



Research paper

Associations of temporal and energetic characteristics of behavior with depressive symptoms: A population-based longitudinal study within Strelau's Regulative Theory of Temperament



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ABSTRACT

Background: Individual dispositions have previously been associated with increased risk for depressive symptoms. The direction of the association has been found to be sometimes reciprocal. We examined whether temperament traits are associated with depressive symptoms and whether depressive symptoms contribute to changes in temperament.

Methods: Participants ($n=674-811$) were from a population-based Young Finns Study. Temperament was assessed by a Finnish version of the Formal Characteristics of Behavior – Temperament Inventory. Depressive symptoms were assessed with modified BDI (mBDI) in 1997, 2001, 2007 and 2012, and BDI-II in 2012.

Results: Higher perseveration and emotional reactivity were associated with higher level of depressive symptoms, and higher endurance was associated with lower level of depressive symptoms in 2007 and 2012. These associations were independent of several potential confounders and baseline depressive symptoms. The results of cross-lagged structural equation modeling showed that the associations between temperament and depressive symptoms were reciprocal: briskness, endurance and activity decreased the risk for depressive symptoms while depressive symptoms decreased the level of these characteristics. Perseveration, emotional reactivity and depressive symptoms reinforced each other over time.

Limitations: The depressive symptoms scales we used are not meant for measuring clinically diagnosed depression. The relationships between temperament traits and depressive symptoms were not strong enough to provide a clinical basis for guiding treatment.

Conclusions: Lower perseveration, lower emotional reactivity and higher endurance seem to be health protective temperament characteristics that reduce the risk for depressive symptoms. The reciprocal associations between temperament and depressive symptoms imply mutual health protective and health declining effects. Clinical relevance of the study is that enhancing positive loops and self-concept, and supporting individual stress management might be helpful in prevention of depressive symptoms.

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1. Introduction

Depression is one of the leading causes of disability worldwide (Ferrari et al., 2013; Moussavi et al., 2007) as measured in years lived with disability (YLDs) (Whiteford et al., 2013, 2015). The burden of mental and substance use disorders has increased by

37.6% between 1990 and 2010 (Whiteford et al., 2013) and depression is suggested to be the leading cause of disease burden worldwide by 2030 (Mathers et al., 2008). Given that the costs associated with depression are substantial – the disease burden induced by depression, lost work years due to depression, and expenses of therapies to prevent the consequences of depression – depression and depressive disorders induce one of the most important public health challenges to date.

Depression has a multifactorial etiology. A robust literature

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implicates that depression is moderately heritable and that genetic factors play a role in its etiology (Dunn et al., 2015). There are also other factors that play a role in the etiology of depression, including potential cognitive, emotional and personality-related endophenotypes that are associated with depression. These endophenotypes include, for instance, deficits in learning and memory (Hasler et al., 2004), emotion-based attention biases (Gotlib and Joormann, 2010) neuroticism and self-referential biases (Goldstein and Klein, 2014).

There are several theoretical models of how personality may be associated with stress (Cox and Ferguson, 1991; Strelau, 2001). For example, a transactional model of person-environment fit assumes that there are sequences of interaction between the person and his/her environment, and the balance in this relationship relates to wellbeing (Lazarus and Folkman, 1984). Personality is associated with stress through appraisal processes (Lazarus and Folkman, 1984). Personality can have influence on how person perceives stress, reacts in stressful situations and subsequently to succession of stress management (Strelau, 2001). Individual differences in stress process and person-environment interactions may induce different health-related outcomes. It is also potential that the association between personality and stress goes the other way round or is reciprocal. It has been shown that Big Five personality traits are associated with depressive symptoms and that depressive symptoms are related to changes in those personality traits (Hakulinen et al., 2015).

In addition to that the etiology of depression is related to potential individual psycho-physiological reactivity patterns, cognitive, emotional, behavioral mediators such as learned helplessness (Seligman, 1972), and personality-related endophenotypes, temperament is also a plausible candidate playing a role in the etiology of depressive tendencies. Temperament refers in general to biologically based, early emerging and relatively stable individual dispositions that reflect the reactivity to environmental stimuli and behavioral-emotional regulation of such reactivity (Strelau, 1998). Temperament traits are in constant relation with other personal components (here depressed mood) over time, what suggest that the association is reciprocal by nature. The enhancement of depressed mood over time might relate to the relatively stable personality characteristics.

Several studies conducted by Strelau (1998, 2008) have shown, that temperament characteristics may predispose individuals to experience stress and to react maladaptively in stressful encounters (see also: Hintsä et al. (2010, 2013a, 2013b), Hintsanen et al. (2011), Lazarus and Folkman (1984)). Our study is based on temperament as proposed by Strelau (2008) and known as the Regulative Theory of Temperament (RTT). RTT has the roots in the European tradition of temperament studies (Pavlov, Eysenck and Gray) and is most known in Europe. The specificity of Strelau's theory consists of underlying individual differences in the energetic and temporal characteristics of behavior, as exposed in the title of the paper. This means that RTT concentrates on traits referring to the formal aspects of behavior in distinction to the content (as e.g., agreeableness or conscientiousness). To a given extent it has some common elements with Rothbart (2011) constructs of reactivity and self-regulation (in RTT – activity) (Rothbart, 2011). As mentioned by the author, the “constructs of reactivity and self-regulation are very similar to Strelau's (Rothbart, 1989, p. 59)” (Rothbart, 1989). The theory of Rothbart is in fact a child-oriented one, whereas RTT refers mainly to adult temperament.

The RTT model defines temperament as basic, relatively stable personality traits that apply mainly to temporal and energetic characteristics of behavior (Strelau, 2008). In RTT, energetic characteristics of behavior refer to individual differences in the level of arousal (Strelau, 2008) – trait-arousal, known after Gray as

arousability determined by neurobiochemical mechanisms (Gray, 1964). They are manifested in such temperamental traits as sensory sensitivity, emotional reactivity, endurance and activity. Sensory sensitivity (SS) is defined by the ease with which the individual reacts to stimuli of low stimulating value. Emotional reactivity (ER) reflects a tendency to react intensively to emotion-generating stimuli. Endurance (EN) denotes an ability to react adequately in highly stimulating situations or in conditions of extensive environmental stimulation, i.e. in situations demanding prolonged behavior. Activity (AC) refers to undertaking behaviors of high stimulating value. By the way, activity as a temperament trait plays a role as a regulator of stimulation need (Strelau and Zawadzki, 2012). Temporal characteristics which refer to such traits as briskness and perseveration play a regulative role in modifying the level of arousal. Briskness (BR) is a tendency to react quickly, to keep a high tempo in activities, and to shift from one behavior to another when necessary. Perseveration (PE) refers to tendency to continue and repeat emotional states (even after cessation of stimuli requiring this behavior).

The existing evidence provides some support for the association between temperament and an increased risk for depression or depressive symptoms. It has been previously shown that impulsiveness, harm avoidant characteristics (shyness with strangers, fatigability), sentimentality and persistence increased the risk of depressive symptoms (Elovainio et al., 2004). Higher harm avoidance has been related to depressive symptoms (Rosenström et al., 2014) and the onset of depression (Kampman and Poutanen, 2011). It has been reported that lower sociability leads to depressive symptoms, but the association between negative emotionality and depressive symptoms seems to be reciprocal (Elovainio et al., 2015). It is not yet known, however, whether temporal and energetic aspects of behavior are prospectively associated with depressive symptoms, and whether the associations between these are reciprocal.

The associations between temperament and depression may result from several reasons. First, temperament and depression may share the same genetic or environmental background (Kendler et al., 1992). Second, temperament is a potential moderator in perceptions of stress and reacting to stressful life events (Elovainio et al., 2004; Strelau, 2001), and thus it may predispose the individual to experience negative emotions and increase tendency to evaluate oneself negatively. There is evidence for the cognitive-neurological model of depression where the negative evaluation increases through certain changes in brain activity (Disner et al., 2011). A temperamental composition of higher emotional reactivity, lower endurance and lower activity has been previously linked to impaired attentional control (Fajkowska et al., 2012). Third, temperament may either increase or decrease the goodness-of-fit between the person and the environment depending on the congruence between environmental demands and the person's dispositional characteristics.

It is also reasonable to assume that depressive mood influences temperament. Several theoretical models of depression, e.g. cognitive model of depression (Beck et al., 1979, 1988), learned helplessness (Seligman, 1972), and cognitive-neurobiological model (Disner et al., 2011) postulate maladaptive cognitive schemas to be related to depression. The cognitive model of depression suggests that depressive self-referential schemas are central to depression. Negative schemas, once activated by stressors, influence information processing in the brain, leading to negatively biased cognitions (attention, processing and memory) (Disner et al., 2011). Specific biases in cognitions contribute to a ruminative response style that increase negative thoughts about the self and the world (Disner et al., 2011).

In depression, there are dysfunctional psychological processes involved: these include biased cognitions, negative emotions,

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