, d.f.=3) indicating that Model I and Model III fit the data equally well. Therefore, as Model III is more parsimonious, it is slightly favoured over model I the DSM-IV-TR model.

Discussion

The purpose of the present study was to examine the structure of common fears, enabling the development of a typology or descriptive framework for fear classification. The factor analytic findings in the first sample proved to be supportive of a division in three categories of fears, containing a blood-injection-injury factor, a situational-animal factor and a heights-related factor. The confirmatory factor analysis carried out on the data of the second sample resulted in an acceptable fit for the three models that were examined.

The results of the present study corroborate findings of FREDRIKSON *et al.* (1), who used a sample of inhabitants of Stockholm and employed 10 of the 11 fears we used, and who also found support for a division in three fear categories with natural-environment fears and situational fears clustering together. However, there are also a number of clear differences between the findings of our study and the findings of previous studies, which are important to note (1, 8, 9). First, the fears within the situational and animal category merged into one single factor. One explanation for this finding is that people with fears of spiders and snakes, on the one hand, and fear of enclosed spaces, darkness and thunder on the other, display a comparable fear response (i.e. sympathetic arousal: 24). A second difference is the fact that some items loaded on a separate heights cluster. This finding is in line with earlier findings in that one factor contained both heights and water items (8, 9). In another study, height was found to be part of the situational factor (e.g. 1, 9, 25). Accordingly, it could be argued that both height and flying are 'absentia terra firma' and that this discerns them from the other nine more solidly grounded fears employed in the current study (8). Support for a separate cluster of fear of heights also comes from recent findings suggesting the presence of underlying physiological abnormalities (i.e. balance control) in individuals with fear of heights (26). These problems particularly seem to involve the experience of 'height vertigo' and difficulties in using visual information to keep postural stability (27).

An important issue pertains to the question as to what extent the present results would support the current DSM nosology. On the one hand, the results provide confirming evidence for the current DSM-IV-TR classification of phobia subtypes. All three models showed a good fit, and the results indicate that the DSM-based model did certainly not provide the worst fit for the data. There are a number of other findings which suggest that the structure of fears possesses commonalities with the structure of phobias as used in the DSM-IV-TR. For example, similar to FREDRIKSON *et al.* (1) findings, support was found for a separate factor of blood-injury-injection or 'mutilation' fears, an existing subtype within the current DSM-IV-TR classification on specific phobias. Conversely, one finding - contradicting the usefulness of a system of dividing fears into the same categories as how specific phobias are divided in subtypes within DSM-IV-TR - is the emergence of a three-factor structure as the best solution of the present data. A plausible explanation for this difference might be that the observed covariations among fears do not extend to other phobia subtypes, as fears may covary differently in the population, as they do with people having clinical problems. Indeed, the emergence of a blood-injection-injury subtype is the only stable finding across studies, while for other factors this seems to vary from study to study. Therefore, it remains unclear to what extent the fears within each subtype are similar to each other, considering the features that are thought to distinguish them from other fears (28). Perhaps fears are, in some respect, more heterogeneous than any form of subtype system would suggest. An example in this respect is fear of flying. There is evidence to suggest that this is a heterogeneous, rather than a unitary, phenomenon, as it seems to be composed of a number of separate fears (29). A study using PRINCALS demonstrated that fear of flying consists of four different subtypes of flying phobias, that is, (1) fear of aircraft accidents, (2) fear of loss of control over themselves or social anxiety, (3) fear of aeroplanes, water, claustrophobia or agoraphobia, and (4) fear of heights (30). Thus, fear of flying might actually be the expression of fears, which are included within subtypes other than the situational subtype, such as fear of heights (natural environment subtype) fear of injury (blood-injection-injury subtype), fear of loss of control (other) or even a combination of these subtypes.

Despite the strength of using both exploratory and confirmatory factor analyses, and two independent, unselected samples taken from the same (general) population, some limitations are worth noting. Firstly, with regard to the data collection, like any other data-gathering method, public transport and public places have limitations in terms of generalisability. However, the samples generally appear to be comparable with the main population in terms of gender distribution, age and ethnicity, as reported by the Dutch Central Bureau of Statistics (17). Secondly, the current study was conducted among the Dutch population, which limits the generalisability of the findings to other (European) countries. Clearly, more research is required to explore the validity and utility of the typology of fears found in the present study.

In conclusion, the present results provide support for a structure of fears largely reflecting the DSM-IV-TR division consisting of five discernable factors or phobia subtypes. This does not rule out that there may be more layers or levels (i.e. higher-order factors) in the hierarchy of fears, such as neuroticism or social fears (8, 12). Because the structure of fears could be inferred from the DSM-IV-TR classification of phobia subtypes, the data suggest that subclinical fears are associated similarly as clinical phobias are. This contention would also be consistent with findings on phenotypic variation (31, 32) showing that the 'heritabilities of phobias are no different from those of milder fears' (12). The notion that fears and phobias are two observable manifestations of a fear response along a single continuum may have implications for clinical practice. Assigning fears to clusters or subtypes, for example as used in the DSM, can help to guide providers of mental health services in the assessment and the selection of components needed to treat clients' fears more effectively.

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