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Research report

Temperament and depressive symptoms: What is the direction of the association?



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ABSTRACT

Background: Temperament characteristics have been suggested to be associated with mental health outcomes, especially depression, but the direction of the association is unknown. In this study, we tested whether temperament characteristics, as defined by the Buss–Plomin adulthood emotionality–activity–sociability (EAS) temperament model, predict depressive symptoms or whether depressive symptoms predict changes in temperament characteristics.

Methods: Participants comprised a population-based sample of 719 men and 1020 women from the Young Finns study aged 20–35 years at baseline in 1997 and who responded to repeated surveys of temperament and depressive symptoms in four study phases from 1997 to 2012. The associations were tested using linear regression models, repeated cross-lagged structural equation models, parallel latent growth curve models and two-dimensional continuous-time state space model (Exact Discrete Model). **Results:** Both low sociability ($\beta = -0.12$, $p < 0.001$) and high negative emotionality ($\beta = 0.34$, $p < 0.001$) predicted subsequent increased depressive symptoms, whereas earlier depressive symptoms predicted increased negative emotionality ($\beta = 0.50$, $p < 0.001$), but not low sociability.

Limitations: The depressive symptoms scale applied may not be used for measuring clinically recognized depression.

Conclusions: Our findings suggest that the direction of the association is from low sociability to depressive symptoms rather than the reverse, but the association between negative emotionality and depressive symptoms seems to be reciprocal.

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1. Introduction

Depression and depressive disorders are among the leading causes of poor quality of life in Western countries (World Health Organization, 2008; Mathers and Loncar, 2006; Mathers and Loncar, 2005). Depression and depressive symptoms cause human suffering, affect families, and are associated with substantial work impairment (Brown et al., 2009; Stewart et al., 2003; Thomas and Morris, 2003). Depressive symptoms have a multifactorial etiology and temperament characteristics have been proposed to be among the risk factors (Elovainio et al., 2004; Kendler et al., 1993; Kendler, 1992;

Kendler and Prescott, 2007; Kampman and Poutanen, 2011; Klein et al., 2011; Clark, 2005; Cloninger, 1986; Svrakic et al., 1992).

Temperament is suggested to reflect individual differences in the autonomic nervous system and the brain's neuroendocrinological functions (Buss, 1991; Plomin et al., 1988). The proposed biological origin and relative stability of temperament make it a suitable construct for studying the etiology of various health problems and associated processes. The existing evidence offers partial support for the association between various temperament characteristics and increased risk of depression (Rothbart and Bates, 1998; Goodyer et al., 1993; Svrakic et al., 1992).

According to Buss and Plomin (1975) and Buss (1991), the temperament dimensions may be categorized into three dimensions: emotionality, activity, and sociability (Emotionality–Activity–Sociability construct, abbreviated EAS). Emotionality refers to the tendency to experience and show frequent and intense negative emotions such as fear, distress, anger, or aggression. Activity refers

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to hyperactive behaviors such as speed, impatience, impulsivity, and vigorous motoric style. Sociability reflects the preference to be with people and to interact with others, as opposed to the preference of being and doing things alone.

Negative emotionality is generally defined as a temperamental sensitivity to negative stimuli (i.e. stress reactivity or proneness to general anxiety (Cloninger and Svrakic, 1993)), causing a broad range of negative moods and cognitions, such as guilt, hostility, and self-dissatisfaction (Clark et al., 1994). People with this temperament get angry, insecure, and distressed easily, especially when facing novel situations or after the occurrence of something unpleasant.

Sociability “is the tendency to prefer the presence of others” (Buss and Plomin, 1984, p. 63). Low sociability is also often defined as a dimension of behavioral inhibition (Kagan et al., 1987) that is defined as the consistent tendency to display fear and withdrawal in unfamiliar situations (Kagan et al., 1984). Children with this temperament are often reticent in social contacts. They are shy towards strangers and timid in unfamiliar situations. Sociability is not, however, the same as shyness, because shy people may desire the presence of others, but they avoid it because they tend to be stressed and anxious when surrounded by other people, especially unfamiliar people. There is substantial evidence that children with stable high levels of low sociability (McDermott et al., 2009; Williams et al., 2009) and/or high negative emotionality have a higher risk of developing mental health problems including depression (Muris and Ollendick, 2005; Vreeke and Muris, 2012). Research on the potential etiological role of temperament in health problems has concentrated mainly on children and adolescents, but negative emotionality and low sociability are likely to be high-risk temperament traits also in adulthood.

There are at least three postulated mechanisms through which temperament affects depressive symptoms. First, temperament and depression may have a shared genetic or environmental background (Kendler, 1992). Second, temperament may moderate an individual's reactions to stressful life events (Ellis et al., 2011; Belsky and Pluess, 2013; Elovainio et al., 2004) due to ineffective coping strategies (Mezulis et al., 2004). This means that if one is prone to being highly negatively reactive to new stimuli it may be difficult to maintain the positive self-evaluation needed for good mental health (Carver and Connor-Smith, 2010). Third, certain temperament characteristics may select individuals into certain environments or influence the individual's behaviors (Kendler and Prescott, 2007). In sum, substantial evidence suggests that some temperamental characteristics may predict later mental health problems, particularly depression.

However, it is reasonable to assume that depression also may alter temperamental characteristics. Long-term depression may even affect biological processes and structures that potentially impact the structural and widespread local functional abnormalities in specific brain regions (Lui et al., 2009) and reduce gray matter volume in the caudate nucleus (Kim et al., 2008) and thus may effect core, biologically rooted psychological structures such as temperament (Buss, 1991). Earlier research has also shown that individual differences in temperament are reflected in structural variances in specific brain areas. Patients with depression have also been found to have increased neuronal responses to emotional social stimuli (Cheng et al., 2010).

In addition to potential physiological mechanisms linking depression to temperament, cognitive and behavioral mediators are also possible. Individuals suffering from depression process information about the world, the future, and especially themselves in a maladaptive fashion compared with healthy individuals (APA, 2000). According to several theoretical models of depression, such as Beck's cognitive model (Beck et al., 1979; Haaga and Beck, 1995; Disner et al., 2011), Seligman's learned helplessness model (Seligman, 1972),

and more recent cognitive neuropsychological models (Clark et al., 2009; Roiser et al., 2012), maladaptive cognitive biases are central to the development and maintenance of depression. Thus, depressed people tend to view the world and themselves in an excessively pessimistic or hopeless light (Stratta et al., 2014). Depressed individuals may judge themselves and their temperament characteristics harshly and underestimate their positive attributes, possessing a self-disparaging and critical view. Such preoccupations may even result in individuals withdrawing from social situations, further affecting their self-image. In the long run, all of these may affect an individual's self-perceptions of temperament characteristics, including sociability, activity, and negative emotionality.

Based on the current evidence, we hypothesized that (A) temperament characteristics, especially low sociability and negative emotionality, are risk factors for depressive symptoms, (B) depressive symptoms may impact temperament, and (C) depressive symptoms and temperament characteristics have a reciprocal association, reinforcing each other. We therefore explicitly tested both directions of the causality hypothesis between temperament and depressive symptoms using linear regression analyses.

2. Methods

2.1. Participants

The Cardiovascular Risk in Young Finns Study is an ongoing population-based follow-up study of coronary heart disease risk factors in Finnish children, adolescents, and young adults (Raitakari et al., 2008). The first cross-sectional study was conducted in 1980 when age cohorts of 3-, 6-, 9-, 12-, 15-, and 18-year-olds were randomly sampled on the basis of social security numbers, resulting in a total of 3596 participants. The measurement of EAS temperament and depressive symptoms was performed in 1997 (the baseline of this study) and repeated in subsequent follow-ups in 2001, 2007, and 2012. In the final study phase, participants had reached an age of 38–41 years. The data used in this study consist of 1739 participants (718 men, 1020 women) with complete information about depressive symptoms from the follow-up assessment in 2012. The participants in this sample were more often women ($p < 0.001$), were slightly older ($p < 0.001$), had a lower body mass index (BMI) ($p = 0.003$), had a higher education ($p < 0.001$), smoked less ($p < 0.001$), consumed less alcohol ($p = 0.005$), and used more medication ($p < 0.001$) than those who dropped out. The characteristics of the study sample are presented in Table 1.

2.2. Procedure

The study was approved by the local ethics committee. Moreover, the study protocol of each study phase corresponded to the proposal by the World Health Organization and conformed to the Helsinki declaration. All participants gave written informed consent, and their treatment complied with APA ethical standards.

2.3. Temperament dimensions

Temperament was self-reported in all study phases by the participants using the Emotionality-Activity-Sociability Temperament Survey presented by Buss (1991). The questionnaire consisted of 27 items on a five-point scale of (1) totally disagree to (5) totally agree. According to the temperament theory by Buss and Plomin (1984) and Buss (1991), emotionality consists of two components: anger and fear. Anger was assessed using seven items (e.g., “I often feel like a powder keg ready to explode”;

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