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The Role of a Medical Psychologist in Maintaining the Rehabilitation Potential of Patients after a Stroke at the Second Stage of Medical Rehabilitation

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ABSTRACT

Stroke can lead to motor, cognitive, and speech disorders that require long-term correction. Rehabilitation potential (RP) indicates the level of maximum possible recovery of a patient in the given time period. Maintaining RP at the second stage of medical rehabilitation (MR) is one of the important tasks of a medical psychologist. However, current Russian scientific literature has not sufficiently disclosed the scope and theoretical foundation of such work. The authors of this lecture analyzed the concept of RP from the theoretical and methodological perspectives of Russian medical (clinical) psychology. In addition, they investigated current studies on the relationship between psychological factors and neuroplasticity mechanisms. Scientific data allow to consider RP as a complex and dynamically changing system formed due to various effects, including psychological ones. The theoretical and methodological tradition of Russian medical (clinical) psychology gives grounds to regard illness perception (IP) as a psychological component of the RP, which is 1) social in origin, 2) mediated in structure, 3) subject to voluntary control. Within the second stage of MR of patients after stroke, formation and improvement of IP to maintain the RP require joint efforts of a neuropsychologist and a pathopsychologist. Modern studies on the relationship between psychological factors and neuroplasticity mechanisms provide scientific grounds for the methods of work of a medical psychologist in medical rehabilitation.

Keywords: medical rehabilitation; rehabilitation potential; stroke; medical psychology; illness perception; activity theory; consciousness; higher mental functions

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Роль медицинского психолога в поддержании реабилитационного потенциала пациентов с острым нарушением мозгового кровообращения на втором этапе медицинской реабилитации

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РЕЗЮМЕ

Острое нарушение мозгового кровообращения (ОНМК) может приводить к двигательным, когнитивным и речевым нарушениям, которые требуют продолжительной коррекционной работы. Реабилитационный потенциал (РП) является показателем уровня максимально возможного восстановления пациента в намеченный отрезок времени. Поддержание РП на втором этапе медицинской реабилитации (МР) – одна из важных задач работы медицинского психолога. Однако ее содержание и теоретический фундамент недостаточно раскрыты в современной отечественной научной литературе.

Авторы настоящей лекции проанализировали концепцию реабилитационного потенциала с теоретико-методологических позиций отечественной медицинской (клинической) психологии. Были изучены актуальные исследования связи психологических факторов с механизмами нейропластичности. Научные сведения позволяют заключить, что РП является сложной и динамически изменяющейся системой, которая формируется в результате действия различных влияний, в том числе психологических. Теоретико-методологическая традиция отечественной медицинской (клинической) психологии дает основания рассматривать внутреннюю картину болезни (ВКБ) как психологический компонент РП, который 1) социален по происхождению, 2) опосредован по строению, 3) доступен произвольному контролю.

В рамках второго этапа МР пациентов с ОНМК работа над формированием и повышением качества ВКБ для поддержания РП требует совместных усилий нейропсихолога и патопсихолога. Современные исследования связи психологических факторов с механизмами нейропластичности предлагают естественно-научные основания методам работы медицинского психолога в рамках медицинской реабилитации.

Ключевые слова: медицинская реабилитация, реабилитационный потенциал, острое нарушение мозгового кровообращения, медицинская психология, внутренняя картина болезни, теория деятельности, сознание, высшие психические функции

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

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INTRODUCTION

Progress in the state system of medical rehabilitation (MR) actualizes the concept of rehabilitation potential (RP) [1]. RP is the maximum possible level of recovery¹ of a patient within the given time period (Order of the Ministry of Health of the Russian Federation No. 788n dated July 31, 2020). One of the primary targets of RP research is personalization of medical services [2]. Explicit RP encourages a multi-professional rehabilitation team (MPRT), a patient, and patient's social environment to expect a definitive rehabilitation outcome. RP prospect reflects the expectations of the MR participants and affects their mindset and motivation. All these make it possible to consider the significance of the psychological aspect of the RP. It is of special importance for the second stage of MR of patients who experienced stroke [3]. Being the key reason for the working population disability, stroke results in movement disturbances (with about 80% in the acute phase and around 40% in the first 6 months), speech (28–40%), cognitive (up to 72%), and other disorders [4–6]. Therefore, special efforts are required to overcome these difficulties, which often leads to a shift in the patient's way of living [7]. In this respect, analyzing the ways by which a medical psychologist can support the RP of patients after stroke at the second stage of MR is relevant.

The aim of this lecture was to study the concept of RP from the theoretical and methodological standpoints of Russian medical (clinical) psychology as well as to review relevant studies on the association between psychological factors and mechanisms of neuroplasticity.

REHABILITATION POTENTIAL: COMPLEXITY, MULTI-FACTOR AND SYSTEMATIC NATURE OF THE CONCEPT

The term rehabilitation potential was coined in the work of Herbert S. Whiting "Classification of Rehabilitation Potential" (1950) [8]. Developing ideas of Howard Rusk, the founder of American rehabilitation medicine, H.S. Whiting proposes a RP classification consisting of three components: 1) physical rehabilitation potential, 2) potential at home, and 3) professional potential. For the first component, the author introduces a graduated approach including five hierarchical levels [8].

With further MR development, the understanding of the RP has changed [9]. Two main driving factors for this transformation can be outlined from the analysis of the current literature. Firstly, the progress of neuroscience contributes to RP concept rethinking [10]. As the understanding of the mechanisms of recovery from dysfunction deepens, it increases the efficiency of the related methods of rehabilitation [11]. The morphological and functional basis of mental processes is being elucidated as well as their influence on somatic changes [12, 13]. This contributes to gradual abandonment of hyper-specific skill training in MR. At the same time, approaches based on patient systemic involvement in the recovery process (sensory feedback (SFB) and biological feedback (BFB), virtual and augmented reality (VR, AR), etc.) become more important [14]. Due to that we need to consider a constantly growing number of factors when determining the RP. We are starting to appreciate the complex structure and dynamic nature of the RP, as well as its dependence on environmental factors and patient's personal characteristics [9].

Secondly, broader application of personalized medicine [15] drives transformation of the goal behind determining the RP. While in the mid-20th century, its main task was to understand whether a patient should be sent to a rehabilitation facility, today such an approach is subject to criticism. [2]. A client-centered approach requires assessing the RP to determine which of the available rehabilitation services will provide the greatest benefit to the patient in their life circumstances.

Following the analysis of the literature on the RP from foreign scientific literature databases (Medline, CINAHL and Embase), Priscilla Lam Wai Shun and her colleagues (2022) outlined a scheme of the RP for acquired brain injury (Fig. 1) [9]. [На рисунке: в овале изменить Interpretating g на Interpreting; в самом нижнем правом прямоугольнике заменить Socio-economical на Socio-economic!!]

This model suggests that the RP is not just a property of a particular patient. On the contrary, it is rather a reflection of the environment and peculiarities of rehabilitation specialists. The experience, competences as well as personal traits of clinicians influence the way they perceive a patient and the forecast they give in every particular case. The state of the health care system, social stereotypes and mindset related to certain diagnoses, cultural peculiarities of

¹ return to previous professional or other labor activities, maintaining the ability to carry out daily activities, and restoring the ability to self-care.

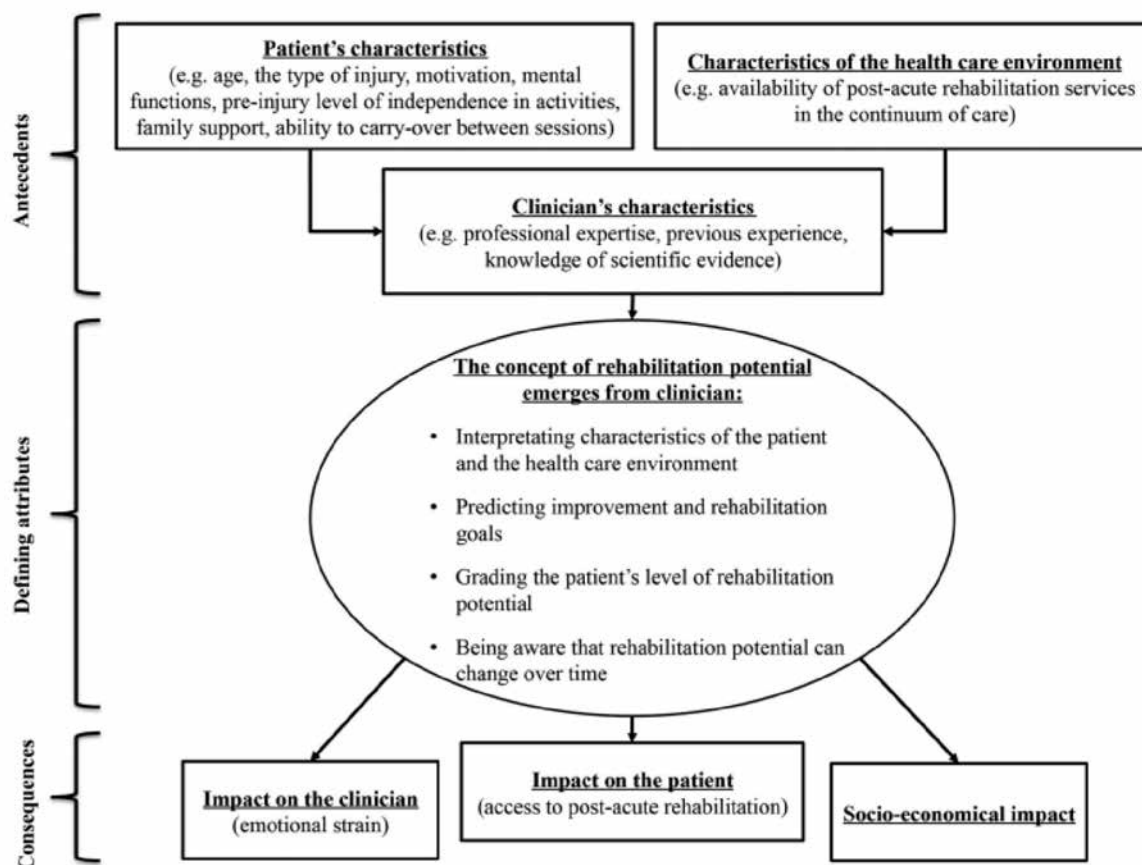


Fig. 1. Study of the RP, according to P. Lam Wai Shun et al. (2022) [9]

society, and other environmental factors determine rehabilitation options that in turn can also dramatically increase or decrease the patient's RP.

Thus, studies of RP allow us to consider this concept in terms of complex dynamic systems. This is in excellent agreement with the view of modern sciences on the subject in contemporary Russian methodology [16]. In particular, it is in line with ideas of complex self-developing systems as the cognitive object of postnonclassical type of rationality [17]. Unlike the usual object of medical and natural sciences, a patient's RP is inaccessible for visual objective examination. It cannot be studied with the use of classical empiric methods. The dictionary definition of the term "*potential*" attributes it to the category of the "*possible*" in contrast to the category of the "*present*" [9]. The RP is a complex cognitive and verbal construction created by MPRT members based on the incoming information. Similarly to the objects studied by synergetics and quantum physics, it is characterized by the stochastic nature and a spectrum of possible ways of further development.

All such properties allow to link the studies of RP to the methodology of Russian clinical psychology for

which aforementioned conceptual grounds are inherent [18]. Memory, thinking, imagination, representation, etc. – the subjects matter of psychological examination – always include the components of subjective reality inaccessible for classical objective research [19]. In order to make them empirically visible, psychology developed the principles of research design that include the combination of qualitative and quantitative methods [20, 21]. From the point of view of this conceptual approach, the goal of rehabilitation is to "create psychologically justified conditions for the potentiation of active self-sustained personal development under newly emerged illness-restricted conditions" [19, page 8]. Using the term "*potentiation*" is illustrative in this context. It places special emphasis on the fact that a systemic psychological approach suggests not a static definition of the RP but rather the process of its continuous search in joint activity [7], creating conditions for its revealing and maintenance. A medical psychologist as a specialist aimed at the study and description of subjective phenomena monitors a complex system of psychic processes capable of restricting available physical abilities and uncritically ignoring present

issues. By establishing a contact and communication with a patient, a medical psychologist seeks to provide the conditions for the fullest possible understanding of: a) the emergence and flow of thoughts, motives, and emotions at any given moment in time; b) the value of personal feelings and individual experience; c) genuine existential needs; d) objective opportunities for growth in the present situation. Therefore, thanks to realization of the reflection potentials [22], communication with a medical psychologist is aimed at the formation, maintenance, and strengthening of the patient's RP. Modern studies of brain and psychic describe the mechanisms providing the material basis for these processes [23].

ILLNESS PERCEPTION AS A PSYCHOLOGICAL COMPONENT OF THE REHABILITATION POTENTIAL

One of the first foreign researchers who drew attention to the psychological component of the RP was S.Z. Nagi [24], the author of the social disability model. In his publication "A study in the evaluation of disability and rehabilitation potential: concepts, methods, and procedures" (1964), he described the psychological study of the RP along with medical, ergotherapeutic, and professional studies. According to S.Z. Nagi, the psychological evaluation of the RP must be carried out with the use of a clinical interview and psychometric testing. Together they elucidate the psychological traits of a patient and his/her view of the nature and repercussions of the disease [24]. Thus, the key psychological component of the RP was something often referred to as illness perception (IP) in modern psychological studies (Fig.2).

Discussing the approaches utilized by a medical psychologist, S.Z. Nagi places emphasis on the use of standard tests (Wechsler Adult Intelligence Scale (WAIS), Minnesota Multiphasic Personality Inventory (MMPI), etc.). Such a view of psychological diagnostics is characteristic of the Western tradition focused on the quantitative approach [25]. However, unlike foreign researchers, since its early stages of formation, Russian psychology has been inclined to the so-called activity paradigm [26]. Its main feature consists in assigning greater value to the qualitative observation of execution of various tasks rather than quantitative evaluation of the results. In this paradigm, the psyche is perceived as a complex dynamic system that exists and develops in close connection with the instrumental activity of a person in the environment [27] (Fig. 3).

Study of a particular person's psyche requires a qualitative description of their activity unfolding in a real-world situation. This allows a medical psychologist (Fig. 4) to determine: a) to which representations a subject is referring in problem-solving, b) how they are interconnected, and c) what drives and guides these connections.

According to the activity approach and cultural – historical concept of higher mental functions (HMF), IP is treated by the Russian psychological school as the result of the process of *nosognosia*, i.e. lifetime, culturally determined development of the person's understanding of the disease during their lifetime [29]. The description of the semiotic model of IP is based on such components of consciousness as sensible tissue, meaning, and personal sense (Fig. 5).

Thus, the Russian model allows to analyze the emergence and development of IP in patients after stroke during the second stage of MR more precisely.

1. *Sensible tissue*. Depending on the volume and localization of a lesion, stroke can lead to disturbance in multidimensional sensual composition of particular representations of reality [30]. Furthermore, the initial stunning impact of stroke provokes the feeling of extreme insecurity [31]. Patients feel loss of control over their body that gives rise to intense frustration. Thus, neuropsychological work on activation of sensory representations and regaining control in the flow of the perceived information of various modalities is one of the components aimed at the improvement of IP. However, for better support of the RP during the second stage of MR, psychological interventions aimed at emotion and affect regulation are just as important [32, 33].

2. *Meaning*. The vocabulary of available means for sensory experience provides its "initial designation" [29]. It guides the flow of associations, gradually building up a narrative that allows one to interpret one's experience in this way or another. Patients suffering from various forms of aphasia due to stroke experience particular difficulties in this respect. In order to create the IP that maintains the RP within MR, they first need neuropsychological and speech therapy so as to restore disordered syntagmatic and paradigmatic associations of verbal processes [34]. However, with the speech function retained, the meaning system can also require professional attention. At the second stage of MR of patients after stroke, a medical psychologist can deal with a mixed differentiation of the vocabulary describing mental processes ("Am I not that crazy yet?", "I have

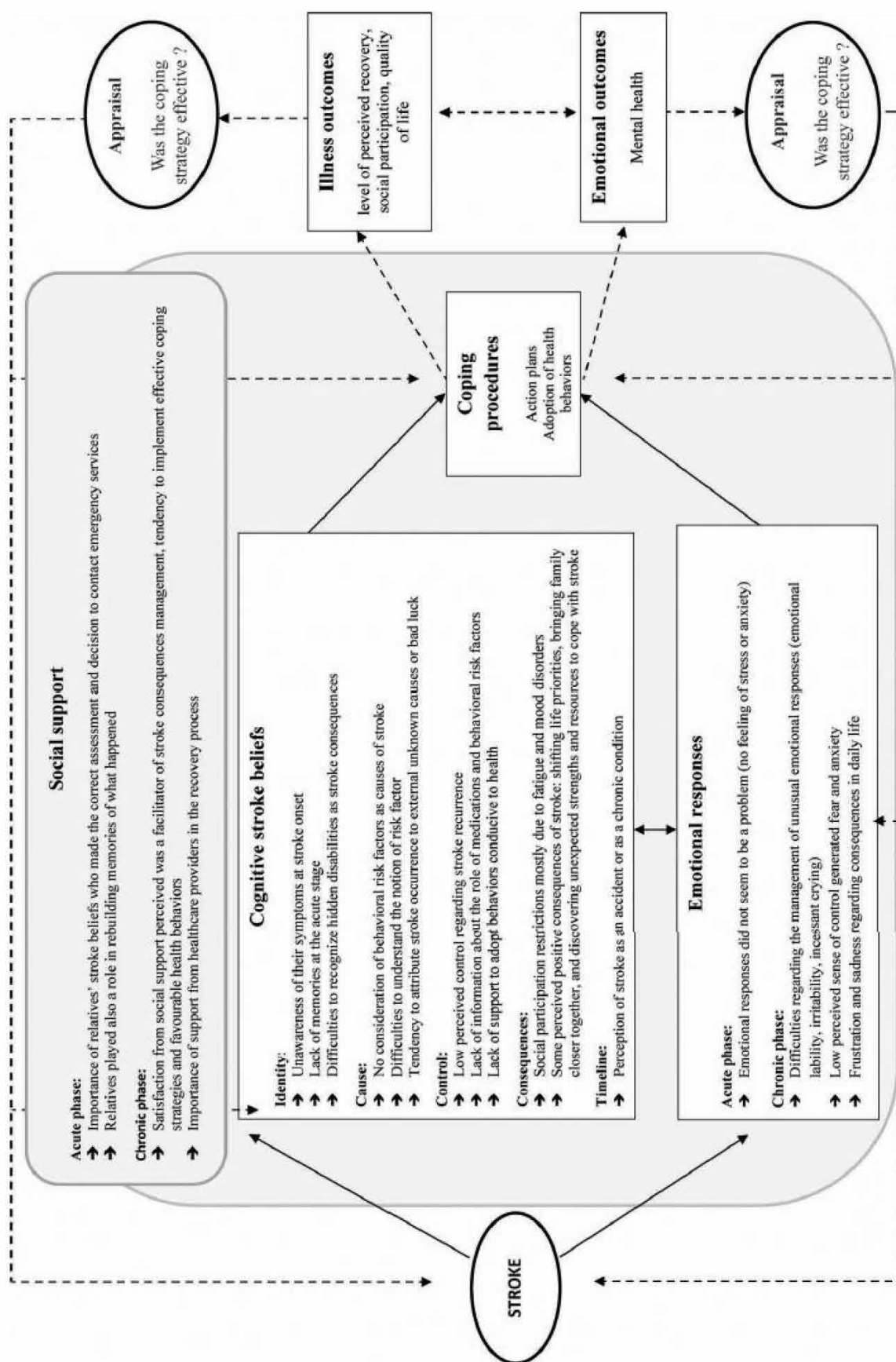


Fig. 2. Common sense-based model of self-regulation for stroke, according to C. Della Vecchia et al. (2019) [28]

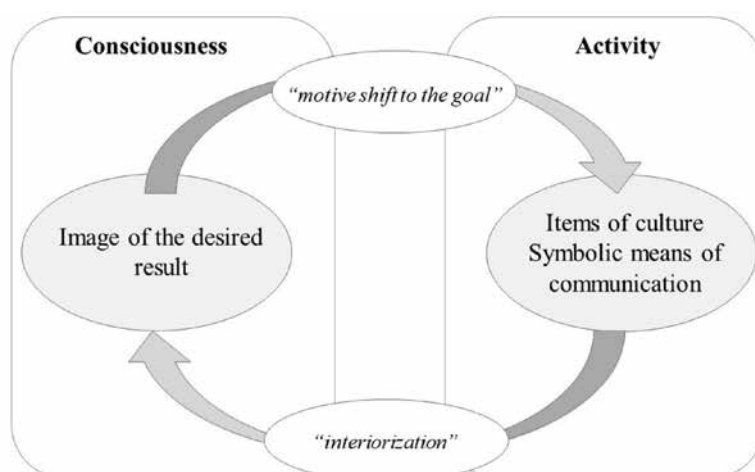


Fig. 3. Dialectical unity of consciousness and activity [27]

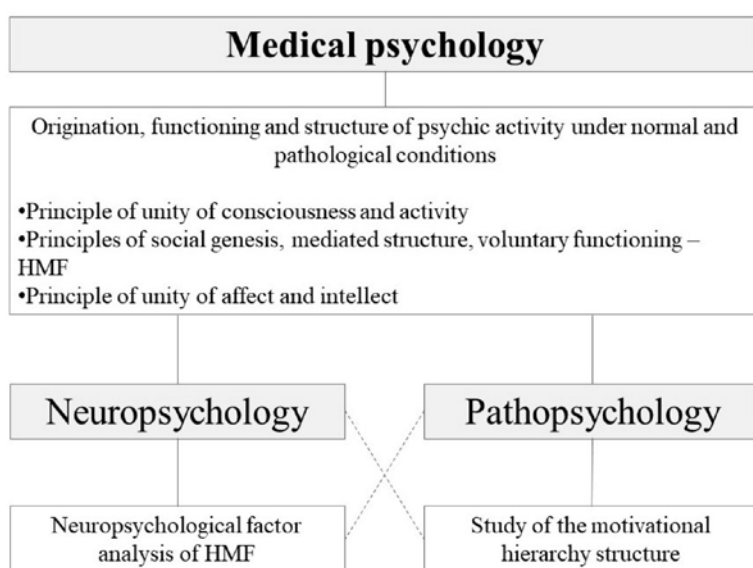


Fig. 4. Relationship between neuro- and pathopsychology within the second stage of MR of patients after stroke

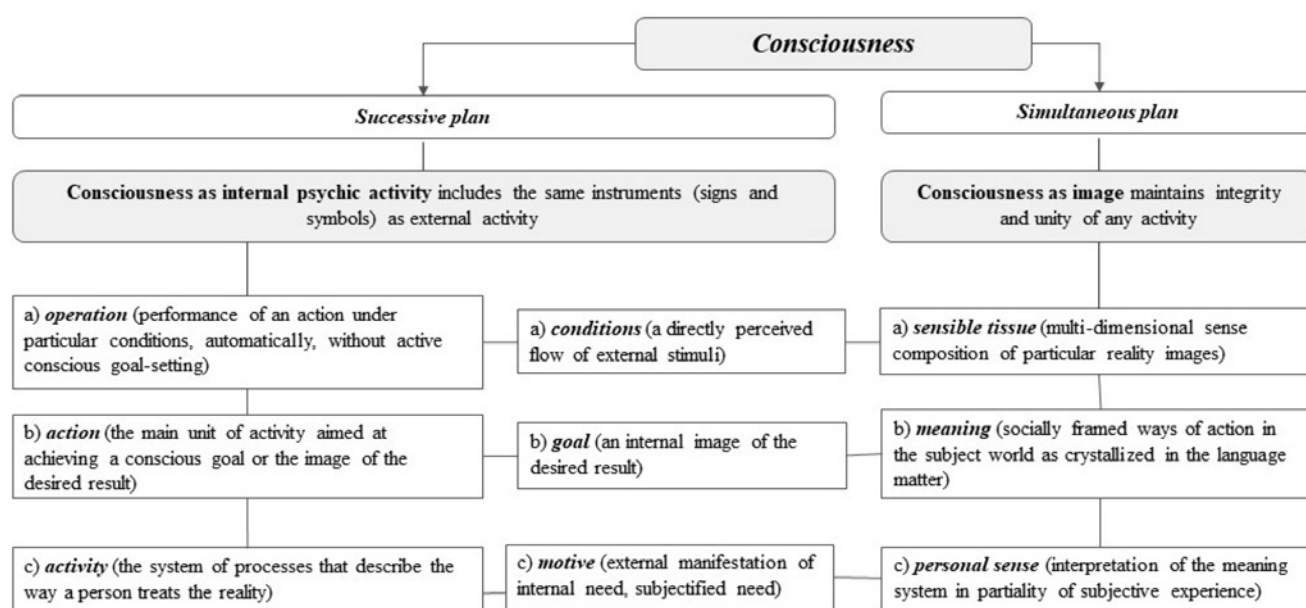


Fig. 5. The two plans of consciousness analysis according to the activity theory by A.N. Leontev [26, 27]

become a dummy”, “My head does not work”, etc.). Such general clichés result in negative emotional experiences, self-assessment, and anxiety regarding one’s own mental status that adversely affect the RP. An interview with 57 adults in the early recovery period of stroke detected the presence of subjective cognitive complaints that were not associated with psychometrical assessment of cognitive processes [35]. The regression analysis of data has shown that subjective complaints served as the most important predictor of patient’s involvement in social activity. Therefore, apart from neuropsychological work with speech, psycho-educational interventions aimed at enrichment of the vocabulary describing psychic functions and states are needed in order to support the RP.

A feeling or experience described with a certain term undergoes the process of the “secondary designation” fitting into a discursive net of myths around a disease that exist in the information space surrounding a person. The narrative to which a subjective perception of the disease refers guides their further mental activity. It determines the direction of an associative sign – symbolic process. Here stroke serves as one of the well-articulated pathologies extensively discussed in the modern media. Being a leading cause of disability, stroke is rightfully considered to be highly socially sensitive. As the world population grows, the incidence of stroke is continuously increasing as well (up to 12 million per year, according to the WHO in 2025) [3]. This contributes to the spread of myths, concerns, and fears in the information space around the topic of stroke that can have a negative effect, being actualized and emotively loaded when a person faces stroke [28] (Fig. 2). Instead, objective knowledge has a positive effect on the recovery process. A longitudinal study of 60 patients after stroke undergoing MR showed a relationship between qualitative knowledge and well-defined expectations from rehabilitation with more successful results at the time of discharge [36]. Thus, the work of a medical psychologist with a patient’s IP is essential in the RP maintenance. Therefore, neuropsychologists deal with the recovery of general operational basics of semantic memory, speech, and executive functions. In the meantime, a pathopsychologist focuses on the conceptual part of the patient’s perception of stroke and helps get rid of irrational and dysfunctional beliefs by using different psychotherapy methods.

3. *Personal sense.* The discursive structure developed from socially framed language means and

meanings acquires a personal sense when subjected to psychic activity of an involved biased individual. A phenomenological study consisting of 73 interviews conducted with six patients in the late recovery period from stroke demonstrated that the participants tended to focus on the social side of their symptoms rather than on the state of a disturbed function itself [31]. As a rule, the patients interpreted a physical deficiency as a complete loss in an important area of live (for example, incapability of going to a pub with friends). Within this social side of their problems, such key topics as change of roles and isolation surfaced as well [31]. An ability to pursue the deep meaning of the disease is associated with peculiarities of motivational hierarchy and other personal traits of a patient. An example of a successful solution to the “meaning problem” [27] was provided by neurobiologist Jill Bolte Taylor [37]. In her autobiographic book “My Stroke of Insight: A Brain Scientist’s Personal Journey”, she described her personal experience of recovery from stroke as something that allowed her to gain new knowledge of the human nature and capabilities, to broaden the understanding of the subject matter of brain science and led to the insight and discovery of the internal source of harmony and peace of mind. Creating the conditions for such transformation of the personal sense of a disease is an important task of a medical psychologist within the second stage of MR of patients after stroke, since it is the deep personal sense that motivates a person to overcome difficulties and limitations [38, 39]. In this context, neuropsychological interventions are necessary for recovery of such HMFs as operational basis of reflection (namely, functions of programming, regulation and control, speech, memory, etc.). A pathopsychological component of rehabilitation consists in the creation of an environment encouraging reflection of subjective experience by a person relying on HMFs.

It is noteworthy that today the activity approach to consciousness and the cultural – historical concept of HMF are becoming increasingly important for contemporary neuroscience [40]. Theoretical and methodological concepts of Russian scientists get larger empirical support in present-day objective experimental studies of cognitive and affective processes [41–43]. In neurorehabilitation practice, this means relying on the International Classification of Functioning, *Disability, and Health* (ICF). The structure of the ICF seeks to describe the patient’s condition in a complex, multi-factor fashion considering the influence of personal

and environmental factors. Defining the domains of activity and participation (d) along with body functions (b) makes it possible to draw some comparisons between the ICF concept and the ideas of the levels described in the activity theory by A.N. Leontev (Fig. 5) [44]. In turn, differentiation between realization and capacity as the two components of the assessment of activity and participation in the ICF corresponds to the ideas of the “zone of proximal development” by L.S. Vygotsky [45].

MECHANISMS OF INFLUENCE OF ILLNESS PERCEPTION ON THE REHABILITATION POTENTIAL OF PATIENTS AFTER STROKE AT THE SECOND STAGE OF MEDICAL REHABILITATION

In fundamental neuroscience, recent decades have brought a large number of studies on the interrelation between depressive patterns of thinking, emotions, and behavior and changes in the mechanisms of brain plasticity [46]. In the article published by Nature Publishing Group, Rebecca Price and Ronald Duman

presented an integrative concept of neuroplasticity that summarizes the results of experiments on animals with clinical materials and studies involving healthy participants (Table 1). This model describes neuroplasticity as a multidomain neurobiological, psychological, and social construct [46]. Depression, low cognitive flexibility, and stereotype repertoire of behavior were associated there with malfunction of plasticity mechanisms in the nervous system disturbing normal energy processes and comprehensive integration of information they encode [47, 48]. On the other hand, high motivation, flexible thinking, and diverse behavior were associated with higher neuroplasticity [13].

The review of studies of the impact of neuroplasticity on stroke recovery published between 2000 and 2023 in such resources as PubMed, Embase, and the Cochrane Library confirmed its substantial prospects for the rehabilitation of patients after stroke [49] (Table 2). Despite that, according to the authors of the article, there are substantial individual differences in neuroplasticity both due to personal experience and to general sociocultural aspects.

Table 1

Neuroplasticity Markers across Levels of Analysis, according to R. B. Price and R. Duman (2020) [46]		
Level of analysis	Dysfunctional state	Treatment goal state
Molecular/cellular	↓ Synaptic number and function, neuronal atrophy	↑ Synaptogenesis, ↑ neurotrophic factors
Neural network	↓ PFC – limbic circuit connectivity	↑ PFC – limbic connectivity and limbic system, ↑ regulatory control over limbic regions
Cognitive function	↓ Flexibility, ↓ cognitive control, ↓ goal-directed inhibition / excitation of lower-order functions	↑ Flexibility and cognitive control, ↑ goal-directed inhibition/excitation capacity
Affective information processing	Rigid negative biases in implicit information processing (e.g., attention, memory, interpretations, self-representations)	Unbiased and flexible information processing
Clinical/self-report	Perseverative negative thoughts, repetitive maladaptive behaviors, depression	Novel positive thoughts/perceptions, diversified behavioral repertoire, euthymic mood, improved function/engagement

Table 2

Key Neuroplastic Changes Associated with Stroke Rehabilitation, according to N. Aderinto et al. (2023) [49]		
Neuroplastic changes	Description of changes	Neural structures involved
Dendritic remodeling	Structural changes in dendrites, including sprouting and arborization	Affected and unaffected brain regions
Synaptic plasticity	Strengthening or weakening of synapses based on activity and experience	Neurotransmitter systems, cortical and subcortical regions
Cortical reorganization	Changes in cortical maps and functional organization of brain regions	Motor and sensory cortices, association areas
Neurogenesis	Generation of new neurons in specific brain regions	Hippocampus, subventricular zone
Axonal sprouting	Formation of new connections or sprouting of existing axons	Corticospinal tract, other neural pathways

Thus, Nicholas Aderinto and his colleagues justified at the neurophysiological level the necessity of personalized interventions and interdisciplinary cooperation for the full use of the enormous potential of neuroplasticity in stroke recovery [49].

When analyzing the options for the application of knowledge about the mechanisms of neuroplasticity in clinical practice, J. Shaffer emphasizes that psychology enjoys unique opportunities for the maximization of the “revolution aimed to transform diagnostics and treatment of mental diseases and to overcome the absence of significant progress in control of underlying health conditions and mortality for the last 100 years” [50, 51]. Referring to the writings of Marian Diamond, one of the founders of studies on neuroplasticity, J. Shaffer describes the key aspects that ensure brain health maintenance. They include novelty and challenges, physical activity and proper nutrition, love, social acceptance, low stress level, as well as healthy sleep [51]. J. Shaffer states that positive psychology [52] can promote positive emotions, thus strengthening interaction with enriched environment and therefore potentially contribute to intensification of the neuroplasticity in their central nervous system (CNS) [13].

Many modern researchers of psychological factors of brain plasticity pay special attention to positive neurophysiological effects of meditation and mindfulness [53]. Thus Isaac N. Treves and his colleagues analyzed 68 correlation studies utilizing structural MRI, fMRI with tasks, fMRI at rest, and EEG. They presented a convincing body of evidence for the relationship between mindfulness and a) reduced reaction of the amygdaloid body to emotional stimuli, b) increased cortical thickness in frontal and insular areas of neocortex, c) increased differentiation of the brain default mode network. According to many researchers, the positive effects of meditation are as follows: 1) changes in the brain activation patterns on fMRI, 2) changes in visual evoked potentials (which reflects the impact of meditation on attention), 3) changes of amplitude and synchronicity of high-frequency oscillations (probably playing an important role in synchronization of brain large neuronal networks) [54]. It should be noted that from the neuropsychological point of view, meditation and mindfulness practices are effective methods of training executive functions enabled by the activity of the prefrontal cortex [55]. Such practices include inhibition of involuntary reactions to stimuli and prolonged attention focusing on the particular mental state. In terms of pathopsychology,

they can be treated as development of a regulatory component of psychic activity and maintenance of the complex hierarchy of motives.

Therefore, IP as a complex system of interrelated subjective perceptions of the disease can be considered as a psychological component of the RP. Based on the properties of its elements, a person formulates their personal view on the prospects of recovery. Emotional processes corresponding to such perception are associated with particular physiological processes that affect the dynamics of neuroplasticity mechanisms in one way or another. Therefore, maintaining the RP during MR requires psychological therapy with IP aimed at strengthening of positive feelings facilitating neuroplasticity and contributing to recovery of CNS malfunctions. At the same time, such IP should refrain from supporting an infantile illusion of the omnipotence of patients [56] but rather provide for their objective acceptance of limitations and good adherence to the MR program.

CONCLUSION

The rehabilitation potential is a complex dynamic system influenced by many different factors, including psychological ones. Just as the action potential of a neuron depends on the integrity of its membrane complex, the rehabilitation potential of a person is determined to a great extent by the functions of their consciousness as the specific boundary between the outer and inner worlds [57]. According to the theoretical and methodological tradition of Russian medical psychology, the IP can be treated as a psychological component of the RP that is 1) social in origin, 2) mediated in structure, 3) accessible to voluntary control. During the second stage of MR of the patients after stroke, work on IP quality improvement for the RP support requires joint efforts of a neuropsychologist and a pathopsychologist. A neuropsychologist is responsible for the recovery of gnostic components of sensible tissue of consciousness and associative connections within the meaning system. A pathopsychologist works on building conditions for the optimization and regulation of affective components of sensible tissue of consciousness and search for the personal sense of the disease for a patient. Modern studies on the relationships between cognitive and emotional processes and neuroplasticity mechanisms provide biological foundations for the methods of work of a medical psychologist within rehabilitation from stroke. They elucidate the brain processes which

can be affected by carefully selected personalized psychological techniques in order to increase intentionality and awareness in the patient.

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