Journal of Psychosomatic Research 72 (2012) 258–265

Contents lists available at SciVerse ScienceDirect

Journal of Psychosomatic Research

Multi-method analysis of the internal structure of the Type D Scale-14 (DS14)

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ARTICLE INFO

Article history:
Received 6 October 2011
Received in revised form 2 January 2012
Accepted 4 January 2012

Keywords:
Factor analysis
Internal structure
Mokken scale analysis
Type D personality
Negative affectivity
Social inhibition

ABSTRACT

Objective: The Type D Scale-14 (DS14) measures distressed (also, Type D) personality by assessing the medium-level trait negative affectivity that encompasses the low-level traits dysphoria, anxiety, and irritability, and the medium-level trait social inhibition that encompasses the low-level traits social discomfort, reticence, and lack of social poise. The literature discusses three different structural models of the DS14. The goal of this study was to investigate which of the three models best describes the internal structure of the DS14.
Method: We used three methods to investigate the internal structure of the DS14 items using data collected in representative samples from the Dutch general population ($N = 3{,}181$). The methods were exploratory factor analysis, confirmatory factor analysis, and Mokken scale analysis.
Results: Exploratory factor analysis suggested a two-factor structure without evidence of the low-level factors, and the other two methods showed evidence of a three-level structure including the low-level factors.
Conclusions: A two-factor model with correlated errors for items defining low-level traits adequately describes the data. The results support the three-level hierarchical model as a conceptual model for Type D personality, and support the interpretation of DS14 scores on item subsets representing medium-level traits and low-level traits.

Introduction

Distressed personality [1–3], Type D for short, is a psychological risk factor for morbidity and mortality in patients suffering from cardiovascular disease [3–5]. Type D is a hierarchically structured [6] personality construct. The general Type D trait represents the high level of the hierarchy (Fig. 1). At the medium level, two traits drive behavior: Negative affectivity (NA) involves the experience of negative emotions across time and situations, and social inhibition (SI) the suppression of emotions in social interaction. The inhibition to express negative emotions in social interactions – that is, high levels of both NA and SI – defines Type D. At the low level of the hierarchy, feelings of dysphoria, anxious apprehension, and irritability drive NA, and discomfort in social situations, reticence, and lack of social poise drive SI [7,8].

Type D is much debated. Ferguson et al. ([9]; also, see [10,11]) concluded that distressed personality more likely is a continuum reflecting degree than the more widely accepted categorization of individuals into Type D or non Type-D. Their position supports the three-level model as a theoretical candidate for the explanation of distressed personality. We compared the three-level model with a two-level model excluding the subtraits level and another two-level model allowing correlated errors to obtain better model fit.

Other controversies with respect to Type D are the following. Coyne et al. [10] and Grande et al. [11] did not find support that cardiac patients with Type D had a greater mortality risk, thus contradicting previous research [12,13]. Dannemann et al. [14] concluded that Type D classification is unstable among cardiac patients before and after surgery. Williams, Curren, and Bruce [15] concluded that Type D and alexithymia are correlated but separate traits but Grande, Glaesmer, and Roth [16] found that the SI scale does not distinguish shyness and introversion. Hence, there are doubts about SI's uniqueness.

The item structure of the Type D Scale-14 (DS14 [2]) reflects the theoretical three-level hierarchy, and uses 14 items to assess Type D, NA (7 items) and SI (7 items), and the NA and SI subtrait triplets (Table 1). Different item subsets from the two seven-item sets assess the two low-level subtrait triplets. Each item statement is assessed on five ordered categories, scored 0 through 4. The NA-scale and the SI-scale yield two total scores, and if both scores are at least 10 points, the patient is diagnosed Type D [8]. Thus, following the hypothesis that inhibition to express negative emotions in social interaction defines Type D, patients scoring in excess of particular cutoffs on both scales are diagnosed Type D. The dichotomy into Type D and non Type-D serves the practical purpose to determine a diagnosis.

Confirmatory factor analysis (CFA) of DS14 data revealed three different internal item structures, two of which suggest doubt about the correctness of the theoretical three-level hierarchy; see Fig. 2.

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doi:10.1016/j.jpsychores.2012.01.005

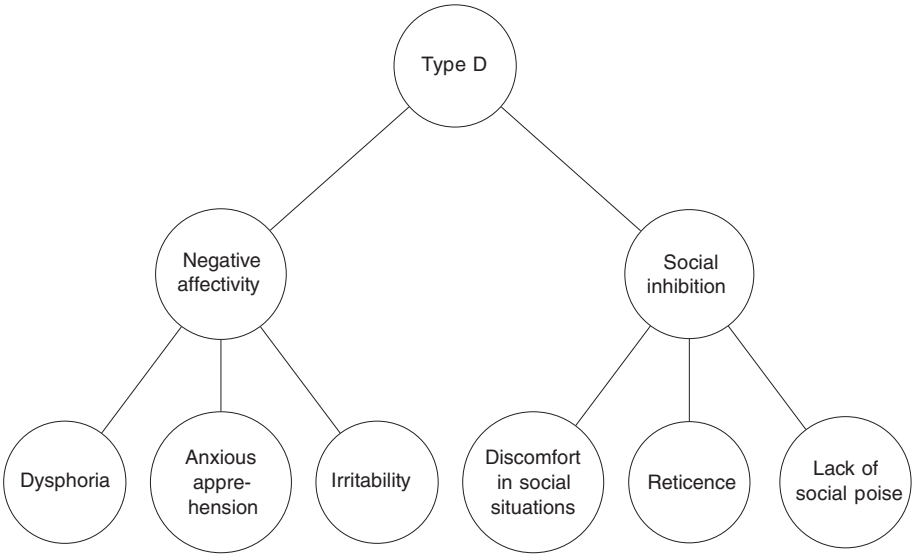

Fig. 1. Hierarchy of the Type D construct.

The "Two-factor Model" represents a two-level hierarchy with NA and SI factors that distinguish the NA-scale and the SI-scale, but ignores the theoretical subtrait triplet structure [17–20]. The model does not explicitly incorporate a higher-order factor for modelling Type D but allows the two factors to correlate, thus suggesting an explanatory higher-order factor. The magnitude of the correlation between the factors suggests the degree to which a higher-order factor is plausible. The "Adapted Two-Factor Model" is based on modification indices of Grande et al.'s [17] Two-Factor Model, allowing cross-loadings and correlated error terms. The "Subtraits Model" [21,22] represents the three-level hierarchy by means of a factor structure with positively correlated error terms that model the low-level subtraits and positively correlated factor scores that model the high-level Type D. The question is whether a careful analysis of DS14 data can provide more conclusive evidence of which theoretical model for the Type D construct is correct.

The goal of this study was to use three psychometric methods for assessing internal structure to compare the three factorial models for the DS14. The three methods provide different statistical perspectives. The methods are exploratory factor analysis (EFA), CFA and Mokken scale analysis (MSA [23,24]); see Emons, Sijtsma, and Pedersen [25] for a similar internal-structure study of the Hospital Anxiety and Depression Scale (HADS [26]).

The outline of this article is as follows. First, we discuss research that used EFA and CFA to study the internal structure of the DS14. Second, we discuss MSA and how MSA may lead to results different from EFA and CFA. Third, we discuss the internal structure of the DS14 suggested by EFA, CFA, and MSA. Fourth, we discuss consequences of the results for the Type D structure and the practical use of the DS14.

Table 1
Item content and medium-level and low-level scales for the items of the DS14 [7,8]

Item	Content	Position in DS14	Low-level scale
Negative affectivity scale			
N1	Often feels unhappy	4	Dysphoria
N2	Takes gloomy view of things	7	Dysphoria
N3	Is often down in the dumps	13	Dysphoria
N4	Worries about unimportant things	2	Anxious apprehension
N5	Often worries about something	12	Anxious apprehension
N6	Is easily irritated	5	Irritability
N7	Is often in a bad mood	9	Irritability
Social inhibition scale			
S1	Inhibited in social interactions	6	Discomfort in social situations
S2	Difficulties starting a conversation	8	Discomfort in social situations
S3	Does not find things to talk about	14	Discomfort in social situations
S4	Closed kind of person	10	Reticence
S5	Keeps others at a distance	11	Reticence
S6	Makes contact easily	1	Lack of social poise (reversed keyed)
S7	Often talks to strangers	3	Lack of social poise (reversed keyed)

Factor analysis results for type D

Traditionally, EFA was the common method for assessing the internal structure of the DS14 in various populations [7,27,28]. Recently, CFA has become more popular [17,21,22]. MSA in combination with EFA and CFA was used to analyze the Addiction Severity Index [29], the HADS [25], the Minnesota Multiphasic Personality Inventory [30], and the Self-Concealment Scale [31]. We discuss studies that used EFA and CFA to assess the internal structure of the DS14.

Exploratory factor analysis

Denollet [7], Svansdottir et al. [21], Zohar et al. [22], Bergvik et al. [27], Hausteiner et al. [28], and Yu, Zhang, and Liu [32] used EFA to assess the internal structure of the DS14. EFA extracts the number of factors and the factor loadings from the data ([33], p. 228). Two rules determine the number of factors. The first rule equates the number of factors to the number of eigenvalues exceeding 1 but is vulnerable to chance capitalization, which leads to overestimation of the number of factors. Horn [34] and Reise et al. [6] proposed parallel analysis to correct for the overestimation. Parallel analysis compares the eigenvalues with eigenvalues generated from artificial data sets based on a multivariate normal distribution with zero correlation between the items, and maintains the eigenvalues that are "significantly" larger than 1. The second rule selects the eigenvalues to the left of the elbow in the scree plot [6] but decisions may be difficult if a sharp elbow does not appear.

The six studies concluded that a two-factor structure best described the data. Denollet [7] found an interpretable, orthogonal two-factor structure, in which Item 6 (Table 1) had a cross-loading