

# Negative affectivity and social inhibition in cardiovascular disease: Evaluating type-D personality and its assessment using item response theory

Wilco H.M. Emons<sup>a,\*</sup>, Rob R. Meijer<sup>b</sup>, Johan Denollet<sup>c</sup>

<sup>a</sup>Department of Methodology and Statistics, Faculty of Social and Behavioural Sciences, Tilburg University, Tilburg, The Netherlands

<sup>b</sup>Department of Research Methodology, Measurement and Data Analysis, University of Twente, Enschede, The Netherlands

<sup>c</sup>Department of Medical Psychology, Tilburg University, Tilburg, The Netherlands

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## Abstract

**Objective:** Individuals with increased levels of both negative affectivity (NA) and social inhibition (SI)—referred to as type-D personality—are at increased risk of adverse cardiac events. We used item response theory (IRT) to evaluate NA, SI, and type-D personality as measured by the DS14. The objectives of this study were (a) to evaluate the relative contribution of individual items to the measurement precision at the cutoff to distinguish type-D from non-type-D personality and (b) to investigate the comparability of NA, SI, and type-D constructs across the general population and clinical populations. **Methods:** Data from representative samples including 1316 respondents from the general population, 427 respondents diagnosed with coronary

heart disease, and 732 persons suffering from hypertension were analyzed using the graded response IRT model. **Results:** In Study 1, the information functions obtained in the IRT analysis showed that (a) all items had highest measurement precision around the cutoff and (b) items are most informative at the higher end of the scale. In Study 2, the IRT analysis showed that measurements were fairly comparable across the general population and clinical populations. **Conclusions:** The DS14 adequately measures NA and SI, with highest reliability in the trait range around the cutoff. The DS14 is a valid instrument to assess and compare type-D personality across clinical groups.

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**Keywords:** Item response theory; Measurement equivalence; Negative affectivity; Social inhibition; Type-D personality

## Introduction

Early identification of cardiovascular patients who are characterized by an unfavorable clustering of psychological risk factors [1] is important in order to improve their

prognosis and quality of life. A recent report of the National Heart, Lung, and Blood Institute working group on outcomes research in cardiovascular disease also recommended studies to identify the key determinants of patient-centered outcomes such as quality of life and functional status [2].

In recent years, we have argued that the personality traits of Negative Affectivity (NA) and Social Inhibition (SI) are of special interest in this context [3]. NA denotes the stable tendency to experience negative emotions [4]; high-NA individuals experience more feelings of dysphoria, anxious apprehension, and irritability across time and situations. SI denotes the stable tendency to inhibit the expression of emotions and behaviors in social interaction [5]; high-SI individuals tend to feel inhibited, tense, and insecure when with others. Individuals who are characterized by high NA

*Abbreviations:* CHD, coronary heart disease; CTT, classical test theory; DIF, differential item functioning; GRM, graded response model; IRF, item response function; IRT, item response theory; NA, negative affectivity; ORC, option response curve; SI, social inhibition.

\* Corresponding author. Department of Methodology and Statistics, Faculty of Social and Behavioural Sciences, Tilburg University, P.O. Box 90153, 5000LE Tilburg, The Netherlands. Tel.: +31 13 466 2397; fax: +31 13 466 3002.

E-mail address: w.h.m.emons@uvt.nl (W.H.M. Emons).

as well as SI seem to scan the world for signs of impending trouble [6] and avoid negative reactions from others through excessive control over self-expression [7].

Relatively high scores on both NA and SI define the distressed personality type or type-D personality [8]. This type-D personality profile is independently associated with an unfavorable clinical course and poor patient-centered outcomes in various cardiovascular populations, including those with ischemic heart disease [3,8], drug-eluting stenting [9], cardiac arrhythmias [10], peripheral arterial disease [11], and heart failure [12]. The DS14 [13] is a brief self-report measure that was specifically designed for standard assessment of a propensity towards general emotional distress of type-D individuals. The DS14 contains revised items from its predecessor, the DS16 [14], and some new items. The DS14 comprises seven items measuring NA and seven items measuring SI. The content of the items and their underlying lower level constructs of the DS14 can be found in Table 1. A score at or above 10 (range 0–28) on both the NA and SI subscales of the DS14 designates those who have a type-D personality [15]. These choices for the cutoffs were based on the median split in representative samples. Clinical evidence for this cutoff-based type-D classification was obtained in longitudinal clinical studies and empirical evidence from latent class cluster analysis [15].

Despite the apparent promise of the DS14 assessment of NA, SI, and type-D personality in cardiovascular patients, a number of substantive and measurement issues still require further examination. First, from earlier studies it is unclear to what extent the items contribute to reliable classification of type-D and non-type-D individuals using a cutoff of 10 on both the NA and SI scales; that is, more information is needed to document the relative contribution of individual items to the measurement precision of the scale and the reliability of NA and SI assessment around the cutoffs. Items that have the highest relative contribution are the strongest markers of the underlying type-D concept.

Second, it is unclear whether there is a difference in item responses between individuals with the same trait values belonging to different clinical populations; that is, individuals surviving an acute coronary event, high-risk individuals without acute coronary event, and individuals from the population at large. Assessment of the comparability across populations is an important part of the validation process when scales are used in different populations. Differences in test and item characteristics between populations may point at substantive qualitative differences [16] in distressed type-D personality that need further exploration.

Both research questions can be more adequately addressed using item response theory (IRT) than using classical test theory (CTT). IRT methods have been applied to measure distress and quality of life in the medical context, including the shortening of scales to measure psychopathology in general, medical wards [17], or quality of life in cancer patients [18], and the rating of musculoskeletal pain in rehabilitation patients [19]. There is, however, a paucity of research on personality in the medical context, including the use of IRT methods in this context. In the present paper, we address this issue by applying IRT analyses to the DS14 assessment of NA, SI, and type-D personality in both individuals from the general population and patients with cardiovascular disorder and hypertension. We first explain the principles of IRT and the advantages of IRT to CTT to analyze the DS14. Second, we report the results of IRT analyses with an emphasis on the relative contribution of individual items to the measurement precision. Third, we focus on the comparability of NA, SI, and type-D assessment in qualitatively distinct groups. Finally, we discuss how the DS14 can be improved in future scale revisions.

### Item response theory

Psychological variables, such as NA and SI, cannot be observed directly. These psychological variables are referred

Table 1  
Item content and lower level construct for the items of the DS14

Item	Content	Position in DS14	Lower level construct
<i>Negative affectivity</i>			
NA1	Worries about unimportant things	2	Anxious apprehension
NA2	Often feels unhappy	4	Dysphoria
NA3	Is easily irritated	5	Irritability
NA4	Takes gloomy view of things	7	Dysphoria
NA5	Is often in a bad mood	9	Irritability
NA6	Often worries about something	12	Anxious apprehension
NA7	Is often down in the dumps	13	Dysphoria
<i>Social inhibition</i>			
SI1	Makes contact easily	1	Social poise (reversed keyed)
SI2	Often talks to strangers	3	Social poise (reversed keyed)
SI3	Inhibited in social interactions	6	Discomfort in social situations
SI4	Difficulties starting a conversation	8	Discomfort in social situations
SI5	Closed kind of person	10	Reticence
SI6	Keeps others at a distance	11	Reticence
SI7	Does not find things to talk about	14	Discomfort in social situations

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