Research paper

Person-centered analysis of psychological traits to explain heterogeneity in patient-reported outcomes of coronary artery disease– the THORESCI study

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ABSTRACT

Background: Heterogeneity in the prognosis of coronary artery disease (CAD) patients may be explained by relatively stable individual psychological differences. Therefore, we studied multiple personality and coping traits using a person-centered approach, and examined the predictive value of this approach for patient-reported outcomes.

Method: 657 CAD patients (age = 66.39 ± 10.6; 79% men) completed multiple self-report questionnaires focusing on demographics, negative affectivity and social inhibition (DS14), neuroticism and extraversion (EPQ), resilience (DRS-15), and coping styles (CISS) after undergoing percutaneous coronary intervention. Depressive symptoms (PHQ-9), anxiety (GAD-7), and treatment adherence (MOS) were assessed at 6 months follow-up. Clinical information was extracted from patients' medical records.

Results: A step-3 latent class analysis identified four subgroup profiles: *Low distress* (31%), *Passive coping* (21%), *Active coping* (20%), and *High distress* (28%). For all patient-reported outcomes, overall significant differences between the subgroups were observed (*p*-values < .05). The *High distress* profile was associated with the highest levels of emotional distress (*d*'s > .94), and lowest levels of positive mood (*d* = −1.02) and treatment adherence (*d* = −2.75) at follow-up. Patients with an *Active coping* profile also experienced increased emotional distress (*d*'s > .50), but participated in cardiac rehabilitation most often (*d* = .13), and reported high levels of positive mood (*d* = −1.02). Patients with a *Passive coping* profile displayed few emotional problems after six months (*d*'s < .30), but participation to cardiac rehabilitation was relatively low (*d* = .04).

Conclusions: This study revealed four distinct psychological latent subgroups, which were predictive of patient-reported outcomes. The results indicate that a person-centered approach is useful in explaining heterogeneity in recovery from PCI, and may enhance personalized medicine in patients with CAD.

1. Introduction

Psychosocial factors have been associated with the morbidity and mortality of coronary artery disease (CAD) (Lichtman et al., 2014; Rozanski et al., 2005; Yusuf et al., 2004). Several recent meta-analyses have indicated that negative emotions, such as depression (Nicholson et al., 2006) and anxiety (Roest et al., 2010), but also more stable traits, such as Type D personality (combination of negative affectivity and social inhibition) (Beutel et al., 2012; von Kanel, 2012), are associated with adverse events and mortality. In addition, chronic stressors, such as a lower socio-economic status (Vathesatogkit et al., 2014) and a lack of social support (Barth et al., 2010) may worsen CAD. However, these meta-analyses also reported substantial heterogeneity in when and how psychosocial factors affect the prognosis of CAD.

While several studies in CAD patients showed an association between psychosocial factors, such as anxiety and depression, with major adverse cardiovascular events during follow-up (de Jager et al., 2018; Meyer et al., 2015), other studies did not find these associations (Pelletier et al., 2015). Moreover, a recent study showed large heterogeneity in the prognostic value of individual depressive symptoms in patients with CAD across sex and age subgroups (de Miranda Azevedo et al., 2018).

This heterogeneity may have several causes, including age differences, comorbid medical conditions and other differences in study characteristics (Denollet, 2013). The risk of adverse events is already higher in older patients due to an aging heart and age-associated conditions, such as kidney disease and anemia (Alexander et al., 2007; Shih et al., 2011; Tay et al., 2008). Furthermore, the choice of endpoint is a

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crucial determinant of the prognostic effect of a risk factor (Mann and Felker, 2014). For example, a recent study showed that Type D personality may be more related to fatal and non-fatal cardiac events than to all-cause mortality, and has different effects in different age-groups (Kupper and Denollet, 2016).

Heterogeneity in clinical outcomes may also be explained by relatively stable individual differences in personality (Chapman et al., 2011). Specific sets of interrelated thoughts, feelings, and behaviors might affect the propensity to experience lower or higher levels of psychological distress (Chapman et al., 2011). Patients scoring high on neuroticism are more vulnerable to experience negative emotions such as anxiety, depression, and anger after a cardiac event (Terracciano et al., 2008). In contrast, resilient patients seem to report better emotional and physical well-being at follow-up (Meister et al., 2015). Furthermore, patients' coping styles, which can be defined as relatively permanent, individual-specific ways of facing difficulties in stressful situations, may play a role in this context (Du et al., 2016; Lazarus and Folkman, 1984). While coping originally was described as a dynamic process, most researchers over the past decades have operationalized coping as trait-like strategies. Coping styles or "defenses" are involuntary behaviors that are used to shield from sudden changes, in this case the cardiac event (Vaillant, 2000, 2011). There are several approaches to classify coping styles. They can be allocated according to level of maturity, where immature defenses include behaviors such as projection, while sublimation and humor are considered mature defenses (Vaillant, 2000, 2011). Another perspective distinguishes different categories of coping styles, such as emotion-focused (e.g., blame myself for procrastinating) and task-oriented coping (e.g., outline my priorities). Whether coping styles are adaptive or maladaptive depends on the situational context.

Most research on personality and coping styles is based on a *variable-centered* approach, which strives to group similar variables or "traits" together. This approach assumes that the population is homogeneous in how these traits operate on outcomes (Cooper and Larsen, 2013; Laursen and Hoff, 2006). A *person-centered* approach aims to identify groups of individuals who share particular attributes or show similar scoring "profiles" (Cooper and Larsen, 2013; Laursen and Hoff, 2006). A profile captures unique personality information that is not well covered by the use of multiple trait scores (Asendorpf, 2015). Identifying profiles based on relatively stable traits might be helpful for a better understanding of the heterogeneity in psychosocial characteristics that may affect the clinical course of CAD, but also for personalized medicine, which aims to individualize care according to the patients' unique characteristics (Chapman et al., 2007; Denollet and Kupper, 2015; Fried, 2017).

The aim of the current study was to apply a person-centered approach to personality traits and coping styles based on latent class analysis in patients with CAD. We also examined the predictive value of this approach in explaining heterogeneity in patient-reported outcomes at six months follow-up.

2. Methods

2.1. Patient population and procedure—the THORESCI study

The current study was part of a large prospective and ongoing observational cohort study, the **T**ilburg **H**ealth **O**utcomes **R**egistry of **E**motional **S**tress after **C**oronary **I**ntervention (THORESCI), which recruits participants from the clinical standard of care Percutaneous Coronary Intervention (PCI) Registry at the St. Elisabeth-TweeSteden Hospital in Tilburg, the Netherlands. All patients who were scheduled for either elective or acute PCI for one or more coronary occlusions were included. Eligible patients were adults and had sufficient understanding of the Dutch language to fill out questionnaires. Patients with life-threatening comorbidities (e.g., metastasized cancer) or severe cognitive disorders (e.g., dementia) were excluded. On the day of the PCI, patients were approached by a member of the research team who explained the study content and its requirements. After providing written consent, the patients were asked to fill out a set of validated psychosocial questionnaires, spread over five measurement moments post-PCI, i.e., immediately following PCI (within one week post-PCI), at one and six months, one year and two years thereafter. For the current study, questionnaire data completed within one month and on six months after PCI were used. The study protocol is in line with the Helsinki declaration and was approved by the institutional medical ethics review board (METC Brabant).

2.2. Personality and coping characteristics

Negative affectivity (NA) and social inhibition (SI)—both NA and SI were assessed with the 14-item Type D scale (Denollet, 2005). Seven NA (e.g., "I am often in a bad mood") and 7 SI (e.g., "I often feel inhibited in social interactions) items are rated on a 5-point Likert scale from 0 (false) to 4 (true). In the current study, internal consistency for NA and SI was high (Cronbach alpha at .88 for SI and NA).

Neuroticism and extraversion—to assess neuroticism and extraversion, two subscales of the Eysenck Personality Questionnaire (EPQ) were used (Eysenck, 1991): the neuroticism subscale (e.g., "Does your mood often go up and down?") and the extraversion subscale (e.g., "Do you enjoy meeting new people?"). Both subscales comprise 12 items and are rated on a dichotomous (yes/no) scale. In the current study, internal consistency for both subscales was high (Cronbach alpha at .86 for neuroticism and at .85 for extraversion).

Social interaction anxiety—social interaction anxiety was evaluated using the Social Interaction Anxiety questionnaire (Mattick and Clarke, 1998). Ten items (e.g., "I have difficulty making eye contact with others") are rated on a 5-point Likert scale from 0 (not at all characteristic of me) to 4 (extremely characteristic of me). In the current study, internal consistency was excellent (Cronbach alpha .93).

Resilience—resilience was evaluated using the Dispositional Resilience Scale (DRS15) (Bartone, 2007). This 15-item scale assesses hardiness, which is a personality or cognitive style linked to good health and performance in stressful situations and comprises three components: challenge (i.e. seeing change and new experiences as exciting opportunities to learn and develop), commitment (i.e. tendency to see the world as interesting and meaningful) and control (i.e. belief in one's own ability to control or influence events) (Bartone, 2007). Items (e.g., "I like the challenge of having to do many things at once") are rated on a four-point Likert scale from 1 (do not agree at all) to 4 (totally agree). In the current study, the DRS15 showed adequate internal consistency (Cronbach alpha at .70).

Coping styles—the Coping Inventory of Stressful Situations (CISS) was used to measure which coping styles patients use during a stressful situation (Endler and Parker, 1990; McWilliams et al., 2003). The CISS comprises four coping styles: emotion-focused (16 items, e.g., "blame myself for procrastinating"), task-oriented coping (16 items, e.g., "outline my priorities"), distraction (10 items, e.g., "take time off and get away from the situation") and seeking social support (6 items, e.g., "visit a friend"). All items are rated on a five-point Likert scale from 1 (not at all) to 5 (very strong). In the current study, internal consistency was high (Cronbach alpha at .92 for emotion-focused coping, at .94 for task-oriented coping, .84 for seeking social support and at .79 for distraction).

2.3. Patient-reported outcomes

Anxiety—to assess whether patients experienced anxiety symptoms during the past two weeks, the Generalized Anxiety Disorder (GAD-7) scale was used (Spitzer et al., 2006). The 7 items of this valid and efficient tool to screen for generalized anxiety are scored on a Likert scale form 0 (not at all), to 3 (almost every day). The recommended cut-off score is ≥10. In the current study, internal consistency was excellent