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Decoding the nexus of stress tolerance, personal readiness for change, and psychological factors using PLS-SEM

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This research examines the intricate connections among three key elements: an individual's ability to tolerate sources of stress, their willingness to adapt to new situations, and various psychological factors that influence human behavior. To analyze these relationships, the study employs a sophisticated statistical technique known as partial least squares structural equation modeling (PLS-SEM). A total of 327 Kazakhstan residents voluntarily participated in the study, comprising 84.6% women and 15.4% men, with ages ranging from 14 to 67 years old. "Stress Source Tolerance Scale" examined stress tolerance, "Personality Readiness Scale" measured readiness to change, and "Fatigue, Monotony, Satiety and Stress Questionnaire" investigated psychological states. The results indicate significant direct and indirect effects of self-esteem, others' perceptions, and world perceptions on stress tolerance, readiness for change, and psychological states. Moreover, systematic preference has a significant mediating effect on the relationship between openness to change and psychological states. Results suggest that understanding these complex relationships may have implications for health, organizational effectiveness, and psychological well-being.

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Introduction

Stress is a ubiquitous aspect of modern life, affecting people's well-being, organizational performance, and psychological states. Understanding how people's stress tolerance, readiness to change, and various psychological factors interact is critical to effectively addressing these issues. The concept of stress resilience, including an individual's ability to cope with stressors, has received much attention in health and organizational psychology. Personal readiness for change is important in today's dynamic world, where adapting to new circumstances is often a prerequisite for success. In addition, psychological factors, including fatigue, monotony, satiety, and stress tolerance, play a key role in people's overall well-being.

Signs that a person has a high tolerance for ambiguity are willingness to take calculated risks, adaptation to new conditions and processes, confident decision-making, feeling that spontaneous actions and plans are correct, and feeling safe in close relationships. Signs of low tolerance for ambiguity are: examining phenomena and factors over and over again before making a decision; feeling that something could end badly, even if a bad outcome is very unlikely; difficulty engaging in and enjoying spontaneous activities; needing constant support from others; feeling insecure in relationships or careers without evidence.

The main purpose of this study is to examine the relationships between the following variables and to clarify how they interact with each other. We test the hypothesis that self-perception, perceptions of others, perceptions of the world, and discipline have direct effects on systematic preferences (SPs), openness to change (OTC), and psychological states such as fatigue, satiety, and stress. Moreover, we hypothesize that SP may mediate the relationship between OTC and psychological states. Therefore, one of the objectives was to identify the factors that constitute the core of stress tolerance and human tolerance to the state of uncertainty and ambiguity. By uncovering these complex relationships, we hope to contribute to the fields of health psychology, organizational psychology, and well-being research. Our findings can inform stress management strategies, enhance organizational effectiveness, and provide research evidence for promoting psychological well-being in a variety of contexts.

The Personal Readiness for Change Scale, conceptualized by Rollnick et al. (1992), encompasses dimensions such as "Openness to Change" and "Systematic Preference." "Openness to change" refers to how willing and ready a person is to accept and adapt to new situations or changes in their life or work environment. In contrast, "systematic preference" is a person's tendency to favor and value structured, organized approaches and systems. Scale of Tolerance to Sources of Stress is further enriched by three critical factors: the "Self-perception" factor, which examines an individual's perception of their personality as either stress-inducing or stress-free; the "Perception of Others" factor, which evaluates whether one's view of others contributes to stress or alleviates it; and the "World Perception" factor, which assesses an individual's view of the external environment as either a source of stress or comfort. Complementarily, the psychological assessment instrument devised by Plath and Richter (1984) is designed to probe into an individual's emotional and cognitive responses to their occupational milieu, with a particular focus on fatigue, satiety, and stress, thereby offering a comprehensive framework for understanding the multifaceted nature of personal and occupational well-being.

This study uses the partial least squares structural equation method (PLS-SEM) to examine the relationships between three main factors:

- Tolerance to Sources of Stress
- Personal Readiness for Change
- Levels of Fatigue, Monotony, Satiety, and Stress

The research aims to understand how these factors are connected and influence each other.

Theoretical background

Impact of stress resistance during quarantine on perception of ambiguous situations. Quarantine and isolation for a long time, although they are considered highly effective measures to counter the new coronavirus (COVID-19), which began at the end of 2019, undoubtedly affect a person's mental health, especially emotional state. The severe acute respiratory syndrome coronavirus 2 SARSCoV-2, the virus causing COVID-19, spread worldwide and caused far-reaching consequences for the mental and physical health of billions of people (Fiorilo and Gorwood, 2020). The World Health Organization (WHO) declared COVID-19 a pandemic on March 11, 2020, when the number of infections and deaths worldwide began to grow exponentially. The first cases were reported in December 2019 in Wuhan, China (World Health Organization, 2020).

The first cases of COVID-19 in Kazakhstan were registered on March 13, 2020, in the cities of Almaty and Nur-Sultan. These cases were imported from Germany and Italy (Maukaeva, 2020). Since March 20, confirmed cases of COVID-2019 have been registered in other regions of the country (Maukayeva, 2020). The vast majority of patients with symptoms had certain manifestations of the disease, and the proportion of the moderate disease course was about 10% (Semenova et al., 2020). Kazakhstan introduced quarantine very early and combined it with other measures to protect the population, including the closure of all educational institutions, restriction of movement, and cleaning with disinfection in public places (Semenova et al., 2020). The highest rates were registered in the south-eastern part of the country (Almaty and South Kazakhstan regions) and in the Akmola region, where the capital of the state, the city of Nur-Sultan, is located (Kuznetsov and Veronika, 2021).

Almost two years after its impact, COVID-19 had a huge effect on the life quality of the Kazakh population. The nature of the pandemic individual experience for Kazakhstanis varied partly depending on socio-demographic factors. The mental state of the Kazakh population was thoroughly checked, and numerous studies found a marked increase in psychological symptoms in the non-clinical population. The mortality rate in the study population was 1%, and the mortality rate with men was 2.6 times higher than with women. Each additional year of age increased the probability of infection and the risk of death from COVID-19 by 1.06 times (Zhussupov et al., 2021).

Coronavirus disease 19 (COVID-19) has become the most devastating event of the 21st century with alarming and lasting consequences for the entire society. Despite the relative success of vaccination programs, the global threat of the new SARS-CoV-2 coronavirus still exists, and therefore ambiguity persists. It is necessary for its control and containment to approach an understanding of the actual scale of SARS-CoV-2 infection, which is also associated with long-term psychological consequences (World Health Organization, 2020).

The COVID-19 pandemic affected all aspects of our lives and changed the daily routine of every family in Kazakhstan. A stable way of life has been replaced by alarming ambiguity (accompanying the pandemic)—a threat to health and life, an unknown course of the disease and the lack of reliable medicines that guarantee healing, ambiguity about the future, fears for their lives and the lives of loved ones, especially adults and elderly parents,

as well as quarantine regime, economic problems and self-isolation have a serious impact on the mental health of the population. All of these factors contain ambiguity about the present, future, health, and life.

In such an unstable time, in constantly changing living conditions, people may experience psychological difficulties. The majority of the population, concerned about the threat of infection, avoids visiting psychologists in medical institutions.

In order to meet the emerging need for psychological support during the COVID-19 outbreak, the UNICEF representative office in Kazakhstan, together with the Republican Scientific and Practical Center for Mental Health of the Ministry of Health of the Republic of Kazakhstan (RSPCMHMHRK), launched a special website[1], which provides information and serves as a platform for individual online consulting services that meet the needs of the population in psychological assistance and support during the pandemic.

Thus, a study conducted by Kim et al. (2021) showed that despite the harsh measures taken in connection with the pandemic at the government level, there were and are individual differences in behavior. At the same time, the indicators of the "Big Five" have different effects on people's behavior. Thus, "openness to experience" and "neuroticism" have the least impact, while "consciousness" and "consent" have the greatest. In terms of a systematic approach, the substructures of a person —"subject of activity" and "personality" most clearly bear the imprint of this crisis period (Khon et al., 2020).

People's experiences during the COVID-19 pandemic in the context of tolerance for ambiguity are associated with the fact that emotions such as fear, irritation, anxiety, and sadness dominate the emotional background. Tolerance for ambiguity turned out to be negatively associated with all negative emotions, which allows us to consider it as a resource that reduces negative experiences in the current situation (Pervushina et al., 2020). Thus, the measures taken by the government and society as a whole, first of all, should be correlated with the individual characteristics of a human as a person and a subject of activity, it is they who form the perception of information related to COVID-19 (Kim et al., 2021).

Personal stress tolerance and perception of ambiguity during the COVID-19 pandemic. Currently, the whole world has found itself in an unprecedented stressful situation in terms of the breadth of coverage—the spread of the COVID-19 virus has made adjustments in almost all spheres of human life. The nature of the subjective stress perception is one of the important factors determining the severity of mental consequences (Dvoryanchikov et al., 2005). The features of information concerning the stress factor play an important role in preventing the aggravation and chronification of mental maladaptation in response to the action of extremely severe stress (Aleksandrovskiy Yu et al., 1991). It is known that attempts to understand the situation, on the one hand, are a constructive way of controlling the experience of ambiguity and danger. With any catastrophic event, there is a sharp increase in the demand for information about it. On the other hand, in the demand wave, the number of materials offering often unrealistic versions of what is happening and promoting ways of coping with the situation, which often poses a danger to human physical and mental health, is sharply increasing, which is already noted by WHO experts (World Health Organization, 2020). Therefore, it is important to take into account the psychological factors contributing to the enhanced search for information.

Stress associated with the conditions of a pandemic can lead to mental health problems, for example, virus exposure or the threat of virus exposure can lead to concern for the health and the health of loved ones, especially among those who find it difficult to perceive ambiguity. People suffered from other stressors, such as isolation or quarantine (isolation from others when infected; self-isolation or quarantine when a person was in close contact with an infected person); anxiety about the future; interruptions related to the supply of food, water, clothing, and medicines; and the abundance of unreliable information, due to insufficient research, the lack of clear recommendations on actions to be taken, as well as financial losses and stigmatization (Brooks et al., 2020).

The principle of tolerance means the principle of patience. Tolerance in the UN Declaration is defined as "… respect, acceptance and recognition of the rich diversity of cultures of our world, our forms of self-expression and ways of being people" UNESCO (1995). To tolerate ambiguity means that a person can come to the fact that he does not know how things will turn out. Signs that a person may have a high tolerance for ambiguity include a willingness to take calculated risks and adaptation to new conditions and processes.

Signs that a person has a high tolerance for ambiguity include willingness to take calculated risks, adaptation to new conditions and processes, making decisions confidently, feeling right with spontaneous actions and plans, and feeling safe in close relationships.

Intolerance for ambiguity has more to do with the action that a person commits or avoids than with his inner experience and how he feels about the next step. Signs that a person may have a low tolerance for ambiguity include: researching phenomena and factors over and over again before making any decision; feeling that something may end badly, even if a bad outcome is very unlikely; it is difficult to engage in spontaneous activity and enjoy it; need to constant support from others; feeling insecure in a relationship or career without proof.

Since this pandemic is a new and unprecedented situation, it means huge ambiguity due to the unpredictability of the future situation (Zandifar and Badrfam, 2020). Ambiguity is a subjective negative state characterized by the presence of negative emotions experienced in response to unpredictable conditions (Freeston et al., 2020), and a feeling of insufficient information to cope with them (Toro et al., 2020). The ambiguity associated with the COVID-19 pandemic is a sense of inability to control or predict events related to the pandemic (del–Valle et al., 2022; Li et al., 2021). Perceptions of ambiguity regarding COVID-19 and differences in the level of tolerance traits for ambiguity arising from various sources (risk, ambiguity, and complexity) are associated with lower trust among people who are less tolerant of ambiguity (Gillman et al., 2023). The Covid-19 pandemic has given rise to widespread uncertainty, a phenomenon well-documented by Lazarus et al. (2023). This uncertainty manifests in various health-related questions that weigh heavily on the public's mind: the risk of infection, the potential impact on personal income, the health of family members, the economic recovery prospects, the availability of essential supplies, and the duration of the pandemic. According to Satici et al. (2020), the sheer unpredictability surrounding these issues represents one of the most significant stress-inducing elements of the pandemic.

Although ambiguity is a normal reaction to situations such as the current one, if distress persists or becomes unbearable, it can become a serious problem for some people (Mertens et al., 2020). Personality resources predict individual differences in cognitive assessments of ambiguity and emotional reactions associated with each situation. People with a higher level of personal resources tend to assess difficult situations as more defined, have a better sense of orientation in these situations, demonstrate more positive emotional reactions, and demonstrate more positive

trends of change over time, reflecting successful adaptation. Such individual characteristics as self-efficacy, tolerance for ambiguity, a sense of consistency, subjective vitality, faith in freedom, and resilience are positive personal resources that perform a buffer function when interacting with subjective ambiguity. The data obtained correspond to the concepts of existential and positive psychology, according to which a person is forced to face absolute ambiguity and find ways to resist these challenges. (Leontiev et al., 2022).

The study (Pogorilska et al., 2021) revealed that the vast majority of volunteers perceive the pandemic as a dangerous, threatening, uncertain situation and make hasty decisions based on polar judgments, react with anxiety, try to avoid ambiguity, rejection of anything unusual. Their experiences were filled with a sense of powerlessness and a deterioration of mood. For most of the subjects, the situation of ambiguity is a source of intolerance. Negative consequences appeared in the behavior (loss of time management skills, laziness). The study revealed that there are direct links between the shock and anxiety factor and the sources of intolerance, novelty and complexity, and general intolerance. Cognitive rethinking of self-isolation during the COVID-19 pandemic is possible after an emotional response and leads to a change in behavioral stereotypes.

Despite the fact that distress due to ambiguity is an obvious and understandable reaction in this context, it should not be pathological (Freeston et al., 2020). Psychological work at an early stage can help people cope with distress and prevent more serious problems. As it was pointed out (Brooks et al., 2020), possession of information and awareness are a key aspect of this pandemic. Thus, in order to prevent excessive involvement (for example, coming out of quarantine to try to regain control of the situation and alleviate suffering (Freeston et al., 2020) and mental health problems, it is necessary to avoid biased information and make sure that people understand what is happening and what they can and cannot do. Most studies have examined personality resilience during the pandemic and its mediating role in the relationship between stress and burnout, stress and quality of life, social isolation, and well-being (Duarte et al., 2022). Emotional exhaustion (feeling of extreme fatigue, decreased activity, loss of interest, frustration) seems to be the most sensitive component of burnout, which responds most quickly to extreme situations during the COVID-19 pandemic and determines the development of other components of burnout. The following factors of stress resistance in the conditions of the COVID-19 pandemic were: the presence of such personal traits as extroversion, honesty, openness to new experiences, and conscientiousness; developed ability to self-government: self-regulation (self-determination, self-motivation, self-relaxation), development of will (initiative, volitional activity and ability to concentrate), sensitivity to oneself (orientation to action after failures, congruence to one's own feelings and integration of contradictions) (Pervichko et al., 2023).

Various life aspects during the pandemic conditions were investigated, for example, elements of bullying in the student environment were identified (Alrawashda, 2020) and its impact on the educational environment (Del-Valle and Aranda, 2021); peculiarities of inclusive learning in the era of digital and virtual learning during quarantine (Evans-Amalu and Claravall, 2021); adopting a posthuman and limitless curriculum in response to the ambiguity caused by the coronavirus (Dube et al., 2023). This work details the rationale for adopting the "After Man" and "Without Borders" curriculum in response to the duality caused by the coronavirus. There are also studies on the impact of the economic state of the country during the pandemic on the quality of life and emotional state of a person (Peñalver and Urbieta, 2021).

The COVID-19 pandemic has made adjustments to people's lifestyles and forced them to reconsider their attitude toward many things. Due to the sharp deterioration of the situation with morbidity caused by coronavirus infection, coordination of the work and response of all public structures, especially in the field of medicine, is of particular importance. In particular, as the results of the study showed, in general, medical workers have a positive socio-psychological state, and a high level of stress tolerance, their lifestyle changed slightly in the conditions of the pandemic, and the structure of ethos and value orientations there was a reassessment of the place and importance of medical activity towards increasing the role of corporate culture and civic responsibility (Nikiforova et al., 2022).

Greenhouse-Tucknott et al. (2020) argue that it should be taken into account that many people are more susceptible to negative environmental influences, which can lead to stress and deterioration of health. Unlike biological and lifestyle factors, psychosocial factors influence health and behavior through social and cultural aspects. The indicator of age-related features of the subjective state of health is considered a balance of positive and negative assessments concerning the state of health of differently-aged people and may depend on the subjective assessment of their mood and well-being.

Readiness for change during the COVID-19 pandemic. The way we feel about change largely explains why some of us succeed and some of us fail when dealing with significant changes. Those who perceive change as something that may or may not happen are particularly vulnerable. Those who treat change as a continuous process face a minimum of problems in their perception. Achieving readiness for change is not an easy task, many people do not know what is needed for this.

A person who adapts slowly to the changes happening around them typically exhibits impatience with the state of ambiguity and perceives life in black and white. People who perceive changes correctly and flexibly understand that change is a time-stretched process (Shirey, 2013).

The model, first developed by the social psychologist Lewin (1958), divides the process of change into three stages: the current (initial) state, the transition (transformation) state, and the desired (final) state. The current state is the status quo, a stable state of equilibrium, unchanged until some force disrupts it. The transition state is the phase in which the deviation from the status quo occurs. During this period, we develop new perspectives and behavioral patterns that lead us to the desired (final) state. To reach the final state, we must go through a period of ambiguity and discomfort in the transition state.

Crises such as the new COVID-19 virus highlight the acute need for transformations for the survival of our society in the 21st century. This serves as a good reminder that even in a seemingly hopeless situation, there is always a way out[2]. The pandemic we are all experiencing is also undergoing a process of change.

The impact of positive psychological resources on employees' mental health, their readiness for change, and ambiguity in the job, psychological capital resources (hope, resilience, optimism, and self-efficacy) are crucial for employees to reduce job ambiguity and strengthen mental health and readiness for change (Taufikin and Iain, 2021). The COVID-19 outbreak negatively affected employees' positive mood, behavior, and work outcomes. Thanks to the accumulation of psychological capital, employees can feel less vulnerable at work. Furthermore, mental health and readiness for change can be strengthened through psychological capital. The future, when the world overcomes COVID-19, certainly appears different. Employees must be prepared for the changes that will occur in the post-COVID scenario.

Readiness for change during the COVID-19 period has a positive and significant impact on the relationship between transformational leadership and employee performance (Zaman et al., 2020). In psychology, the topic of readiness for change and psychological states has been studied mainly in the field of organizational psychology. For example, in a study (Rehman et al., 2021), one of the legitimate reasons for the failure of a change strategy is employees' fear of the ambiguity of future events connected with changes. Employees' confidence, emotions, and behavior need to be shaped so that employees are ready for changes. Management should offer more opportunities to involve employees in the decision-making process and ensure that relevant rules and regulations can be applied more fairly and openly, thereby reducing the impact of the context of ambiguity on employees and eliminating possible resistance to change, and be prepared for them (Shao et al., 2022).

According to research, the role of readiness for change as an intermediary rather than as an independent variable is obvious (Effiyanti et al., 2021). Other authors have focused on managing organizational change rather than on individuals' readiness for change. Examining the readiness for change from a micro-point of view, that is, from the point of view of the individual, the authors (Alolabi et al., 2022) made a significant addition.

Bouckenooghe (2010) describes that readiness for change consists of three elements (emotional, cognitive and intentional). The emotional element includes a person's feelings, the cognitive element is a belief that helps people understand the result of a change, and the intentional element is the degree to which a person is willing to invest energy, effort and perseverance to make a change in the true spirit.

The relationship between psychological factors and willingness to change has been studied in previous studies, such as a person's willingness to tolerate change (Al-Maamari et al., 2018). In the study, Jimmieson and White (2011) attempt to explain the mechanisms by which the methods of managing two changes (communication and participation) affect the intentions of employees to support change, that is, the authors study the employees' personal attitudes and perceptions of readiness for change and individual fear of change, since the latter are associated with individual productivity (Weeks et al., 2004). Some authors have predicted that psychological factors have a positive effect on OTC (Devos et al., 2007), maintaining readiness for change (Al-Ghazali and Afsar, 2022), and concerns about personal failures (Weiner, 2020).

Methodology

This study concentrates on the latter phase, examining the interconnections among the scales. Two key divisions define the research. The initial section emphasizes the adaptation of the scales for implementation in this situation and carrying out research to guarantee their validity and dependability. We conducted exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) for the scales during this phase. For every scale, we also computed composite reliability and Cronbach's alpha coefficients. Detailed information is presented in the data collection tools section. Examining the relations among the several scales takes up the second section. This work mostly focuses on this later phase and investigates the interactions among the several scales. Investigating these connections will help us to better grasp the fundamental ideas and their interconnections.

This study utilized a quantitative approach to examine the relationships between various latent constructs: Scale of Tolerance to Sources of Stress, Personal Readiness for Change Scale, and Questionnaire of Fatigue, Monotony, Satiety, and Stress. A hypothetical model was constructed in Fig. 1. The data was
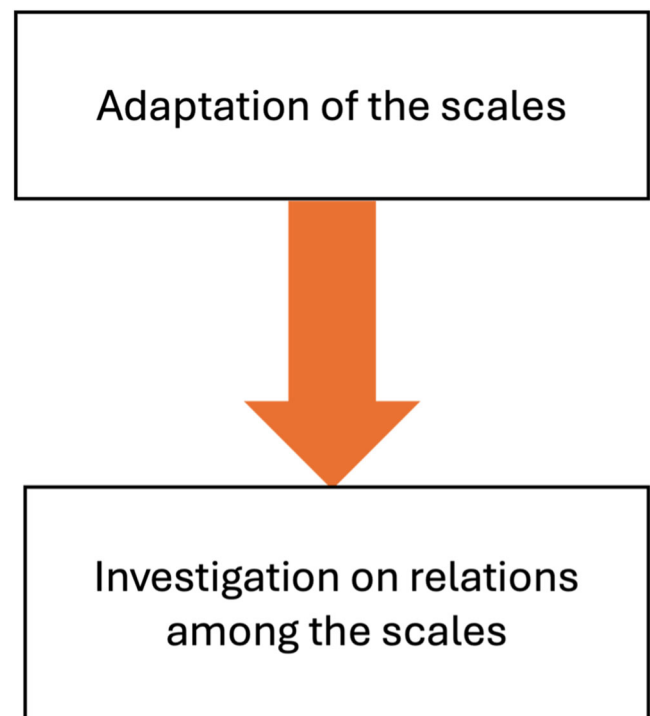

Fig. 1 Research process.

analyzed using partial least squares structural equation modeling (PLS-SEM), a multivariate statistical technique well-suited for modeling complex relationships between multiple latent variables. PLS-SEM was selected over traditional SEM methods for several reasons (Hair et al., 2021; Henseler, 2017). Primarily, it can effectively analyze data that doesn't follow a normal distribution, which is common in social science research. PLS-SEM has a predictive focus, making it particularly useful when the research aim is to predict key target constructs or identify key driver constructs. It's often preferred in exploratory research where the theoretical foundations may not be fully established. These advantages make PLS-SEM a valuable tool for researchers in fields such as psychology, management, and marketing, where data often doesn't meet the strict assumptions required by traditional SEM approaches.

The study was conducted in the Kazakh language. The diagnostic tools used in the study were previously translated and adapted to the Kazakh language.

Sample. Totally 327 Kazakhstan residents took part, of which 84.6% were women, 15.4% were men on a voluntary basis. The age of the participants ranged from 14 to 67 years old [mean value = 23.23, standard deviation (SD) = 10.45857.

Data collection tools. The process of working with scales involves three distinct phases. In the initial phase, the linguistic validity of the scales was established. This step is crucial to ensure that the scales are appropriately adapted to the linguistic context in which they are being used, thereby ensuring that the items on the scale are understood in the intended manner by respondents.

Following the establishment of linguistic validity, the second phase involved conducting EFA. The purpose of EFA is to identify the underlying structure of the scales by determining the number and nature of the factors that explain the patterns of correlations among the scale items. This analysis is essential for understanding how different items on a scale relate to each other and to identify potential dimensions that the scale measures.

In the subsequent phase, CFA was undertaken. Unlike EFA, CFA is used to test a hypothesized factor structure, which is usually informed by the results of the EFA or theoretical considerations. In this stage, the previously identified factor structure is tested for its fit with the observed data. This analysis provides a stringent test of the scale's structure by assessing how well the proposed model fits the data.

After establishing the validity and reliability of the scales through these analyses, further analyses were conducted. Ensuring the scales' validity and reliability is paramount as it underpins the trustworthiness of any subsequent findings derived from the use of these scales in research. Only after these foundational qualities are confirmed can other analytical procedures be meaningfully applied to explore deeper insights and relationships within the data.

Potential participants were recruited by means of a survey on social networks, using a convenient selection of different age categories in an online survey within the period from August 11 to October 12, 2021.

Scale of tolerance to sources of stress. The "Scale of Tolerance to Sources of Stress" was developed by Raspopin in 2012. This methodology aims to examine tolerance towards stress and its various sources. It encompasses evaluative judgments made by individuals concerning themselves, others, and the world at large. Within this methodology, stress tolerance is explored through assessments that categorize perceptions as either stressful or non-stressful.

The scales used include:

1. The "Self-perception" factor: Evaluates stressful versus non-stressful perceptions of one's own personality.
2. The "Perception of Others" factor: Assesses stress versus non-stress perceptions related to other individuals.
3. The "World Perception" factor: Measures stress versus non-stress perceptions of the external world.
4. The "Overall Tolerance" Scale: Gauges the general level of stress tolerance.

Each item on these scales is rated using a 5-point bipolar verbal-numerical Likert scale. The methodology's design involved choosing pairs of antonymous words that represent the stressful and non-stressful evaluations of the variables under study. Fourteen such word pairs were formulated for each scale.

The reliability and validity of the scale were tested using EFA and CFA. Bartlett's test showed the data was suitable for EFA ($\chi^2 = 9577$, df = 780, $p < 0.001$), and the KMO measure was 0.956 (Watkins, 2018). Item 11 (I am Unlonely-Lonely) and 14 (I am Anxious-Calm.) from the Self-perception factor were removed due to a low loading of 0.35. EFA using maximum likelihood extraction and varimax rotation (Williams et al., 2010), identified a three-factor structure (Self-perception, Perception of Others, World Perception) with factor loadings from 0.360 to 0.915, explaining 54.8% of variance. CFA showed the final model had an adequate fit, with significant factor loadings. Fit statistics were acceptable (χ^2/df = 2.16, CFI = 0.908, TLI = 0.902, SRMR = 0.0473, RMSEA = 0.0596) (Brown, 2015; Hu and Bentler, 1999). Cronbach's alpha coefficients and composite reliability were calculated for each factor: Self-perception (0.879, 0.887), Perception of Others (0.951, 0.953), and World Perception (0.955, 0.956). Reliability was adequate with Cronbach's alpha and composite reliability >0.80 for each factor (Bacon et al., 1995; Peterson and Kim, 2013; Taber, 2018). Overall, the analysis supports the validity of the three-factor model as an accurate representation of the data structure.

The personal readiness for change scale. The scale, originally developed by Rollnick et al. (1992), assesses an individual's adaptability and willingness to embrace change in personal and professional contexts. The 35-item measure comprises seven subscales capturing key facets of successfully navigating change. To validate a Kazakh version of the scale, we followed a translation-reverse translation process to ensure linguistic equivalence. EFA, using maximum likelihood extraction and varimax rotation (Watkins, 2018), was conducted to examine the factor structure. Bartlett's test confirmed data suitability ($\chi^2 = 3218$, df = 276, $p < 0.001$) and the KMO index was 0.916. Based on low factor loadings (<0.40), items 3 (I am not the kind of person who changes my plans), 4 (Once involved in a job, I expect the day to start unpredictably), 5 (In my opinion, no one should be overly hopeful), 9 (I can make any situation work to my advantage), 17 (If I make a decision, it's hard to change it), 20 (People come to me when they are pushed to the edge), 22 (Using tried and true methods is right), 26 (Not everything goes as I think), 29 (I prefer to go with the main flow, not sideways), 31 (Don't always implement your demand in public), and 34 (I resort to specific actions to solve a problem) were removed. EFA, using maximum likelihood extraction and varimax rotation (Williams et al., 2010), identified a two-factor structure—Openness to Change and Systematic Preference—that accounted for 40.3% of the variance. CFA indicated satisfactory model fit, with χ^2/df = 2.09 CFI = 0.914, TLI = 0.901, SRMR = 0.0602, and RMSEA = 0.0576 meeting recommended thresholds (Brown, 2015; Hu and Bentler, 1999). All factor loadings were statistically significant. Internal consistency was demonstrated for both factors (Openness $\alpha = 0.911$, CR = 0.913; Systematic $\alpha = 0.831$, CR = 0.835) (Bacon et al., 1995; Peterson and Kim, 2013; Taber, 2018). In sum, analyses supported the validity and reliability of the adapted two-factor Personal Readiness for Change Scale in Kazakh.

The Questionnaire of Fatigue, Monotony, Satiety, and Stress. The psychological assessment instrument developed by Plath and Richter (1984) aims to measure an individual's sentiments and perceptions concerning their occupational environment, focusing on four primary domains: Fatigue, Monotony, Satiety, and Stress. This 40-item scale explores the nuanced relationships among job satisfaction, cognitive exhaustion, occupational stress, and repetitiveness. This tool was subsequently adapted for implementation within the Kazakh cultural milieu. The procedure of translation-reverse translation was executed to maintain linguistic authenticity. The instrument's psychometric properties were rigorously assessed through both EFA and CFA. Bartlett's Test of Sphericity yielded a statistically significant result ($\chi^2 = 6134$, df = 595, $p < 0.001$), while the KMO Measure of Sampling Adequacy registered a score of 0.926, indicating the appropriateness of the data for EFA (Watkins, 2018). Five items (19 (I feel clumsy and sleepy), 21 (I have to force myself to), 23 (During work, I want to get up, not move much and warm up), 35 (My work is too monotonous and I would be happy with any change during the working day), and 38 (It is not difficult for me to make any decision on my own, about doing my job)) were omitted due to their sub-threshold factor loadings of less than 0.35. The EFA implemented the maximum likelihood extraction method in conjunction with the 'oblimin' rotation strategy (Williams et al., 2010). The emerging factors deviated from the initial theoretical framework, prompting a re-evaluation and renaming based on the constituent items of each factor, resulting in Fatigue, Satiety, and Stress. These identified factors showcased loadings ranging from 0.384 to 0.856 and cumulatively accounted for 46.8% of the total observed variance. The ensuing CFA revealed an adequate

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Table 1 Hypotheses related to the model in Fig. 2.

H1: An individual's self-perception has an effect on openness to change (Self→OTC).
H2: An individual's self-perception has an effect on systematic preference (Self→SP).
H3: An individual's self-perception has an effect on fatigue (Self→Fatigue).
H4: An individual's self-perception has an effect on satiety (Self→Satiety).
H5: An individual's self-perception has an effect on stress (Self→Stress).
H6: An individual's perception of others has an effect on openness to change (Other→OTC).
H7: An individual's perception of others has an effect on systematic preference (Other→SP).
H8: An individual's perception of others has an effect on Fatigue (Other→Fatigue).
H9: An individual's perception of others has an effect on (Other→Satiety).
H10: An individual's perception of others has an effect on stress (Other→Stress).
H11: An individual's world-perceptions has an effect on openness to change (World→OTC).
H12: An individual's world-perceptions has an effect on systematic preference (World→SP).
H13: An individual's world-perceptions has an effect on Fatigue (World→Fatigue).
H14: An individual's world-perceptions has an effect on satiety (World→Satiety).
H15: An individual's world-perceptions has an effect on stress (World→Stress).
H16: Openness to change has an effect on fatigue (OTC→Fatigue).
H17: Openness to change has an effect on satiety (OTC→Satiety).
H18: Openness to change has an effect on stress (OTC→Stress).
H19: Systematic preference has an effect on fatigue (SP→Fatigue).
H20: Systematic preference has an effect on satiety (SP→Satiety).
H21: Systematic preference has an effect on stress (SP→Stress).
H22: Openness to change has an effect on systematic preference (OTC→SP).

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model fit, with all component items demonstrating significant factor loadings. The fit metrics from the CFA, $\chi^2/\mathrm{df} = 1.86$, notably CFI (0.923) and TLI (0.915), exceeded the established benchmark of 0.90, and both SRMR (0.0796) and RMSEA (0.0513) verified the model's adequacy (Brown, 2015; Hu and Bentler, 1999). Reliability metrics for each dimension, as measured by Cronbach's alpha and composite reliability, were delineated as Fatigue $\alpha = 0.912$, CR = 0.915; Satiety $\alpha = 0.916$, CR = 0.916; Stress $\alpha = 0.893$, CR = 0.893 (Bacon et al., 1995; Peterson and Kim, 2013; Taber, 2018). Cumulatively, the evaluations underscore the robustness and reliability of the tripartite Fatigue–Satiety–Stress model, tailored for the Kazakh context.

Data analysis. The PLS-SEM statistical technique was utilized for this study due to the data's non-normal distribution. PLS-SEM is a multivariate analytical method that combines elements of PLS regression and SEM to analyze the relationships between latent (unobserved) variables and observed variables. It is well-suited for analyzing complex data structures with many latent variables that have nonlinear relationships to each other and to the observed variables. PLS-SEM can also be used as an alternative to traditional SEM in situations where there is high multicollinearity among the data. For this analysis, the PLS-SEM was implemented using the R statistical software environment (version 4.2.2) along with the RStudio IDE (version 2021.09). Specifically, the "SEMinR" R packages were used to carry out the PLS-SEM data analysis. PLS-SEM has gained popularity as a statistical technique because of its ability to handle non-normal data and model complexity not supported by traditional SEM methods (Hair et al., 2021).

Findings
Reflective measurement models conceptualize constructs as causing variation in their observed indicators, with causality flowing from the latent construct to its manifest indicators. This contrasts with formative measurement models that posit indicators as causing variation in constructs. In reflective models, each indicator serves as an imperfect reflection of the underlying construct. The indicators represent effects rather than determinants of the constructs. The regression coefficients linking indicators to their associated constructs are known as factor loadings and represent the absolute contribution of each indicator to the overall construct. High correlations among indicators are expected in reflective models, as the indicators are conceptualized as reflecting the same underlying phenomenon. The shared variation among the indicators represents the influence of the latent construct, while error variances represent indicator-specific effects unrelated to the construct (Ghasemy et al., 2020; Hair et al., 2021). In summary, reflective models assume unidirectional causality from constructs to indicators, with indicators reflecting the construct, factor loadings depicting indicators' contributions to constructs, and high correlations amongst indicators due to their shared origin in the underlying constructs (Tables 1–4).

In the provided measurement model, various dimensions or constructs are gauged through associated items. According to Hair et al. (2021), the loading factor should be above 0.7. All loading factors are above 0.7. Beginning with the 'Self-perception' dimension, it encompasses six items, with factor loadings oscillating between 0.731 and 0.836. These loadings signify a moderate to high degree of association between the items and the underlying 'Self-perception' construct. The internal consistency of this dimension, as measured by Cronbach's alpha ($\alpha = 0.875$) and rhoC ($\rho c = 0.906$), is commendable. Furthermore, its average variance extracted (AVE) is recorded at 0.617, underscoring that a satisfactory quantum of variance in the items is attributed to the construct rather than measurement error. Turning our attention to the 'the perception of Other' dimension, it is discernible that it has the most expansive range of items, 11 in total, with factor loadings ranging from 0.717 to 0.874. These values reinforce the moderate to high relationship between items and the 'perception of Other' construct. Exceptionally, this dimension's internal consistency is robust, evidenced by an alpha of 0.952 and a rhoC of 0.958, accompanied by an AVE of 0.655. All constructs manifest factor loadings in excess of 0.7, indicative of a sound association between items and their respective constructs. Furthermore, the internal consistency, as gleaned from all Cronbach's alpha values, surpasses the widely accepted threshold of 0.7. This observation is buttressed by analogous trends in rhoC values. Additionally, the AVE values for all constructs exceed the customary benchmark of 0.5, suggesting that over half of the variance in items can be ascribed to the constructs (Hair et al., 2021). In summation, the model demonstrates that the

Table 2 Factors loading, Cronbach alpha, rhoC, AVE, and rhoA for each dimension.

Dimension	Items	Loading	alpha	rhoC	AVE	rhoA
Self	self_2	0.731	0.875	0.906	0.617	0.876
	self_5	0.738				
	self_7	0.834				
	self_9	0.803				
	self_10	0.762				
	self_12	0.836				
Other	other_3	0.740	0.952	0.958	0.655	0.953
	other_4	0.819				
	other_5	0.806				
	other_6	0.760				
	other_7	0.845				
	other_8	0.829				
	other_9	0.874				
	other_10	0.716				
	other_11	0.873				
	other_12	0.809				
	other_13	0.818				
	other_14	0.808				
World	world_1	0.716	0.956	0.961	0.636	0.961
	world_2	0.757				
	world_3	0.813				
	world_4	0.826				
	world_5	0.814				
	world_6	0.839				
	world_7	0.806				
	world_8	0.805				
	world_9	0.801				
	world_10	0.821				
	world_11	0.735				
	world_12	0.764				
	world_13	0.809				
	world_14	0.847				
OTC	PR_23	0.704	0.863	0.898	0.594	0.866
	PR_25	0.777				
	PR_27	0.816				
	PR_28	0.755				
	PR_30	0.811				
	PR_32	0.758				
SP	PR_12	0.719	0.731	0.831	0.552	0.736
	PR_14	0.730				
	PR_33	0.751				
	PR_35	0.771				
Fatigue	Fa_8	0.721	0.864	0.899	0.597	0.865
	Fa_17	0.757				
	Fa_26	0.813				
	Fa_27	0.804				
	Fa_28	0.778				
	Fa_29	0.758				
Satiety	Fa_24	0.795	0.919	0.935	0.674	0.925
	Fa_33	0.787				
	Fa_34	0.775				
	Fa_36	0.871				
	Fa_37	0.860				
	Fa_39	0.826				
	Fa_40	0.828				
Stress	Fa_4	0.775	0.887	0.912	0.596	0.891
	Fa_5	0.800				
	Fa_7	0.783				
	Fa_11	0.775				
	Fa_12	0.729				
	Fa_13	0.735				
	Fa_15	0.804				

instrument in question offers a reliable measure of the constructs of interest. Nevertheless, for a more nuanced evaluation, other facets like discriminant validity, potential cross-loadings, and model fit indices, not delineated in the table, ought to be taken into consideration.

In examining the Fornell-Larcker Cross-Loading table, we aim to assess discriminant validity. Ideally, for each construct, the square root of the AVE (represented by diagonal values) should surpass the off-diagonal values in the corresponding rows and columns. The 'Self-perception' construct notably displays a primary loading of 0.785, which comfortably exceeds its cross-loadings with other constructs, exemplifying good discriminant validity. The 'the perception of other' construct, with a primary loading of 0.81, has a discernible cross-loading with 'World perception' at 0.711. Similarly, the 'World perception' construct, with a dominant loading of 0.797, hints at this overlap. The 'Openness to Change' construct, characterized by a loading of 0.771, presents minimal cross-loadings, reflecting strong discriminant validity. 'Systematic preference', with a paramount loading of 0.742, consistently outstrips its cross-loadings, underscoring excellent discriminant validity. The 'Fatigue' construct manifests a dominant loading of 0.772, with a notable cross-loading of 0.591 associated with 'Openness to Change'. The 'Satiety' dimension, having a loading of 0.821, exhibits a significant cross-loading with 'Stress' at 0.762, raising potential concerns. Lastly, the 'Stress' construct mirrors this pattern, with its primary loading at 0.772 and a proximate cross-loading with 'Satiety'.

Discriminant validity is essential to confirm that unrelated constructs are indeed distinct. Original estimates of the HTMT ratio provide the initial assessment based on the sample data. To refine these estimates and assess their stability, bootstrap techniques are employed, generating the "Bootstrap Mean" and "Bootstrap SD" (standard deviation) columns. The bootstrap mean offers an average HTMT ratio derived from numerous resampled datasets, while the bootstrap SD gives a sense of the variability in these estimates. An HTMT ratio below thresholds such as 0.85 or 0.90, depending on the specific literature, is generally considered indicative of acceptable discriminant validity, confirming that the constructs under examination are sufficiently distinct. For example, the "Self→SP" construct pair shows a notably low HTMT ratio (0.178 original estimate and 0.192 bootstrap mean), highlighting strong discriminant validity. Conversely, the "Satiety→Stress" pair, with an HTMT ratio approaching 1 (0.85 original and 0.849 bootstrap mean), raises concerns about the distinctiveness of these constructs, suggesting they may capture similar underlying concepts.

Overall, the table meticulously evaluates the discriminant validity of various constructs, employing both original and bootstrap estimates to ensure the findings' robustness. High t-statistics and confidence intervals not encompassing 1 reinforce the discriminant validity of the constructs, underscoring the reliability of these assessments in distinguishing between related and unrelated constructs within the study.

Formative measurement. Table 5 presents variance inflation factor (VIF) values, which are used to diagnose multicollinearity in regression analysis. Typically, a VIF value exceeding 10 suggests high multicollinearity, while values between 5 and 10 warrant caution. In this table, all VIF values are notably below the threshold of 5, with the highest VIF being 2.205. This implies that the constructs in the model have minimal multicollinearity issues,

Table 3 Fornel-Larcker cross-loading.

	Self	Other	World	OTC	SP	Fatigue	Satiety	Stress
Self	0.785	.	.	.	.	.	.	.
Other	0.472	0.810	.	.	.	.	.	.
World	0.506	0.711	0.797	.	.	.	.	.
OTC	0.453	0.322	0.302	0.771	.	.	.	.
SP	0.069	0.151	0.166	0.277	0.743	.	.	.
Fatigue	0.422	0.298	0.252	0.591	0.045	0.772	.	.
Satiety	−0.084	0.084	−0.033	−0.049	0.409	−0.107	0.821	.
Stress	−0.015	0.113	0.030	−0.060	0.377	0.023	0.762	0.772

Table 4 Heterotrait–Monotrait ratio (HTMT).

HTMT	Original Est.	Bootstrap mean	Bootstrap SD	t-stat.	2.5% CI	97.5% CI
Self→Other	0.517	0.518	0.057	9.052	0.400	0.624
Self→World	0.550	0.551	0.051	10.759	0.451	0.647
Self→OTC	0.516	0.517	0.058	8.938	0.401	0.627
Self →SP	0.178	0.192	0.043	4.144	0.119	0.287
Self→Fatigue	0.482	0.482	0.054	8.879	0.374	0.586
Self→Satiety	0.093	0.119	0.038	2.448	0.068	0.211
Self→Stress	0.102	0.126	0.021	4.851	0.090	0.172
Other→World	0.746	0.746	0.040	18.598	0.662	0.820
Other→OTC	0.351	0.352	0.059	5.952	0.233	0.467
Other→SP	0.185	0.200	0.055	3.348	0.109	0.320
Other→Fatigue	0.324	0.326	0.065	4.984	0.199	0.453
Other→Satiety	0.099	0.123	0.037	2.662	0.075	0.215
Other→Stress	0.131	0.154	0.043	3.055	0.093	0.255
World→ OTC	0.322	0.323	0.06	5.350	0.205	0.440
World→SP	0.208	0.223	0.051	4.055	0.131	0.331
World → Fatigue	0.268	0.272	0.060	4.476	0.158	0.394
World→Satiety	0.067	0.101	0.025	2.723	0.069	0.167
World→Stress	0.089	0.121	0.024	3.757	0.087	0.180
OTC→SP	0.344	0.353	0.068	5.064	0.228	0.493
OTC→Fatigue	0.681	0.682	0.059	11.496	0.560	0.790
OTC→Satiety	0.106	0.134	0.030	3.521	0.090	0.206
OTC→Stress	0.130	0.159	0.030	4.335	0.112	0.230
SP→Fatigue	0.087	0.136	0.036	2.396	0.079	0.221
SP→Satiety	0.483	0.481	0.065	7.442	0.350	0.603
SP→Stress	0.459	0.456	0.071	6.471	0.313	0.590
Fatigue→Satiety	0.130	0.153	0.051	2.573	0.079	0.270
Fatigue→Stress	0.085	0.119	0.024	3.500	0.082	0.177
Satiety→Stress	0.850	0.849	0.032	26.628	0.783	0.907

Table 5 VIF values.

	Self	Other	World	OTC	SP
OTC	1.392	2.094	2.187		
SP	1.581	2.116	2.187	1.283	
Fatigue	1.604	2.117	2.205	1.378	1.108
Satiety	1.604	2.117	2.205	1.378	1.108
Stress	1.603	2.117	2.205	1.378	1.108

suggesting the constructs are reasonably distinct and the model is statistically robust (Hair et al., 2021). In summary, the presented VIF values do not raise any immediate concerns about multi-collinearity in the data.

In the path analysis presented in Table 6, several significant relationships stand out, each underscored by confidence intervals that exclude "0", denoting statistical significance. A notable positive association is seen from 'Self' to 'OTC' (original estimate: 0.384) and from 'Self' to 'Fatigue' (original estimate: 0.164), indicating that variations in 'Self' have a meaningful impact on both 'OTC' and 'Fatigue'. Similarly, 'Other' shows significant positive effects on 'Satiety' (original estimate: 0.234) and 'Stress' (original estimate: 0.199), suggesting that changes in 'Other' influence these outcomes. The path from 'OTC' to 'SP' (original estimate: 0.293) and 'OTC' to 'Fatigue' (original estimate: 0.531) also reveal strong positive relationships, highlighting 'OTC's impact on both 'SP' and 'Fatigue'. Additionally, 'SP' has a pronounced positive effect on 'Satiety' (original estimate: 0.456) and 'Stress' (original estimate: 0.426), illustrating the significant influence of 'SP' on these variables. These findings, supported by robust t-statistics and bootstrap means, provide a clear picture of the interrelations among the variables, with significant paths illustrating the dynamic interactions within the model.

Table 7 shows total effect path coefficients and provides a nuanced view of the relationships between variables, high-lighting the combined direct and indirect influences within the model. For instance, the total effect of 'Self' on 'Fatigue' is notably strong (original estimate: 0.372), indicating that 'Self' has a significant cumulative impact on 'Fatigue', which surpasses the direct influence previously observed. This

Table 6 Path coefficients.

Path	Original Est.	Mean	SD	t-stat.	2.5% CI	97.5% CI
Self→OTC	0.384	0.387	0.059	6.532	0.270	0.502
Self→SP	−0.144	−0.149	0.076	−1.903	−0.296	−0.004
Self→Fatigue	0.164	0.163	0.060	2.757	0.050	0.283
Self→Satiety	−0.049	−0.049	0.063	−0.783	−0.174	0.072
Self →Stress	0.024	0.024	0.062	0.386	−0.102	0.142
Other→OTC	0.130	0.132	0.080	1.618	−0.027	0.289
Other→SP	0.036	0.040	0.089	0.405	−0.127	0.219
Other→Fatigue	0.096	0.100	0.071	1.355	−0.040	0.246
Other→Satiety	0.234	0.236	0.065	3.607	0.108	0.358
Other→Stress	0.199	0.203	0.074	2.697	0.057	0.347
World→OTC	0.016	0.017	0.079	0.198	−0.140	0.169
World→SP	0.125	0.125	0.089	1.404	−0.051	0.294
World→Fatigue	−0.040	−0.040	0.066	−0.597	−0.171	0.094
World→Satiety	−0.200	−0.200	0.076	−2.637	−0.347	−0.051
World→Stress	−0.129	−0.130	0.085	−1.515	−0.298	0.036
OTC→SP	0.293	0.293	0.068	4.311	0.158	0.424
OTC→Fatigue	0.531	0.533	0.063	8.443	0.403	0.651
OTC→Satiety	−0.168	−0.171	0.054	−3.084	−0.279	−0.066
OTC→Stress	−0.213	−0.219	0.061	−3.513	−0.340	−0.100
SP→Fatigue	−0.122	−0.123	0.041	−2.979	−0.200	−0.043
SP→Satiety	0.456	0.460	0.049	9.391	0.362	0.551
SP→Stress	0.426	0.431	0.054	7.916	0.322	0.532

Table 7 Path coefficients for total effect.

path	Original est.	Bootstrap mean	Bootstrap SD	t-stat.	2.5% CI	97.5% CI
Self→Fatigue	0.372	0.374	0.051	7.255	0.276	0.477
Self→Satiety	−0.128	−0.132	0.063	−2.040	−0.254	−0.006
Self→Stress	−0.072	−0.076	0.062	−1.158	−0.195	0.043
Other→Fatigue	0.156	0.160	0.080	1.948	0.005	0.317
Other→Satiety	0.246	0.251	0.066	3.717	0.120	0.379
Other→Stress	0.202	0.208	0.075	2.699	0.057	0.354
World→Fatigue	−0.047	−0.047	0.075	−0.623	−0.197	0.100
World→Satiety	−0.143	−0.143	0.078	−1.835	−0.301	0.007
World→Stress	−0.078	−0.079	0.084	−0.917	−0.247	0.079
OTC→Fatigue	0.496	0.497	0.066	7.507	0.359	0.621
OTC→Satiety	−0.034	−0.037	0.062	−0.554	−0.158	0.081
OTC→Stress	−0.089	−0.093	0.067	−1.331	−0.227	0.037

suggests the presence of mediating factors that enhance the effect of 'Self' on 'Fatigue'.

Similarly, the negative total effect of 'Self' on 'Satiety' (original estimate: −0.128) and 'Stress' (original estimate: −0.072) implies that, beyond direct impacts, there are other pathways within the model that contribute to these relationships, possibly intensifying the negative influence of 'Self' on 'Satiety' and slightly buffering its impact on 'Stress'.

The total effects involving 'Other' as a predictor show positive influences on 'Fatigue', 'Satiety', and 'Stress', with the effects on 'Satiety' and 'Stress' being particularly notable (original estimates: 0.246 and 0.202, respectively). These outcomes suggest that 'Other' plays a significant role in influencing these variables, potentially through a combination of direct and indirect paths.

Conversely, the total effects from 'World' to outcomes like 'Fatigue', 'Satiety', and 'Stress' are negative, although the magnitudes are relatively small, hinting at a more complex interplay of variables that might slightly mitigate or amplify the direct effects seen in the previous table.

The relationship between 'OTC' and 'Fatigue' is especially strong (original estimate: 0.496), aligning with the direct effect and underscoring a predominantly direct pathway. However, the minimal total effects of 'OTC' on 'Satiety' and 'Stress' (original

Table 8 R-square and adjusted R-square values.

	OTC	SP	Fatigue	Satiety	Stress
R^2	0.221	0.097	0.397	0.225	0.191
AdjR^2	0.213	0.086	0.387	0.213	0.181

estimates: −0.034 and −0.089) suggest that 'OTC' has a negligible overall impact on these variables, with little deviation from the direct effects previously observed.

The total effect path coefficients elucidate the multifaceted nature of the relationships among the variables in the model. They reveal how some variables exert a significant cumulative impact on outcomes through a blend of direct and mediated influences, while others show a more straightforward, predominantly direct relationship. This comprehensive view underscores the intricate dynamics within the model, highlighting the importance of considering both direct and indirect effects to fully understand the interdependencies among the variables.

Table 8 delineates the proportion of variance explained by the independent variables in each of the models for the outcomes:

OTC, SP, Fatigue, Satiety, and Stress. The model for "Fatigue" demonstrates the highest explanatory power with ($R^2 = 0.397$) and an adjusted ($R^2 = 0.387$). On the contrary, "SP" has the lowest (R^2) value of 0.097, indicating minimal variability captured by the predictors, which further drops slightly to an adjusted (R^2) of 0.086, accounting for the number of predictors. The models for "OTC", "Satiety", and "Stress" have comparable explanatory powers, falling in the range of approximately 0.191 to 0.221 for (R^2) values. The adjusted (R^2) values, which account for model complexity, are slightly lower across all outcomes but are consistent with their respective (R^2) values.

The f-square values in Table 9 represent the effect sizes of the predictors on the respective outcomes. Higher values indicate a more substantial effect. For "OTC," the strongest predictor is "Self" with an f-square value of 0.137, indicating a moderate effect, while "Other" has a small effect at 0.01. "World" seems to have negligible influence, given its value is 0. For "Fatigue," "OTC" is the dominant predictor with an f-square value of 0.339, suggesting a strong effect. "Self" and "Other" have minor effects with values of 0.028 and 0.007, respectively. In predicting "Satiety," "SP" exhibits a prominent effect at 0.24, while "Other" has a value of 0.033, suggesting a smaller influence. For the "Stress" outcome, "SP" has the highest impact with an f-square value of 0.20, whereas "OTC" also contributes but to a lesser extent at 0.041. For the "SP" outcome, the predictors seem to have a negligible effect, given their f-square values are close to 0. Overall, the table shows the varying influences of predictors on different outcomes, with some predictors like "Self" for "OTC" and "OTC" for "Fatigue" showing notable effects.

According to the analysis results, 13 hypotheses were approved, and 9 hypotheses were not approved. In Fig. 2, dashed lines indicate unsupported hypotheses Fig. 3. "Self-perception", "Perception of Others" and "World Perception", which are the dimensions of the Scale of Tolerance to Sources of Stress variable, directly or indirectly affect the least one of the "Fatigue", "Satiety", and "Stress" variables. The list of cases where the hypotheses are supported is given in Table 10.

Table 11 presents a mediation analysis, examining the indirect effects of various paths within a structural model. This analysis helps to understand how one variable may affect another through one or more mediator variables. The paths are categorized based on the sequence of variables involved, showing the original estimate of the effect, the bootstrap mean and standard deviation (SD) for robustness, the t-statistic for significance, and the 95% confidence intervals (CIs) to gauge the precision of the estimates.

The paths involving "Self" show several significant indirect effects. For instance, the path from "Self" through "OTC" to "Fatigue" has a positive effect (original estimate: 0.204), indicating that "OTC" significantly mediates the relationship between "Self" and "Fatigue". The negative effects from "Self" through "OTC" to "Satiety" and "Stress" (original estimates: −0.064 and −0.082, respectively) suggest that "OTC" also mediates negative impacts of "Self" on these outcomes. The paths from "Self" through "SP" to "Fatigue", "Satiety", and "Stress" show smaller and less consistent effects, with only the paths to "Satiety" and "Stress" being marginally significant.

For paths starting with "Other", the effects are generally smaller and less significant, indicating a weaker mediation by "OTC" and "SP" on the relationships between "Other" and outcomes like "Fatigue", "Satiety", and "Stress". Notably, none of these paths show significant effects, suggesting that "Other" has a limited indirect influence on these outcomes through "OTC" and "SP".

Paths beginning with "World" show even weaker and non-significant effects across all outcomes, highlighting that "World" has minimal indirect influence through "OTC" and "SP" on "Fatigue", "Satiety", and "Stress". This suggests that the role of
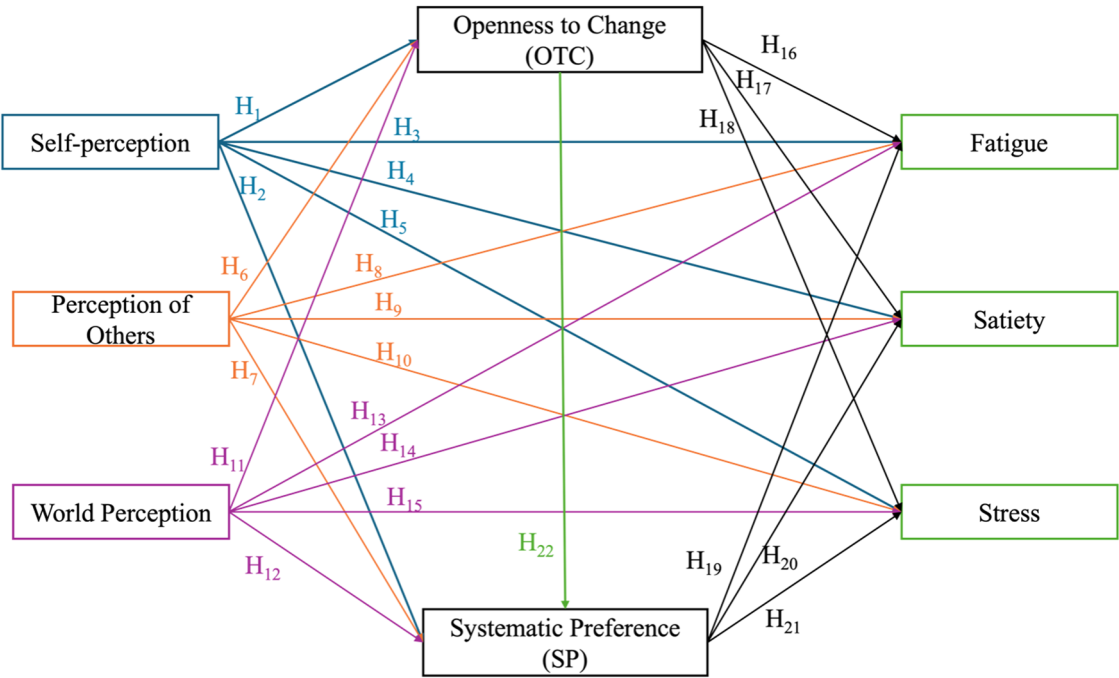
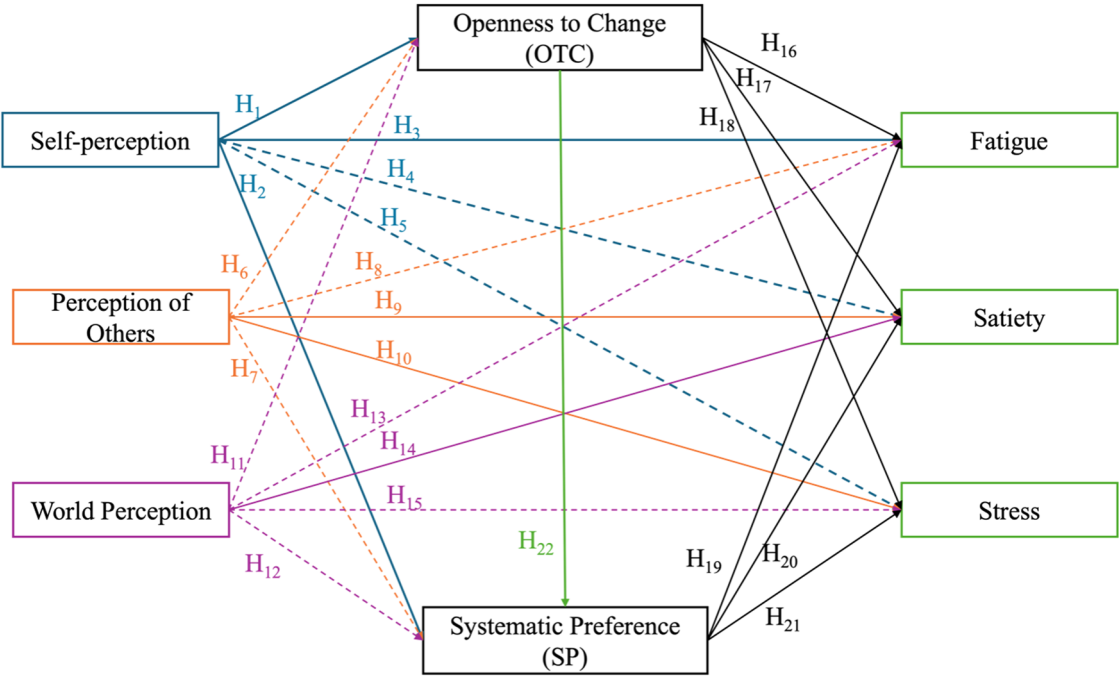| Table 9 F-square values.					
	OTC	**SP**	**Fatigue**	**Satiety**	**Stress**
Self	0.137	0.014	0.028	0.002	0
Other	0.01	0.001	0.007	0.033	0.022
World	0	0.008	0.001	0.023	0.009
OTC	0	0	0.339	0.023	0.041
SP	0	0	0.022	0.24	0.200

Fig. 2 Hypothetical model.

Fig. 3 Final model.

Table 10 Supporting the hypotheses.	
Hypotheses	**Results**
H1: An individual's self-perception has an effect on openness to change.	Approved
H2: An individual's self-perception has an effect on systematic preference.	Approved
H3: An individual's self-perception has an effect on fatigue.	Approved
H4: An individual's self-perception has an effect on satiety.	Not approved
H5: An individual's self-perception has an effect on stress.	Not approved
H6: An individual's perception of others has an effect on openness to change.	Not approved
H7: An individual's perception of others has an effect on systematic preference.	Not approved
H8: An individual's perception of others has an effect on fatigue.	Not approved
H9: An individual's perception of others has an effect on satiety.	Approved
H10: An individual's perception of others has an effect on stress.	Approved
H11: An individual's world perceptions has an effect on openness to change.	Not approved
H12: An individual's world perceptions has an effect on systematic preference.	Not approved
H13: An individual's world perceptions has an effect on Fatigue.	Not approved
H14: An individual's world perceptions has an effect on satiety.	Approved
H15: An individual's world perceptions has an effect on stress.	Not approved
H16: Openness to change has an effect on fatigue.	Approved
H17: Openness to change has an effect on satiety.	Approved
H18: Openness to change has an effect on stress.	Approved
H19: Systematic preference has an effect on fatigue.	Approved
H20: Systematic preference has an effect on satiety.	Approved
H21: Systematic preference has an effect on stress.	Approved
H22: Openness to change has an effect on systematic preference	Approved

"World" in the mediation process is negligible within the context of this model.

Interestingly, the triple mediation paths (e.g., "Self →"OTC"→"SP"→"Fatigue") reveal some notable effects. The negative effect on "Fatigue" and positive effects on "Satiety" and "Stress" indicate complex mediation relationships involving "Self", "OTC", and "SP". These paths suggest that the influence of "Self" on these outcomes is significantly mediated by both "OTC" and "SP", with the direction of the effect depending on the specific outcome.

The mediation analysis highlights the complexity of the relationships within the structural model, with "OTC" and "SP" serving as key mediators for the effects of "Self", "Other", and

"World" on "Fatigue", "Satiety", and "Stress". The analysis underscores the importance of considering indirect effects to fully understand the dynamics among these variables.

To determine whether "OTC" and "SP" serve as full or partial mediators in the relationships between the variables, we need to compare the direct effects (from the direct path table) with the indirect effects (from the mediation analysis table) and the total effects (from the total effect path table). Full mediation is indicated when the direct effect of the independent variable on the dependent variable becomes non-significant once the mediator is included in the model, while partial mediation is indicated when the direct effect remains significant but is reduced in magnitude.

Table 11 Mediation analysis.

Path	Original est.	Bootstrap mean	Bootstrap SD	T	2.5% CI	97.5% CI
Self→OTC→Fatigue	0.204	0.207	0.044	4.690	0.125	0.295
Self→OTC→Satiety	−0.064	−0.067	0.024	−2.632	−0.121	−0.024
Self →OTC→Stress	−0.082	−0.085	0.027	−3.050	−0.141	−0.038
Self→SP→Fatigue	0.018	0.018	0.012	1.507	0.000	0.045
Self →SP→Satiety	−0.066	−0.069	0.036	−1.831	−0.138	−0.002
Self→SP→Stress	−0.061	−0.064	0.034	−1.818	−0.131	−0.002
Other→OTC→Fatigue	0.069	0.070	0.043	1.620	−0.016	0.154
Other→OTC→Satiety	−0.022	−0.022	0.015	−1.454	−0.055	0.005
Other→OTC→Stress	−0.028	−0.029	0.020	−1.394	−0.073	0.006
Other→SP→Fatigue	−0.004	−0.005	0.011	−0.386	−0.029	0.017
Other→SP→Satiety	0.016	0.018	0.041	0.400	−0.060	0.103
Other→SP→Stress	0.015	0.018	0.039	0.394	−0.055	0.099
World→OTC→Fatigue	0.008	0.009	0.043	0.195	−0.076	0.092
World→OTC→Satiety	−0.003	−0.004	0.014	−0.182	−0.035	0.023
World →OTC→Stress	−0.003	−0.004	0.018	−0.186	−0.041	0.031
World→SP→Fatigue	−0.015	−0.015	0.013	−1.203	−0.043	0.006
World→SP→Satiety	0.057	0.058	0.042	1.354	−0.023	0.141
World→SP→Stress	0.053	0.054	0.039	1.355	−0.023	0.131
Self→OTC→SP→Fatigue	−0.014	−0.014	0.006	−2.252	−0.028	−0.004
Self→OTC→SP→Satiety	0.051	0.052	0.015	3.415	0.025	0.085
Self→OTC→SP→Stress	0.048	0.049	0.015	3.281	0.023	0.080
Other→OTC→SP→Fatigue	−0.005	−0.005	0.003	−1.328	−0.013	0.001
Other→OTC→SP→Satiety	0.017	0.018	0.012	1.471	−0.004	0.044
Other→OTC→SP→Stress	0.016	0.017	0.011	1.457	−0.003	0.041
World→OTC→SP→Fatigue	−0.001	−0.001	0.003	−0.185	−0.007	0.006
World→OTC→SP→ Satiety	0.002	0.002	0.011	0.191	−0.020	0.024
World→OTC→SP→Stress	0.002	0.002	0.010	0.189	−0.018	0.023

"OTC" as a mediator: In path, "Self→Fatigue", the direct effect was significant (original estimate: 0.164), and the total effect was also significant (original estimate: 0.372). The indirect effect through "OTC" was significant (original estimate: 0.204). Given that the direct effect remains significant in the presence of the mediator ("OTC"), but the total effect is larger than the direct effect, "OTC" appears to serve as a partial mediator in the relationship between "Self" and "Fatigue". In the path "Self→Satiety", the direct effect was slightly negative but not strongly significant (original estimate: −0.049), and the total effect was more negative (original estimate: −0.128). The indirect effect through "OTC" was negative and significant (original estimate: −0.064). The presence of "OTC" enhances the negative effect, suggesting partial mediation, as the direct path remains albeit with a reduced effect. In the path "Self→Stress", the direct effect was very weak (original estimate: 0.024), and the total effect was negative (original estimate: −0.072). The indirect effect through "OTC" was negative and significant (original estimate: −0.082). This could indicate a shift towards full mediation, as the direct effect is negligible and the total effect is primarily driven by the indirect path through "OTC".

"SP" as a mediator: In the path "Self→Fatigue", the direct effect was positive (original estimate: 0.164), and the total effect was larger (original estimate: 0.372). The indirect effect through "SP" was minimal (original estimate: 0.018). This suggests that "SP" does not significantly mediate the relationship between "Self" and "Fatigue", indicating no mediation or, at most, very weak partial mediation. In the path "Self→Satiety", the direct effect was slightly negative (original estimate: −0.049), and the total effect was more negative (original estimate: −0.128). The indirect effect through "SP" was negative but weak (original estimate: −0.066). Given the small magnitude of the indirect effect and the persistence of the direct effect, "SP" seems to serve as a partial mediator. In the path "Self→Stress", the direct effect was weak (original estimate: 0.024), and the total effect was negative (original estimate: −0.072). The

indirect effect through "SP" was negative but weak (original estimate: −0.061). Similar to "Satiety", "SP" appears to serve as a partial mediator, as the direction of the effect changes but the direct effect is not completely nullified.

"OTC" acts as a partial mediator in the relationships between "Self" and "Fatigue", "Satiety", and possibly as a full mediator for "Stress", given the negligible direct effect. "SP" appears to serve as a partial mediator for "Satiety" and "Stress", with a minimal or no mediating effect on "Fatigue". The presence of significant direct effects, alongside the indirect effects, predominantly suggests partial mediation by "OTC" and "SP" for most pathways, with the potential for "OTC" to act as a full mediator in the specific case of "Self" to "Stress".

Discussion
The results of this study shed light on the complex relationships among stress source tolerance, personal readiness to change, and some psychological factors such as fatigue, satiety, and stress. Our analysis using the PLS-SEM revealed significant findings of relevance across domains.

From the most general perspective, stress source tolerance (self-perception, perception of others, world perception), has a direct effect on personnel readiness to change (OTC and SPs) and psychological factors such as fatigue, satiety, and stress. Self-perception plays a significant role in influencing readiness to change. It positively affects the OTC dimension but negatively affects the SPs dimension. It also directly and indirectly contributes to fatigue levels positively and but indirectly negatively affects satiety. While it is theoretically reasonable to expect that self-perception has a significant positive influence on OTC, only a few empirical studies have focused on this topic (Maksum et al., 2022; Prima and Eliyana, 2018; Tsai and Li, 2023; Xu et al., 2021). Similarly, self-perception does not significantly influence fatigue, satiety, or stress (Dev, 2018; Limm et al., 2010).

Perceptions of others directly and indirectly positively affect satiety, and stress. Also, it only indirectly positively affects fatigue. The perception of other people positively and significantly influences the sense of satiety and stress (Christensen and Moran, 1998; Schönfeld et al., 2016). The perception of other people positively and significantly influences the sense of satiety and stress but does not have a significant impact on OTC (Antinori et al., 2017; Sukhov et al., 2018; Roczniewska and Higgins, 2019). World perception only directly negatively affect satiety. However, it doesn't affect fatigue and stress directly or indirectly. These findings are consistent with previous studies (Lizar et al., 2015; Tamba and Iancu, 2023).

According to our hypothesis, SP has an effect on fatigue, satiety, and stress. SP is one of the measured factors or constructs that is used to analyze the relationship between various psychological factors (fatigue, satiety, and stress). SP is assessed using a scale and includes evaluations and preferences related to the extent to which an individual prefers systematic and orderly approaches to various aspects of his or her life. That is, high SP values may indicate that a person tends to have a more orderly and systematic lifestyle, while low SP values may indicate a more random and unpredictable behavioral style. We analyze the effects of SP on various states, such as fatigue, satiety, and stress, to determine whether there is a relationship between how systematically an individual approaches life and their psychological states. The results of this analysis provide insight into how SP can influence psychological factors and possibly an individual's overall well-being. Table 6 shows that SP has a significant negative effect on Fatigue. Interpreting these results, we can say that people with more pronounced SP are less prone to fatigue. The path coefficient for the effect of SP on fatigue has a negative value (-0.122), indicating that the level of SP is negatively correlated with the level of fatigue. In other words, people with higher SP values tend to be less fatigued. The path coefficient for SP on satiety has a positive value (0.456), indicating that there is a positive correlation between SP and satiety. Individuals with higher SP values tend to have higher satiety. The path coefficient for SP on stress tolerance is 0.426 indicating a significant positive effect. This means that SP is positively related to the level of stress tolerance.

"Openness to Change " functions as a mediator in the relationships between "Self-perception" and "Fatigue", "Self-perception" and "Satiety", and "Self-perception" and "Stress", with varying degrees of mediation observed. While "Openness to Change " acts as a partial mediator in the first two paths by enhancing or reducing the effects, it potentially serves as a full mediator in the latter path, where the direct effect is negligible, and the total effect is primarily influenced by the indirect effect through "Openness to Change". "Systematic Preferences" exhibits limited mediating effects on the relationships between "Self-perception" and "Fatigue", "Self-perception" and "Satiety", and "Self-perception" and "Stress", with its role ranging from non-significant to weak partial mediation. Despite slight changes in effect directions and magnitudes, the persistence of direct effects suggests that "Systematic Preferences" does not substantially alter the underlying dynamics of these relationships. Also, the study revealed the mediating role of "Systematic Preference" in the relationship between OTC and psychological states such as fatigue, satiety, and stress. SP serves as a bridge linking "Openness to Change" to levels of fatigue, satiety, and stress. This mediation emphasizes the importance of people's SPs in shaping their psychological well-being. According to the data presented in this paper, OTC has a positive effect on Fatigue and a negative effect on Satiety and stress. This is confirmed by the high values of path coefficients and their statistical significance. Table 6 of the paper summarizes the path coefficients for different predictors of

different outcomes, including fatigue, satiety, and stress. The study conducted with employees (Kanar, 2006) found parallel results that a positive attitude towards change is strongly correlated with a favorable perspective on routines. Similarly, Benlagha and Hemrit (2018) confirm the link between OTC and stress.

Conclusion and recommendation

The comprehensive path analysis, incorporating direct, indirect, and total effects, along with mediation analyses, provides a nuanced understanding of the complex relationships between self-perception, perceptions of others, world perceptions, and their impacts on outcomes like fatigue, satiety, and stress. The significant direct effects from 'Self-perception' to 'Openness to Change ' and 'Fatigue', as well as from 'perception of other ' to 'Satiety' and 'Stress', underscore the direct influence these perceptions have on the respective outcomes. Mediation analyses reveal that 'Openness to Change' and 'Systematic Preference' play crucial roles in these relationships, acting as partial mediators in most paths, and potentially as a full mediator in the relationship between 'Self' and 'Stress' via 'Openness to Change'. The mediation is particularly notable in the paths where 'Self' influences 'Fatigue', 'Satiety', and 'Stress', both directly and indirectly, through 'Openness to Change' and 'Systematic Preference', reflecting the complexity of these interactions. Moreover, the analysis of total effects corroborates the significant cumulative impact of these variables, highlighting the importance of considering both direct and mediated influences to fully grasp the dynamics at play. The variance explained by the models, as indicated by R-square values, and the effect sizes, as captured by f-square values, further contribute to our understanding of these relationships. Overall, the findings illustrate the intricate web of influences among self-perceptions, perceptions of others, world perceptions, and their consequent effects on fatigue, satiety, and stress, emphasizing the multifaceted nature of these relationships within the structural model.

To summarize the overall conclusion, people with a high willingness to change tend to be more fatigued, less satiated, and less stress-resilient. At the same time, people with a high degree of SP are less prone to fatigue and experience greater satiety and greater stress tolerance. In principle, this fits with the theory that people who are disciplined are more easily fatigued and less affected by stress than people who are less disciplined, such as people who tend to be open to change.

These findings have practical implications for developing strategies to manage stress, increase readiness for change, and improve psychological well-being. Additional research may further our understanding of these relationships and help develop more effective methods to support psychological health and adaptation to change.

In the context of recommendations for practice, our results suggest that interventions to improve individuals' readiness for change should take into account their self-perception and the role it plays in shaping that readiness. Organizations could foster more positive self-perceptions among employees by providing regular constructive feedback, recognition for achievements, and opportunities for personal and professional development. Managers should also be trained to identify and address negative self-talk patterns in their team members.

In addition, the impact of systemic preferences on employees' psychological states should be recognized, and strategies should be developed to mitigate potential negative effects. For example, organizations could strive to create a more equitable and inclusive environment by implementing transparent and fair performance evaluation and promotion processes. Providing resources such as employee assistance programs, stress management workshops,

and work-life balance initiatives can also help employees cope with the psychological pressures associated with systemic preferences.

By taking a holistic approach that addresses both individual self-perceptions and systemic factors, organizations can cultivate a supportive environment that enhances employee well-being and readiness for change. This, in turn, can lead to improved organizational effectiveness and better health outcomes for workers. Implementing these strategies will require commitment from leadership, ongoing dialog with employees, and a willingness to invest in evidence-based interventions. However, the benefits—including a more resilient and adaptable workforce—make these efforts worthwhile.

Overall, this study contributes to the understanding of the interaction of stress resilience, readiness to change, and psychological factors. It opens avenues for further research and practical applications to promote well-being and effectiveness in various domains.

From a practical standpoint, the results of our study can be valuable for change management consultants dealing with the complex interplay of stress resilience and various psychological factors during periods of change. Additionally, the obtained results can be incorporated into the curriculum of courses related to change readiness, stress, organizational psychology, health psychology, self-regulation, and stress resilience. The combination of the methods used can be fruitful for psychological assessment during times of change. Further research could focus on the examination of cross-cultural factors related to stress resilience, change readiness, and various psychological factors, as well as ways to develop psychological readiness for different types of changes.

This study holds both theoretical and practical significance. Firstly, it is one of the few studies that explore stress resilience in a complex relationship with change readiness and various psychological factors.

It's worth noting the limitations of this study. Firstly, the study had a relatively small sample size, which limits the generalizability of these results. Furthermore, our sample was slightly biased towards more women and students, despite our efforts to reduce attrition with additional incentives.

The results cannot be generalized as the study was conducted among respondents whose socio-demographic structure may not necessarily align with that of Kazakhstan. Future research could aim to identify personal and professional stressors that contribute most to stress and potential interventions to help the population cope better and become more stress-resilient. Longitudinal research over many years could reveal changes in stress resilience, change readiness, and various psychological factors over time.

Data availability

Notes

1 https://mentalcenter.kz
2 https://www.unep.org/ru

References

Aleksandrovskiy Yu A, Lobastov OS, Spivak LI, Shchukin BP (1991) Psychogenius in extreme conditions. Medicine, Moscow. https://www.studmed.ru/aleksandrovskiy-yua-lobastov-os-spivak-li-schukin-bp-psihogeniya-v-ekstremalnyh-usloviyah_93a5d7a5a36.html

Alrawashda MN (2020) The risk of bullying as a result of COVID-19 among University Students. Opción 36:1597–1625

Al-Maamari QA, Muhammed Kassim RN, Raju V, Al-Tahitah A, Ameen AA, Abdulrab M (2018) Factors affecting individual readiness for change: a conceptual framework. Int J Manag Hum Sci 2(1):13–18. http://www.ijmhs.org/index.aspx

Alolabi YA, Ayupp K, Dwaikat MA (2022) The effect of transformational leadership on individual readiness to change: the mediating roles of work engagement and organizational justice (a study of UAE construction industry). Int J Acad Res Econ Manag Sci 11(3):538–570. https://doi.org/10.6007/IJAREMS/v11-i3/15340

Al-Ghazali BM, Afsar B (2022) Impact of psychological capital on mental health, readiness for organizational change, and job insecurity: hotel employees' perspective in COVID-19. J Tour Fut. https://doi.org/10.1108/JTF-07-2020-0116

Antinori A, Carter OL, Smillie LD (2017) Seeing it both ways: openness to experience and binocular rivalry suppression. J Res Personal 68:15–22. https://doi.org/10.1016/j.jrp.2017.03.005

Bacon DR, Sauer PL, Young M (1995) Composite reliability in structural equations modeling. Educ Psychol Meas 55(3):394–406. https://doi.org/10.1177/0013164495055003003

Benlagha N, Hemrit W (2018) The inter and intra relationship between economics, administrative sciences and social sciences disciplines. Res Soc Sci Technol 3(3):92–115. https://doi.org/10.46303/ressat.03.03.6

Bouckenooghe D (2010) Positioning change recipients' attitudes toward change in the organizational change literature. J Appl Behav Sci 46(4):500–531. https://doi.org/10.1177/0021886310367944

Brooks SK, Webster RK, Smith LE, Woodland L, Wessely S, Greenberg N, Rubin GJ (2020) The psychological impact of quarantine and how to reduce it: rapid review of the evidence. Lancet 395:912–920. https://doi.org/10.1016/s0140-6736(20)30460-8

Brown TA (2015) Confirmatory factor analysis for applied research (2nd edn.). Guilford Publications, New York, NY

Christensen AJ, Moran PJ (1998) Psychological aspects of end-stage renal disease. In: D. W. Johnston DW, Johnston M, Bellack AS, Hersen M (eds.). Health psychology, vol. 8. Comprehensive clinical psychology. Elsevier Science Publishers B.V. pp. 321–338

Dev S (2018) Effects of procrastination behavior, stress tolerance and study habits on academic achievements of Indian Students residing in India (Kerala) and UAE. Res Soc Sci Technol 3(3):16–31. https://doi.org/10.46303/ressat.03.03.2

Devos G, Buelens M, Bouckenooghe D (2007) Contribution of content, context, and process to understanding openness to organizational change: two experimental simulation studies. J Soc Psychol 147(6):607–630

Del-Valle MV, Aranda M (2021) Enseñar en tiempos de CoVid-19: Retos y posibilidades. Opción 37:12–30. https://doi.org/10.5281/zenodo.7465973

Del-Valle MV, López-Morales H, Andrés ML, Yerro-Avincetto M, Gelpi Trudo R, Urquijo S, Canet-Juric L (2022) Intolerance of COVID-19-related uncertainty and depressive and anxiety symptoms during the pandemic: a longitudinal study in Argentina. J Anxiety Disord 86:102531. https://doi.org/10.1016/j.janxdis.2022.102531

Duarte I, Alves A, Coelho A, Ferreira A, Cabral B, Silva B, Peralta J, Silva J, Domingues P, Nunes P et al. (2022) The mediating role of resilience and life satisfaction in the relationship between stress and burnout in Medical students during the COVID-19 pandemic. Int J Environ Res Public Health 19(5):2822. https://doi.org/10.3390/ijerph19052822

Dube B, Mahlomaholo S, Setlalentoa W, Tarman B (2023) Creating sustainable learning environments in the era of the posthuman: towards borderless curriculum. J Curric Stud Res 5(1):i–x. https://doi.org/10.46303/jcsr.2023.1

Dvoryanchikov NV, Starichenko NV, Enikolopov SN (2005) Features of perception and experience of "invisible" stress by military personnel working with sources of ionizing radiation. J Practical Psychol 1:49–54. https://www.researchgate.net/publication/258205500_Osobennosti_vospriatia_i_perezivania_nevidimogo_stressa_voennosluzasimi_rabotausimi_s_istocnikami_ioniziruusih_izlucenij 10.3200/SOCP.147.6.607-630

Evans-Amalu K, Claravall E (2021) Inclusive online teaching and digital learning: lessons learned in the time of pandemic and beyond. J Curric Stud Res 3(1):i–iii. https://doi.org/10.46303/jcsr.2021.4

Effiyanti E, Lubis AR, Sofyan S, Syafruddin S (2021) The influence of transformational leadership on organizational performance: a case study in Indonesia. J Asian Financ Econ Bus 8(2):583–593

Fiorillo A, Gorwood P (2020) The consequences of the COVID-19 pandemic onmental health and implications for clinical practice. Eur Psychiatry 63:1–2. https://doi.org/10.1192/j.eurpsy.2020.35

Freeston M, Tiplady A, Mawn L, Bottesi G, Thwaites S (2020) Towards a model of uncertainty distress in the context of Coronavirus (COVID-19). Cogn Behav Therapist 13:e31. https://doi.org/10.1017/S1754470X2000029X

Gillman AS, Scharnetzki L, Boyd P et al. (2023) Perceptions and tolerance of uncertainty: relationship to trust in COVID-19 health information and vaccine hesitancy. J Behav Med 46:40–53. https://doi.org/10.1007/s10865-022-00302-9

Ghasemy M, Erfanian M, Gaskin JE (2020) Affective events theory as a theoretical lens for improving the working environment of academics in developing economies. J Appl Res High Educ 13(1):300–324. https://doi.org/10.1108/jarhe-02-2020-0030

Greenhouse-Tucknott A, Pickering S, Butterworth J, Smeeton NJ, Wrightson JG, Dekerle J (2020) Prolonged cognitive activity increases perception of fatigue but does not influence perception of effort, affective valence or performance during subsequent isometric endurance exercise. https://doi.org/10.31236/osf.io/7f4hs

Hair JF, Astrachan CB, Moisescu OI, Radomir L, Sarstedt M, Vaithilingam S, Ringle CM (2021) Executing and interpreting applications of PLS-SEM: Updates for family business researchers. J Fam Bus Strateg 12(3). https://doi.org/10.1016/j.jfbs.2020.100392

Henseler J (2017) Bridging design and behavioral research with variance-based structural equation modeling. J Advert 46(1):178–192. https://doi.org/10.1080/00913367.2017.1281780

Hu L, Bentler PM (1999) Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Struct Equ Modeling 6(1):1–55. https://doi.org/10.1080/10705519909540118

Jimmieson NL, White KM (2011) Predicting employee intentions to support organizational change: an examination of identification processes during a re-brand. Br J Soc Psychol 50(2):331–341. https://doi.org/10.1111/j.2044-8309.2010.02005.x

Kanar M (2006) The relationship between openness to change and employees' perception of organizational routines and the effects of empowerment. Doctoral dissertation, Marmara Universitesi (Turkey)

Khon NN, Rogaleva LN, Kim AM, Aidosova ZHK, Aldabergenov NA (2020) Model "Big Five", system approach and efficiency of labor activity. Vestn Kazn Ser Psychol Sociol 1:85–93. https://doi.org/10.26577/JPsS.2020.v72.i1.08

Kim AM, Khon NN, Baimoldina LO, Aidossova ZhK (2021) Systems approach and psychological research in a pandemic. Vestn Kazn Psychol Sociol Ser 76(1):17–24. https://doi.org/10.26577/JPsS.2021.v76.i1.02

Kuznetsov A, Veronika S (2021) Spatial variation and hotspot detection of COVID-19 cases in Kazakhstan, 2020. Spat Spatio Temporal Epidemiol 39:100430. https://doi.org/10.1016/j.sste.2021.100430

Lazarus MD, Gouda-Vossos A, Ziebell A, Brand G (2023) Fostering uncertainty tolerance in anatomy education: lessons learned from how humanities, arts and social science (HASS) educators develop learners' uncertainty tolerance. Anat Sci Educ 16:128–147. https://doi.org/10.1002/ase.2174

Leontiev D, Mospan A, Osin E (2022) Positive personality resources as buffers against psychological reactions to uncertainty. Curr Psychol. https://doi.org/10.1007/s12144-022-03879-1

Li Q, Luo R, Zhang X, Meng G, Dai B, Liu X (2021) Intolerance of COVID-19-related uncertainty and negative emotions among Chinese adolescents: a moderated mediation model of risk perception, social exclusion and perceived efficacy. Int J Environ Res Public Health 18:2864. https://doi.org/10.3390/ijerph18062864

Limm H, Angerer P, Heinmueller M et al. (2010) Self-perceived stress reactivity is an indicator of psychosocial impairment at the workplace. BMC Public Health 10:252. https://doi.org/10.1186/1471-2458-10-252

Lizar AA, Mangundjaya WL, Rachmawan A (2015) The role of psychological capital and psychological empowerment on individual readiness for change. J Dev Areas 49(5):343–352

Lewin K (1958) Group Decision and Social Change. In: Maccoby EE, Newcomb TM, Hartley EL (eds.) Readings in social psychology. Holt, Rinehart, Winston, New York, pp. 197–211

Maksum MA, Purwono J, Hidayatullah FS (2022) The influences of change readiness and self-efficacy on teacher performance during the COVID-19 pandemic. AL-ISHLAH: J Pendidik 14(2):1271–1282. https://doi.org/10.35445/alishlah.v14i2.1898

Maukayeva S, Karimova S (2020) Epidemiologic character of COVID-19 in Kazakhstan: a preliminary report. North Clin Istanb 7:210–213. https://doi.org/10.14744/nci.2020.62443

Mertens G, Gerritsen L, Duijndam S, Salemink E, Engelhard IM (2020) Fear of the coronavirus (COVID-19): predictors in an online study conducted in March 2020. J Anxiety Disord 74:102258. https://doi.org/10.1016/j.janxdis.2020.102258

Nikiforova S, Lamanova A, Injigolyan A, Aliyeva M (2022) Sociological analysis of the dynamics of socio-psychological well-being of medical workers in the conditions of the COVID-19 pandemic. J Psychol Sociol 82(3):102–111. https://doi.org/10.26577/JPsS.2022.v82.i3.010

Peñalver EA, Urbieta AS (2021) Coronavirus y comunicación económico-financiera en el ámbito periodístico inglés-español: características lingüístico-discursivas. Opción 37(94):72–101. https://produccioncientificaluz.org/index.php/opcion/article/view/37359/40785

Pervichko E, Mitina O, Koniukhovskaia J, Kurtser I (2023) Factors of stress resistance in doctors and medical workers during the COVID-19 pandemic. Psychiatry Psychother Clin Psychol 14(1):27–48. https://doi.org/10.34883/PI.2023.14.1.008

Pervushina ON, Fedorov AA, Dorosheva EA (2020) The experience of the COVID-19 pandemic and tolerance to uncertainty. Reflexio 13(1):5–20. https://doi.org/10.25205/2658-4506-2020-13-1-5-20. (In Russ.)

Peterson RA, Kim Y (2013) On the relationship between coefficient alpha and composite reliability. J Appl Psychol 98(1):194–198. https://doi.org/10.1037/a0030767

Plath HE, Richter P (1984) Ermüdung-Monotonie-Sättigung-Stress (BMS). Verfahren zur skalierten Erfassung erlebter Beanspruchungsfolgen. Psychodiagnostisches Zentrum, Berlin

Pogorilska NI, Synelnykov RY, Palamar BI, Tukaiev SV, Nezhyva LL (2021) Features of psychological experiences in severe quarantine during the covid-19 pandemic: the role of tolerance for uncertainty. Wiadomosci Lekarskie (Wars, Pol : 1960) 74(6):1312–1316. https://doi.org/10.36740/wlek202106104

Prima H, Eliyana A (2018) The impact of self-efficacy and perceived organizational support on operational managers' readiness to change. Increasing management relevance and competitiveness. Taylor & Francis. pp. 171–176

Raspopin EV (2012) Scale of resistance to sources of stress (online), date retrieved. Humanities University, Yekaterinburg, Russia. https://s.science-education.ru/pdf/2012/6/16.pdf

Rehman N, Mahmood A, Ibtasam M, Murtaza SA, Iqbal N, Molnár E (2021) The psychology of resistance to change: the antidotal effect of organizational justice, support and leader-member exchange. Front Psychol 12. https://doi.org/10.3389/fpsyg.2021.678952

Roczniewska M, Higgins ET (2019) Messaging organizational change: How regulatory fit relates to openness to change through fairness perceptions. J Exp Soc Psychol 85:103882. https://doi.org/10.1016/j.jesp.2019.103882

Rollnick S, Heather N, Gold R, Hall W (1992) Development of a short 'readiness to change' questionnaire for use in brief, opportunistic interventions among excessive drinkers. Br J Addict 87(5):743–754. https://doi.org/10.1111/j.1360-0443.1992.tb02720.x

Satici B, Saricali M, Satici AS, Griffiths MD (2020) Intolerance of uncertainty and mental wellbeing: Serial mediation by rumination and fear of COVID-19. Int J Mental Health Addict. https://doi.org/10.1007/s11469-020-00305-0

Semenova Y, Glushkova N, Pivina L, Khismetova Z, Zhunussov Y, Sandybaev M, Ivankov A (2020) Epidemiological characteristics and forecast of COVID-19 outbreak in the republic of Kazakhstan. Korean Acad Med Sci 35:1–12. https://doi.org/10.3346/JKMS.2020.35.E227

Schönfeld P, Brailovskaia J, Bieda A, Zhang XC, Margraf J (2016) The effects of daily stress on positive and negative mental health: mediation through self-efficacy. Int J Clin Health Psychol 16(1):1–10. https://doi.org/10.1016/j.ijchp.2015.08.005

Shao L, Guo H, Yue X, Zhang Z (2022) Psychological contract, self-efficacy, job stress, and turnover intention: a view of job demand-control-support model. Front Psychol 13:868692. https://doi.org/10.3389/fpsyg.2022.868692

Shirey MR (2013) Lewin's theory of planned change as a strategic resource. JONA: J Nurs Adm 43(2):69–72. https://doi.org/10.1097/NNA.0b013e31827f20a9

Sukhov A, Sihvonen A, Olsson LE, Magnusson P (2018) That makes sense to me: openness to change and sensemaking in idea screening. Int J Innov Manag 22(8):1–15. https://doi.org/10.1142/S1363919618400091

Taber KT (2018) The use of Cronbach's alpha when developing and reporting research instruments in science education. Res Sci Educ 48:1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Tamba G, Iancu I (2023) Emerging adults and the use of textual digital communication: a reflection on self-esteem, loneliness, anxiety, and wellbeing. Res Soc Sci Technol 8(1):31–50. https://doi.org/10.46303/ressat.2023.3

Taufikin Z, Iain MA (2021) Readiness to change during the Covid-19 pandemic: study of self-efficacy and perceived organizational support on lectures performance. Acad Strateg Manag J 20. https://www.abacademies.org/articles/readiness-to-change-during-the-covid19-pandemic-study-of-selfefficacy-and-perceived-organizational-support-on-lectures--performanc-11226.html

Toro RA, Avendaño-Prieto BL, Vargas N (2020) Transdiagnostic model of anxiety and depression according to the relationship with affect, intolerance of uncertainly, and anxiety sensitivity. Revista. CES Psicol ía 13:140–152. https://doi.org/10.21615/cesp.13.1.9

Tsai MH, Li NP (2023) Trait self-control, emotions, and openness to alternative viewpoints. Curr Res Behav Sci 5:100131. https://doi.org/10.1016/j.crbeha.2023.100131

UNESCO (1995). Declaration of Principles of Tolerance. http://undocs.org/ru/A/RES/51/95

Watkins MW (2018) Exploratory factor analysis: a guide to best practice. J Black Psychol 44(3):219–246. https://doi.org/10.1177/0095798418771807

Weeks WA, Roberts J, Chonko LB, Jones E (2004) Organizational readiness for change, individual fear of change, and sales manager performance: an empirical investigation. J Personal Sell Sales Manag 24(1):7–17. https://doi.org/10.1080/08853134.2004.10749012

Weiner BJ (2020) A theory of organizational readiness for change. Handbook on implementation science. Edward Elgar Publishing, Camberley

Williams BA, Onsman A, Brown GT (2010) Exploratory factor analysis: a five-step guide for novices. J Emerg Prim Health Care 8(3):1–13

World Health Organization (2020) Mental health and psychosocial considerations during COVID-19 outbreak (online), date retrieved. World Health Organization. https://apps.who.int/iris/handle/10665/331490

Xu X, Xia M, Zhao J, Pang W (2021) Be real, open, and creative: how openness to experience and to change mediate the authenticity-creativity association. Think Skills Creativity 41:100857. https://doi.org/10.1016/j.tsc.2021.100857

Zaman M, Novitasari D, Goestjahjanti F, Fahlevi M, Nadeak M, Fahmi K, Setiawan T, Asbari M, Tinggiilmuekonomi S, Bumiputera D, Indonesia Pembangunan S (2020) Effect of readiness to change and effectiveness of transformational leadership onworkers' performance during Covid-19 pandemic. Solid State Technol 63:185–200

Zhussupov B, Saliev T, Sarybayeva G, Altynbekov K, Tanabayeva S, Altynbekov S, Tanabayeva S, Altynbekov S, Tuleshova G, Pavalkis D, Fakhradiyev I (2021) Analysis of COVID-19 pandemics in Kazakhstan. J Res Health Sci 21:e00512. https://doi.org/10.34172/jrhs.2021.52

Zandifar A, Badrfam R (2020) Iranian mental health during the COVID-19 epidemic. Asian J Psychiatry 51:101990. https://doi.org/10.1016/j.ajp.2020.101990

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Competing interests

The authors declare no competing interests.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Where ethics approval was obtained from the institutional review board (IRB) of Turan University, named the Turan University Ethics Committee on March 18, 2021, with the following ID number: 2021-01.

Informed consent

Informed consent was obtained from all participants in this study prior to their completion of the study. Within the scope of this study, written informed consent was obtained from all participants. Participants were given detailed written and verbal information about the purpose, scope, method and possible risks of the study. Participants signed consent forms indicating that they voluntarily participated in the study, agreed to use the collected data for scientific purposes, and to publish the results anonymously. No payment was made to the participants for their participation in the study. All participants were assured in writing that the information they provided would be kept confidential, their personal data would be protected, and the results of the research would only be reported anonymously. Participants were informed that they had the right to withdraw from the study at any time and were assured that their data would be destroyed in this case.

Additional information

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