HOW HARDINESS AND THE QUALITY OF LIFE RELATE TO THE PARAMETERS OF AUTONOMIC REGULATION

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Abstract

The prognostic significance of the two tests most often used by psychologists for describing a subject’s quality of life, the Short Form-36 Health Status Survey and the Hardiness Test has been evaluated in the research. As an indicator of the state of internal control, correlative activity of the sympathetic nervous system and the parasympathetic nervous system, as the two divisions of the autonomic nervous system, was chosen. A total of 59 students and office workers participated. The study was conducted in two successive stages within a single session. During each of the stages, the heart rate was recorded at an R-R interval of 300, which made it possible to assess slow and fast waves on the cardiogram. During the first stage, the R-R intervals were recorded with the subject in the state of quiet wakefulness; during the second stage, the subject’s health was discussed. It has been shown that a person’s own feeling about the state of their health is not associated with important parameters that describe state of the internal environment. The only correlation between a person’s own description and the actual inner state is possible when the person describes one’s own real responsibilities and how he carries them out.

Keywords: hardiness, quality of life, autonomic system, sympathetic and parasympathetic systems

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Relevance

Practically all contemporary theories explaining work of the brain draw on the idea that it does not respond to external influence but it anticipates changes in the ambient environment (Frith, 2011). It is possible to presume that it makes predictions about what happens not only in the outside world but also about what emerges in the body itself. On one hand, these predictions manifest themselves in reactions of systems responsible for allostasis (Sterling, 2003) and, on the other hand, in a person’s verbal description of their own state. Thus, the predictive capability of the brain with regard to the intrinsic state of a particular person can be described as a correlation between their description of themselves and physiological changes taking place in the body (Hering, Lachowska, & Schlaich, 2015; Jelenova, Prasko, Ociskova, Hruby, Latalova, Holubova, & Mihal, 2016; Azam, Katz, Mohabir, & Ritvo, 2016).

A description of this correlation is significant since it will help to satisfy the need for understanding the extent to which it is possible to rely on the results of screening tests designed to reveal early symptoms of a disease in people with no clinical manifestations of that disease.

It is possible to suggest that a person’s subjective description of their state of health and their attitude towards life obstacles are connected in a way not entirely apparent with the peculiarities of internal control over physiological processes and therefore has prognostic value in the context of assessing a person’s health in general, as well as very early symptoms of changes of regulatory processes in the body (Tyagi, Cohen, Reece, Telles, & Jones, 2016; Keller, Kouros, Erath, Dahl, & El-Sheikh, 2014; Williamson, Porges, Lamb, & Porges, 2015).

It was of interest to evaluate prognostic significance of the two tests most often used by psychologists: the Short Form-36 Health Status Survey (SF-36) and the Hardiness Test (Maddi, 1987, 1998). As an indicator of the state of internal control, correlative activity of two parts of the autonomic nervous system (ANS) – the sympathetic nervous system (SNS) and the parasympathetic nervous system (PSNS) – was chosen.

The SNS and the PSNS are responsible for ensuring that different aspects of the body’s internal environment function properly. While the SNS is activated when
circumstances in the external environment change abruptly, the PSNS, to a great extent, sees to recovery of spent resources. It is for this reason that these systems may even function unidirectionally when the body’s level of activity is low, whereas, at the height of its functioning capacity, their activities are orthographic and aimed in different directions. And very frequently, activity of one system suppresses activity of the other.

Activation of the SNS attests to the degree of allostatic load in the trial subject and is associated with the stress level of regulatory systems (Holsboer & Ising, 2010). Activation of the parasympathetic nervous system, which originated earlier in evolution than the sympathetic system for stability provision within the internal environment, demonstrates the level of the body’s reserve possibilities.

The SF-36 measures quality of life according to eight scales (Ware, et al., 2000). It is widely used to assess the condition of people who are ill (Nikolaeva & Elnikova, 2015). However, it can be used in screening those who are apparently healthy. Scales one to four reflect the “physical component of health”, and scales 5 to 8 provide the picture of the “psychological component”.

The “hardiness” is defined as a system of beliefs about oneself and about the world as well as the relationship between these beliefs. It is a mode of functioning that includes three relatively autonomous components: dispositions of commitment, control and challenge. According to this paper, manifestation of these three components and of hardiness in its entirety safeguards the body against internal pressure in stressful situations by means of hardly coping with stress and downplaying its significance. Maddi (Maddi, 1998) emphasises how important these three components for the maintenance of health are, as well as the optimal level of working capacity and alertness under stress conditions (Masserova, & Kaznacheeva, 2010; Fatkullina, 2011).

It can be assumed that, among healthy people, hardiness and their own conception of their state of health are reflected by changes in the balance between the sympathetic and the parasympathetic branches of the autonomic nervous system, evaluated at the states of quiet wakefulness and of stress. In the present case, it was done within the framework of a conversation about their health. The reaction to this conversation depends on the person’s
own perception of the state of his or her health and how he or she feels about it. Therefore, the intensity of changes in the balance between the SNS and the PSNS is capable of reflecting a person’s view of him or herself as either healthy or unhealthy.

Materials and methods

The study sample was constituted by 59 students and office workers between the ages of 18 and 70 in the city of Yelets (average age of 25.1 ± 11.0 years, hereinafter referred to as [m]+[SD]). Their heart rates were recorded by using the Omega M hardware and software package (The Dinamika Company, Russia) and standard leads (in the sitting position, with electrodes placed on wrists of both hands).

The study was conducted in two successive stages within a single session. During each of the stages, the heart rate was recorded at an RR interval of 300, which made it possible to assess slow and fast waves on the cardiogram. During the first stage, the RR intervals were recorded with the subject in the state of quiet wakefulness; at the second stage, the subject’s health was discussed. Only test subjects with sinoatrial heart rate in the state of quiet wakefulness participated in the study. The second recording was done for further elaboration (an additional time while the test subject was in the process of describing the state of their health). Technical artefacts (if there were any) were edited by means of Omega M software via manually adjusting erroneous markers of R-peaks to correct positions. Isolated physiological artefacts (if there were any) were edited using algorithms of the Kubios HRV-heart rate variability analysis software (Tarvainen et al., 2014).

Assessment of ANS activity was carried out based on analysis of the subjects’ heart rates, using the Nerve-Express system (Riftine, 2010). This software evaluates the status of the ANS on a graph, with the orthogonal axes representing the parasympathetic nervous system (PSNS, the X axis) and the sympathetic nervous system (SNS, the Y axis), with consideration for individual border lines for the power of the parasympathetic and sympathetic waves within the spectrum of the heart rate (Riftine, 2014). Negative values of the PSNS and SNS figures show a decrease in activity – sharp (-4), significant (-3), moderate (-2) and slight (-1) – corresponding to the branch of the ANS.
The value of zero indicates that the system is balanced. Positive values point to an increase in activity: slight (+1), moderate (+2), significant (+3) and sharp (+4).

Thus, there are 81 dots on the graph, corresponding to the ANS states received from analysis of over 10,000 test subjects. These dots are grouped in zones describing functional state of the ANS. For example, the square at the centre of the Y-axis including the PSNS and SNS values from -1 to +1 describes the zone of balanced ANS activity (Riftine, 2014).

The Short Form-36 Health Status Survey (SF-36) was used in a version adapted for Russian-language audience and prepared by The Evidence CPR (Clinical Pharmacology Research) Company. The scores for each scale range from 0 to 100 percent, with 0 percent representing complete inability to carry out daily activities on one’s own and 100 percent reflecting total lack of complaints (limitations) under the weight of those same daily activities.

1. Physical Functioning (PF) reflects the extent to which a person’s physical condition restricts his or her ability to perform physical tasks (looking after one’s personal needs, walking, climbing stairs, carrying heavy objects, etc.). Low scores on this scale indicate that a patient’s physical activity is severely limited by the state of their health.

2. Role-Physical Functioning (RP) reflects the influence that a person’s physical condition exerts on the roles the person fulfils in his or her daily activities (at work and while carrying out their everyday responsibilities). Low scores on this scale attest to patients’ daily activities being significantly limited by their physical condition.

3. Bodily Pain (BP) reflects the influence that pain syndromes exert on a person’s ability to engage in his or her day-to-day activities, including work around the home and outside of the home. Low scores show the pain substantially restricting the patient’s activity.

4. General Health (GH) reflects a person’s perception of his (her) state of health at the present moment. The lower the score on the scale is, the lower the patient’s estimation of the state of his or her health is.

5. Vitality (VT) reflects how people feel, if they are at full strength and energy or, on the contrary, completely drained of both. Low scores bear witness to the patient’s fatigue and a lowering of the involvement in life activities.
6. Social Functioning (SF) reflects the degree to which a person’s physical or emotional state limits his or her social activity (interaction with other people). Low scores indicate a considerable limitation in the patient’s social contacts and a reduced level of interaction owing to deterioration of their physical and emotional condition.

7. Role-Emotional Functioning (RE) evaluates how a person’s emotional state interferes with the ability to work or carry out other daily activities (including large expenditures of time, a decrease in the amount of work, defect of its quality, etc.). Low scores on this scale are interpreted as restrictions in a patient’s ability to perform their workaday activities caused by a worsening in their emotional state.

8. Mental Health (MH) reflects the level of positive emotions. Low scores attest to presence of mental problems, as well as depression and anxiety.

In regards to the Hardiness Test (Maddi, 1987, 1998), a Russian conversion drawn up by Leontyev & Rasskova (2006) was used. It had the following scales:

1. Commitment was defined as “the belief that involvement in events gives the maximal possibility of finding something worthwhile and interesting”. A person with developed sense of commitment derives pleasure from their own activity. In contrast, absence of this belief gives rise to sense of rejection and the “outside of life” feeling. “If you feel self-confident and that the world is rather benign, you have commitment”.

2. Control is the conviction that endeavouring allows one to exert influence upon events around him or herself, even though this impact is not absolute and success is not guaranteed. The opposite of this is the feeling of helplessness. People with highly developed sense of control feel that they choose their own sphere of action, their own way in life.

3. Challenge is assurance of a person of everything that happens contributes to his or her development due to knowledge that comes from experience both positive and negative. A person considering life as a means of acquiring experience is ready to act in absence of any reliable guarantees of success, at risk and peril, believing that to strive for simple comfort and security would impoverish one’s life. At the basis of risk-taking there is the idea that development comes from active assimilation of knowledge gained through experience and its subsequent use.
The consistency of the scales used on the study sample in the two methods (their internal validity, described with the use of Cronbach’s coefficient) was within standard values.

Two statistical packages – G*Power version 3 and IBM SPSS Statistics version 22 – were used to process the results. The level of statistical significance (p) was arrived at by initially assigning the value Power = 1 – β = 0.80, and the null hypothesis deviated at p≤α=0.05 (Faul et al., 2007).

**Results and their discussion**

A correlation analysis between the scores of the two questionnaires and the values of ANS parameters was carried out. Interconnection (high, significant correlation of moderate strength) was established only between PSNS and RP (Role-Physical Functioning) scores (see Table 1). It should be noted that the other three physical components of a person’s health were determined exclusively on the basis of a test subject’s self-esteem, i.e. how they assess the level of their own physical condition and physical activity as well as the level of pain they feel. These scales merely reflect the test subject’s perception of the given actions and situations. Such self-esteem may reflect the actual level of the body functional reserves (manifested in the level of parasympathetic activity for normally developing test subjects); however they might be unable to reflect it (Nikolaeva et al., 2013).

Table 1.

<p>| Correlations between quality of life parameters and ANS (PSNS and SNS) activation |
|--------------------------------------|--------------------------------------|</p>
<table>
<thead>
<tr>
<th>Scales</th>
<th>PNS</th>
<th>SNS</th>
</tr>
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<tbody>
<tr>
<td>PF</td>
<td>r=0.270; p=0.195&gt;0.05</td>
<td>r=0.162; p=0.338&gt;0.05</td>
</tr>
<tr>
<td>RP</td>
<td><strong>r=0.415; p=0.010&lt;0.05</strong></td>
<td>r=0.150; p=0.373&gt;0.05</td>
</tr>
<tr>
<td>BP</td>
<td>r=0.007; p=0.800&gt;0.05</td>
<td>r=0.145; p=0.388&gt;0.05</td>
</tr>
<tr>
<td>GH</td>
<td>r=0.184; p=0.276&gt;0.05</td>
<td>r=0.134; p=0.422&gt;0.05</td>
</tr>
<tr>
<td>VT</td>
<td>r=0.003; p=0.794&gt;0.05</td>
<td>r=0.142; p=0.397&gt;0.05</td>
</tr>
<tr>
<td>SF</td>
<td>r=0.251; p=0.127&gt;0.05</td>
<td>r=0.022; p=0.750&gt;0.05</td>
</tr>
<tr>
<td>RE</td>
<td>r=-0.218; p=0.193&gt;0.05</td>
<td>r=0.038; p=0.709&gt;0.05</td>
</tr>
<tr>
<td>MH</td>
<td>r=0.016; p=0.764&gt;0.05</td>
<td>r=0.135; p=0.419&gt;0.05</td>
</tr>
</tbody>
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The RP scale differs from the PF, BP and GH scales by the evaluation including an external factor: responsibilities that the test subject assumes as a part of their professional, family and social activities. Thus, this scale can be considered a marker of how well a test
subject has adapted to the society (Ware, 2003), which should to a certain degree correspond to the level of functional reserves in their body. Please note that there was no significant correlation with the activity of the sympathetic system, which indicates the level of stress in test subjects whose development was in keeping with the norms (Nikolaeva et al., 2016).

These findings conform to those of other authors. The predictive significance of parasympathetic activity level in evaluation of functional state of the body in the context of adaptation to psycho-physiological workloads has been shown (Tereshchenko, 2003) for test subjects of various groups and ages and for different kinds of workloads.

An interdependency (a significant, weak correlation) was established only between hardness and the RE score (the amount of work performed and the scope of daily responsibilities that are possible under the current emotional conditions). There is, however, no significant correlation between hardness and the level of ANS activity. Among the indicators of the psychological component of health, the RE indicator has distinctive features analogous to those of the RP indicator among physical components of health (Ware, 2003). It can be presupposed that if test subjects have high levels of commitment, control and challenge when involved in life’s work that they have chosen for themselves, with all other conditions being equal, this gives them an advantage in coping with a situation with emotional circumstances.

**Conclusion**

Thus, a person’s perception of their state of health is not associated with the important parameters that describe the state of the internal environment. The only correlation between a person’s own description and the actual inner state arises when people describe their real responsibilities and how they carry them out.

There is a substantial gap between a person’s actual physiological reserves and the picture that they have of their own state of health, which may have evolutionary significance. This is exactly what makes it possible for a physically weak female to protect her young in a stressful situation, regardless of her body real reserves, or a male to defend his home, or any person, no matter the gender, to commit heroic acts of survival, independent of their body reserves at that moment.
This situation, however, might have a negative effect when, in the absence of any threat of bodily harm, a person could, due to certain conditions and personality traits, look for signs of deterioration of his or her health – not in real physiological symptoms, but in their own imaginary notions.

References


