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# Anxiety, Depression and Anger: Application of a Bifactor Model to Identify Common Symptoms

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**Abstract**

Anger manifestations, depression and anxiety are strongly related to individual´s discomfort and well-being. The aim of the present study is to investigate the fit of a bifactor model applied on emotional disposition measures emphasizing the specification of a general factor through the identification of specific responses or indicators that can account for the communality between depression, anxiety and anger. The results obtained show two large groups of indicators that would be common in these affective disposition types: affective and cognitive responses. On the one hand, affective responses include agitation, irritability, and tension or nervousness. On the other hand, cognitive symptoms are linked to the presence of repetitive worrying and uncontrollable thoughts. In this way, it is possible to identify a general stress response in this group of indicators.

**emotional disposition; bifactor model; general factor specification**

## INTRODUCTION

Anger manifestations, depression and anxiety are strongly related to individual´s discomfort and well-being. Moreover, these affective dispositions are associated to an increased risk of developing somatic illnesses and negative outcomes in general heath [1]. Although these variables are relevant, research on anxiety, depression and anger are still predominantly based on and individual approach which does not take in consideration their combined assessment and the analysis of their commonality [2].

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In contrast to this tendency, current approaches in psychopathology contemplate the observed co-occurrence of symptoms in different mental disorders [3]. Based on this comorbidity between the symptomatology of different psychopathologies, dimensional models have been proposed in contrast to the more traditional categorical models. Many of these models are represented by factor structures called bi-factor, which contemplate that symptoms are explained both by a general factor of distress (GF, which considers the commonality of the symptomatology) and by specific psychopathological sub-domains (SF, accounts the specific components of disorders beyond the general factor) [4].

From the context of general psychopathology, it was verified the existence of a general factor (GF) of psychological distress that also explained the specific symptomatology of depres-

sion, hostility / aggression, and tension / nervousness [3]. Other studies have emphasized the relationship between these emotional dispositions and cardiovascular diseases [1, 2, 5]. In the last-mentioned studies, the existence of a general dispositional trait of negative affect, that contemplates the superposition between depression, anger and anxiety, is postulated.

Besides the evidence obtained regarding the application of bifactor models for the joint study of these affective trends, these are not exempt from criticism. Some of these are associated with the general use of bifactor models, and others are more specifically associated with their application in the study of psychopathology [6]. Two criticisms can be identified related to the biased use of bifactor models [7]: a) the isolated interpretation of classical fit indexes, and b) the absence of solid theoretical foundations. In relation to the latter, current criticisms emphasize the lack of specification of the meaning of the GF [8]. So far, this last aspect has not been studied by previous investigations. For this reason, the aim of the present study is to investigate the fit of a bifactor model applied on affective disposition measures emphasizing the specification of GF through the identification of specific responses or indicators that can account for the communality between depression, anxiety and anger.

The possibility of recognizing those specific affective dispositional responses or indicators that are better explained by the GF, has relevance in two main points: 1) it will make it possible to have a clearer notion of those responses or indicators linked to these affective dispositions that would be common to all of them; and 2) it will thus lead to the formulation of clearer hypotheses about the common ground mechanism, the role and effect of these variables on psychopathology and general health.

## MATERIALS AND METHODS

### *Participants*

One thousand and thirty-four participants from Dominican Republic took part in the study. They were selected by an accidental non-probabilistic sampling procedure. The ages of the participants were between 18 and 80 years old (Mean = 30.85, Standard Deviation = 15.39). Regarding gender, 45.9% (n = 374) were male and 54.1% (n = 441) female. It should be noted that this research has been approved by the National Bioethics Committee (CONABIOS) which is part of the Public Health Ministry of Santo Domingo, Dominican Republic (protocol number 028-2014).

### *Measures*

To measure the symptoms of anxiety, depression and anger, instruments were chosen that met three requirements: 1) they had to be instruments widely used internationally, 2) they had to contemplate cognitive, affective and behavioral symptoms, and 3) they had to have psychometric validation studies for the population of the Dominican Republic. Accordingly, the instruments selected were:

*State-Trait Anger Expression Inventory, STAXI-2.* Recent studies carried out in the Dominican Republic validated the original factorial structure (CFI values, and TLI greater than .95). Internal consistency indexes were adequate (Cronbach's alpha values between .78 and .86). In this investigation, the Anger-Temperament Trait Scale was implemented [9].

*State-Trait Anxiety Inventory, STAI.* Newly developed studies in the Dominican Republic showed a factorial structure according to the original model, and optimal internal consistency indexes for State Anxiety ($\alpha$ = .86 for Present Anxiety; $\alpha$ = .88 for Well-Being) and acceptable for Trait Anxiety ($\alpha$ = .83 for Present Anxiety and an $\alpha$ = .77 for Well-Being) were obtained. In this case, the Trait Anxiety Scale was used [10].

*Beck Depression Inventory II (BDI-II).* In a recent investigation carried out in the Dominican Republic in which psychometric properties of the BDI-II were explored an $\alpha$ = .78 was obtained for the Cognitive dimension; $\alpha$ = .77 for the Somatic dimension; and $\alpha$ = .70 for the Affective dimension. For its part, the total scale was the only one that presented values higher than .80 [11].

### *Data Analysis*

To analyze and test the presence of a general factor of orthogonal dispositional affective factor to

a series of sub-factors (i.e. Depression, Anxiety and Anger), a Bi-factor Model was applied using Confirmatory Factor Analysis (CFA). This type of models (g-factor models) is adequate to understand those psychological processes that involve general and specific effects [12].

To carry out this CFA, the statistical software Mplus version 6.12 was used. The estimation method 'robust weighted square minimums' (WLSMV) was implemented, considering it the most appropriate when it comes to categorical data or when the multivariate normality assumptions are not met. As suggested by the literature, multiple adjustment indicators and the corresponded cut-off criteria were used [13]. When checking the fit of a bifactor model, it is relevant to consider indexes other than the traditional fit indexes, mainly considering the omega (ω), the H index, the percentage of common variance explained (ECV), and the ECV at the level of each item (ECV-I) [14].

## RESULTS

When applying the analysis, specification errors were observed in theoretically unexpected negative charges in the Trait Anxiety specific factor (SF). The detailed observation of the estimated parameters made it possible to detect a very high correlation between the Anxiety and Depression SF´s (r between – .761 y .824), that was expected considering the lack of specificity of the STAI-T and the overlap of the items with Major Depressive Disorder measures [15]. When the items are grouped under the same SF, the specification errors disappear, which is why further analyses are carried out on the basis of this modified bifactor model [6].

Results obtained (see Table 1) show that the fit indexes are acceptable, leading to the conclusion that the model fit is adequate.

**Table 1.** Fit Indexes for the Bifactor Model

| Model | $\chi^2$ | df | CFI | TLI | RMSEA | WRMR |
|---|---|---|---|---|---|---|
| Bifactor | 3213.83 | 943 | .928 | .921 | .048 | 1.60 |

Furthermore, there are no poorly specified indicator values in the bifactor model [6]. Table 2 synthesizes the calculated complementary indexes.

**Table 2.** Complementary Bifactor Indices

| Factors | ECV | Omega | H Index |
|---|---|---|---|
| General Factor | .541 | .961 | .936 |
| Depress/Anxiety Factor | .406 | .957 | .892 |
| Anger Factor | .698 | .919 | .826 |

The complementary indexes show that the GF is well defined by its indicators and moreover, its consideration as a general orthogonal latent variable is replicable (index H = .936). This GF explains 54.1% of the variance in the items (ECV = .541), and an optimal reliability index was obtained (ω = .961). The two remained SF obtain an optimal value of H index too (H Depress/Anxiety Factor = .892; H Anger Factor = .826), and an adequate Omega index (ω Depress/Anxiety Factor = .957; ω Anger Factor = .919). Summarizing, the indexes described above support the existence of a reliable orthogonal GF which enables to explain a large amount of the item´s variance. Regarding the SF, just the Anger SF can explain well the variance of its items. These occur because de GF does not have a significant implication in the Anger specific items.

Finally, in table 3 the IECV obtained is presented for the items that were best explained by the GF. The results obtained allow observing that some of the items that make up depressive and anxiety traits are better explained by this GF. On the other hand, this is not the case for temperament anger indicators.

**Table 3.** ECV-I values for each item by SFs.

| | ECV-I | |
|---|---|---|
| Ítems | Dp | Ax |
| Depress | | |

| | | | |
|---|---|---|---|
| BDI11 | Agitation | .797 | |
| BDI17 | Irritability | .826 | |
| Anxiety | | | |
| STAI25 | I miss opportunities by not deciding soon | | .928 |
| STAI27 | I'm a calm, collected person | | .973 |
| STAI28 | I see the difficulties piling up and I can't cope | | .856 |
| STAI29 | I worry too much about unimportant things | | .990 |
| STAI31 | I tend to take things too seriously | | .911 |
| STAI37 | I am haunted and disturbed by unimportant thoughts | | .969 |
| STAI38 | I'm so affected by the disappointments, I can't forget them | | .995 |
| STAI40 | When I think about current concerns, I get tense and agitated | | .965 |

## DISCUSSION

The objective of this study was to present evidence of common indicators in affective disposition measures of Depression, Anxiety and Anger Traits. For this purpose, a bifactor model was applied, and the results obtained show two large groups of indicators that would be common in these affective disposition types: affective and cognitive responses. On the one hand, affective responses include agitation, irritability, and tension or nervousness. On the other hand, cognitive symptoms are linked to the presence of repetitive worrying and uncontrollable thoughts. In this way, it is possible to identify a general stress response in this group of indicators [16]. Indeed, the GF is defined by some indicators that have been identified in the general perception of stress, mainly regarding the perceived lack of balance between demands and resources (e.g., item 28 of the STAI, "I see that difficulties pile up and I can't handle them). Then there are symptoms that would account for more affective and cognitive stress responses.

Depression and anxiety are often conditions with high comorbidity, suggesting a latent common factor between the two [17]. Our results are in line with this evidence, given that the general factor explains to a greater extent indicator associated with anxiety and depression (i.e. beyond the explanation of their specific factors). Although anger has been proposed as a key predominant factor to explain psychopathology by being associated with a general trait of negative affectivity [18], the modeling of this relationship would not be explained so much by the presence of the same latent factor that explains the relationship between depression and anxiety, but rather by the interrelationship or reciprocal relationships that depression and anxiety may present with respect to anger over time. Some data from previous longitudinal research support the latter possibility, accounting for the fact that levels of anger/hostility may have reciprocal long-term effects on anxiety and depression [19].

Despite the fact that the objective of this study was to identify the indicators most related to the GF, an important limitation is that we did not perform external validation analyses. For example, future research could verify whether the predictive weight of this GF on relevant psychological and health-related variables. Another unverified aspect is the fit index of this model in clinical populations. It is worth researching whether there would be invariance in the fit, in the factorial weights, and in the main indicators of the GF between the general population and the clinical population.

Another aspect to consider as a possible limitation of the present study refers to the instruments used. For example, the BDI-II it neglects certain relevant factors associated with depression. This is not a problem unique to the BDI-II since the phq-9 has similar limitations. In this regard, it has been suggested to use combined scales, for example, combining items from the BDI-II plus the phq-9 to cover well the diagnostic criteria for major depression. Another important limitation in the case of the STAI-R concerns content validity, given that 65 % of the STAI-R

items also measure symptoms of the major depressive episode. Even so, in the present work only the items associated with anxiety and not those linked to well-being-depression have been considered for the analysis. It would be desirable in future research to replicate the analyses with other instruments to evaluate the stability of the results.

In short, this research identifies for the first time those common responses or indicators in traits related to affective disposition. These results enable the development of longitudinal studies to visualize the temporal and causal relationship between these responses and their dynamic relationship with health and diseases indicators.

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