3. Formation of professional self-consciousness begins with professional training in the university, but this process has its own characteristics, which manifest themselves in different ways at different stages of training *(Semyenova, 2014)*.

4. In the early stages of training, psychology students already have a professional self-awareness, which manifests itself in the fact of realizing their professional abilities, potentials and prospects. At the same time, there is a tendency to overestimate professional self-esteem and the level of claims with a "blurred" view of the specifics of professional activity.

5. In the second stage of vocational training, there is a significant correction of ideas about professional activity, which leads to a change in the professional image of oneself and the correction of professional self-esteem. These changes occur with the experience of emotional discomfort.

6. In the subsequent stage of forming professional self-awareness, there is a deepening of the notion of professional activity, an adequate system of criteria for professionalism is formed, self-esteem is being raised and the professional image of self is adequately constructed with the isolation of its professionally important qualities. But even in this case the peculiarities of the formation of professional self-consciousness are manifested. So, at the last (final) course of study, there is a repeated decrease in professional self-esteem and in the students' perceptions about themselves, they primarily distinguish business, rather than professionally-important qualities.

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DEVELOPMENT OF A FUNCTIONAL MODEL OF THE INFORMATION SYSTEM OF DETERMINATION OF EMOTIONAL AND COGNITIVE DISORDERS IN PATIENTS WITH DISCIRCULAR ENCEPHALOPATHY

Abstract

The article presents information technology for the detection of emotional and cognitive disorders, which provides a detailed display of the process of their detection, by designing IDEF0 diagrams. The results reflect a structured description of the diagnostic process, which allows identifying emotional and cognitive disorders in patients with discirculatory encephalopathy. This information technology can be used by psychiatrists, psychotherapists and medical psychologists.

Keywords

Information technology, emotional and cognitive disorders, IDEF0 diagrams

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Introduction.

The vascular diseases of the brain at present are one of the main medical problems in most industrialized countries of the world. In recent years, a steady tendency towards the growth of dyscirculatory encephalopathy (DE) in the structure of cerebrovascular pathology has been observed in Ukraine. In today's conditions, the question of studying the mechanisms of formation and specificity of clinical manifestations of DE in the able-bodied population are relevant *(Bachinskaya, 2010; Mischenko, 2010)*.

The problem of development of DE is one of the leading places in the domestic neurology and psychiatry, in connection with its high prevalence and predominant lesion at the initial stage of the disease of working-age people, as well as severe medical and social consequences *(Kozhina, 2012; Vysotkaya, Kozhina, Rysovanaya, Chaika, 2013)*. In patients with initial stages of DE, cognitive and emotional disorders are minimal, so their diagnosis is a rather complicated task. The presence of a large number of interrelated indicators characterizing psychological disorders, the analysis of which requires the use of mathematical methods and software, determined the need for the development and implementation of information technology (IT) detection of cognitive and emotional disorders in patients with DE *(Vysotskaya, Panferova, Kozyuk, Dobrodzhennaya, 2016)*.

Literature review and problem statement.

Psychiatry uses a number of information technologies and systems. The computer system "DX-NT", developed by firm DX-Complex *(Yuryeva, Nosov, 2006)*, is based on the technology of topographic mapping of biorhythmics of the human brain by determining the severity of nerve and psychological diseases. She puts emphasis on the visual determination of the severity of nervous and psychological diseases, but does not solve the problems of assessing the severity of cognitive disorders in patients with DE.

The TESTER information system is designed to detect cognitive impairments *(Kulik, Nikonets, Tkachenko, Lukyanov 2011)*, but its database does not include the results of laboratory tests, which affects the accuracy of diagnostic DE.

The system of design and automation of tests "PRACTIC", which has a modular structure and includes 3 modules (module for creating tests, module interpreter, module UserInfo), allows you to conduct psycho-diagnostic examinations. The structure of the system allows to ensure accumulation of the general normative base of tests, however, high and stringent requirements to the technical means and its software is a significant disadvantage *(Alexandrovsky, Shchukin, 1991)*. One of the subsystems of this system is "TESTAN", which allows to automate the multifactor arbitrary question-related test, as well as develop new tests based on the psychometric analysis of points of available techniques. It consists of several independent modules, the main ones of which are intended for input into the information system of the completed questioning test methods, automated data collection, processing and automated interpretation. However, this system is quite complex in use and more focused on scientific, but not practical work *(Alexandrovsky, Shchukin, 1991)*.

The computer system of psychodiagnosis SMOL-Expert *(Blakeer, 2002)* is based on the SMOL test. It provides testing, processing results, maintaining a database, interpreting the results of the survey. SMOL is a shortened version of the well-known MMPI test used for psychological counseling. The disadvantages of this program are: the lack of the ability to detect cognitive impairments and the prognosis of the further development of emotional disorders, as well as the generation of a large number (more than 400,000) of output options.

The well-known is the united software complex, which includes the expert system "Longitude" and the experimental-diagnostic complex (EDC), which are interconnected by a multitude of common components, but are intended for various purposes. An expert system of individual support for the development of children "Longitude" is used to determine the level of psychomotor development and control of its dynamics in children from two months to seven years. This software is a supplement to the usual methods of examining a child's specialist. However, this system allows you to work only with children. An extended version of this system, Longitude +, also includes applied techniques for psychological work with adolescents and adults. EDC is a set of diagnostic, research and teaching techniques used in the diagnosis of psycho-emotional disorders designed to collect and process experimental data, adapt and standardize psychodiagnostic techniques that do not have modern adapted versions, as well as for applied use, including counseling and conducting research *(Miroshnikov, 2010)*. The presented program complex does not allow to take into account the factor of the presence of cerebrovascular pathology of chronic form.

The automated information system "The map of the patient who appealed for psychiatric help" is intended to automate the process of conducting an outpatient card. This information system helps doctors-psychiatrists (therapists-psychotherapists), especially the beginners, in making the correct diagnosis *(Altamirov, 2016)*. However, this system is intended to support decision-making by the doctor of the psychiatric and narcological department and does not take into account the possibility of the presence of neurological diseases in patients.

Aimedika's Drug Acceptance Assistance System forms the list of the most likely diseases, based on more than 22 million scientific articles on medical topics and clinical practice results *(Aimedika. 2009)*. Computer system *(Tonkikh, 2009)* provides solution to the problem of rationalization of the definition of gravity of the course of cerebrovascular diseases with the allocation of clinical groups. However, these systems do not solve the problem of detecting and predicting cognitive and emotional disorders in patients with dyscirculatory encephalopathy.

Hardware-software psychodiagnostic complex "Multispihometer" *(Alexandrovsky, Shchukin, 1991)* is an integrated computerized workplace of a psychiatrist (physician-therapist), which includes hardware, specialized software and methodological support. The purpose of this complex is the assessment of the level of development of the important qualities of the patient, psychological and psychophysiological properties, but the lack of an integral criterion of compliance, which would combine the results of test methods available in the library is a significant disadvantage of the complex *(Alexandrovsky, Shchukin, 1991)*.

In the United States, a number of expert systems have been developed to detect and assess various psychological and psycho-neurological disorders that impede successful education, work and self-fulfillment, for example, the DYSLEXPERT system *(Kan, Kuznetsova, Miraculous, 2010; Blonk, Bercken, De Bruyn, 1996)*. One of the latest developments in this type of system is the FEARDEX (Fear Diagnostic Expert System) system that diagnoses phobia. The system interface is intended for contact with patients, who display drawings and animation materials. According to the authors, when comparing the findings formed by FEARDEX and consisting of psychiatrists, there are differences for unexplained cases; in the case of more pronounced phobias, the differences disappear *(Kan, Kuznetsova, Miraculous, 2010; Feardex, 2012)*. However, the characteristic feature of these systems is a narrow specialization in a certain area of psychodiagnostics. It does not allow for a general diagnosis of emotional disorders, and in complex cases, additional examination or interaction with a specialist may be proposed, which increases the time for the diagnosis.

As the analysis of literature shows, some of the world's expert systems in the field of psychodiagnosis are designed to make a diagnosis by a specialist, but the very principle of working with the system - questioning the doctor and passing the system judgments on the case of fixed indicators - remains unchanged. An example of this is the interface of the professional expert system "Psychodiagnostics" posted on the site of the Australian recruiting company Psych Press. Designed for certified professionals, the system allows you to determine the degree of severity or the absence of signs of mental disorders and personal violations of the American classification of mental disorders DSM-IV. Descriptions of the techniques of psychodiagnosis are presented in the comments, which makes it possible to use the system as a reference and library *(Kan, Kuznetsova, Miraculous, 2010)*. However, this system is quite complicated and requires additional training and certain skills in working with information systems in the field of psychodiagnosis.

The program complex "NeuroPro 0.25" *(Tsaregorodtsev, 1999)* discovers a different level of study of circulatory encephalopathy. The artificial neural network, on the basis of which the presented complex operates, is a computer model of multivariate analysis composed of neurons that function as nonlinear summators and organized in a layered manner using weight connecting synapses, which to some extent imitates biological neural networks. Given the important role in predicting the efficacy of pharmacotherapy for patients with dyscirculatory encephalopathy, against the backdrop of a large number of clinical parameters that are in a nonlinear relationship, the use of neural network systems is justified and promising, however, the diagnosis of this disease with this complex is complicated.

The analysis of references has shown that to date, known medical and psychological information systems and technologies that use a different mathematical device, allow to automate the process of detecting DE or cognitive and emotional disorders in various other diseases. However, there is no specialized information system based on information technology to determine the risk of development of cognitive and emotional disorders in patients with DE.

The aim and tasks of the study.

Therefore, the purpose of the work is to develop a functional model for the information system for identifying emotional and cognitive disoders in patients with DE in order to improve the quality of diagnosis and reduce the time spent for this.

To develop a functional model, IDEF0 charts were constructed that contribute to structured description of automated processes. Execution of IDEF0 rules requires sufficient rigor and accuracy, without at the same time imposing excessive restrictions on the actions of a physician or psychologist.

Results of studies.

At the initial stage of creating the IDEF0 diagram, we describe all its elements: input, output, control, and mechanisms of influence. Figure 1 shows the structure of the information process for identifying emotional and cognitive disorders in patients with DE.

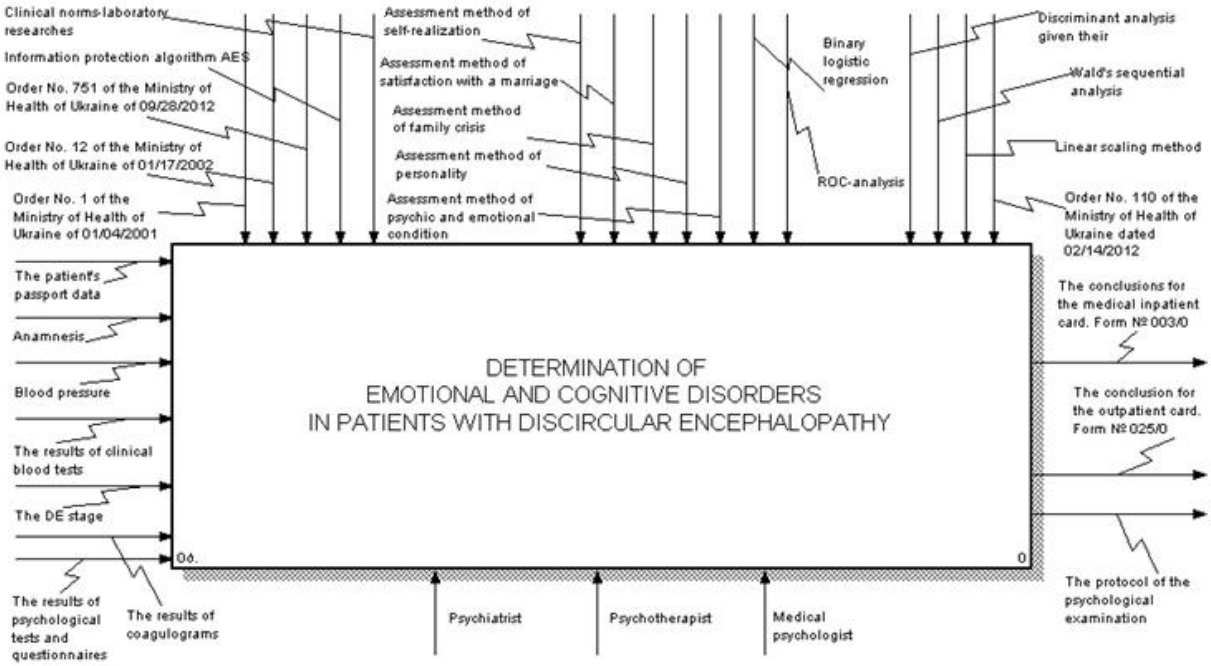

FIGURE 1. CONTEXT DIAGRAM OF THE INFORMATION PROCESS FOR IDENTIFYING EMOTIONAL AND COGNITIVE DISORDERS IN PATIENTS WITH DE

To manage this business process, you need: the laws of Ukraine (Order No. 110 of the Ministry of Health of Ukraine dated 02/14/2012 "On Approval of Forms of Primary Accounting Documents and Instructions for their Filing Used in Health Care Facilities, Regardless of Form of Ownership and Subordination", Order No. 12 of the Ministry of Health of Ukraine of 01/17/2002 "On Approval of the Instruction on the Obligatory Preliminary and Periodic Psychiatric Inspections", Order No. 1 of the Ministry of Health of Ukraine of 01/04/2001 "On Approval of Forms of Medical Registration Documents Used in the Laboratory Ores of medical and prophylactic institutions", Order No. 751 of the Ministry of Health of Ukraine of 09/28/2012" On the Establishment and Implementation of Medical and Technological Documents for the Standardization of Medical Aid in the System of the Ministry of Health of Ukraine"), information protection algorithm AES, clinical norms-laboratory researches, methods of psychological research (assessment of personality, self-realization, satisfaction with a marriage, family crisis, psychic and emotional condition), methods of mathematical statistics (binary logistic regression, linear scaling method, discriminant analysis given their, Wald's sequential analysis, ROC-analysis).

The patient's passport data, anamnesis, blood pressure, the results of clinical blood tests and coagulograms, the DE stage, the results of psychological tests and questionnaires (indicators of depression and anxiety, physical functioning, emotional functioning, psychological health, trust, diplomacy , adaptability, psychosocial stress indicator, intro-extroversion, internality, clearness, authority, satisfaction with lack of self-esteem, etc.).

The mechanism of influence for this information technology was a psychiatrist, a psychotherapist, a medical psychologist.

At the output of the presented process, we obtain the conclusions for the medical inpatient card of the patient, the conclusion for the outpatient card and the protocol of the psychological examination.

For a more detailed description of the process of identifying emotional and cognitive disorders in patients with DE, a first-level decomposition diagram was presented, which is presented in Figure 2.

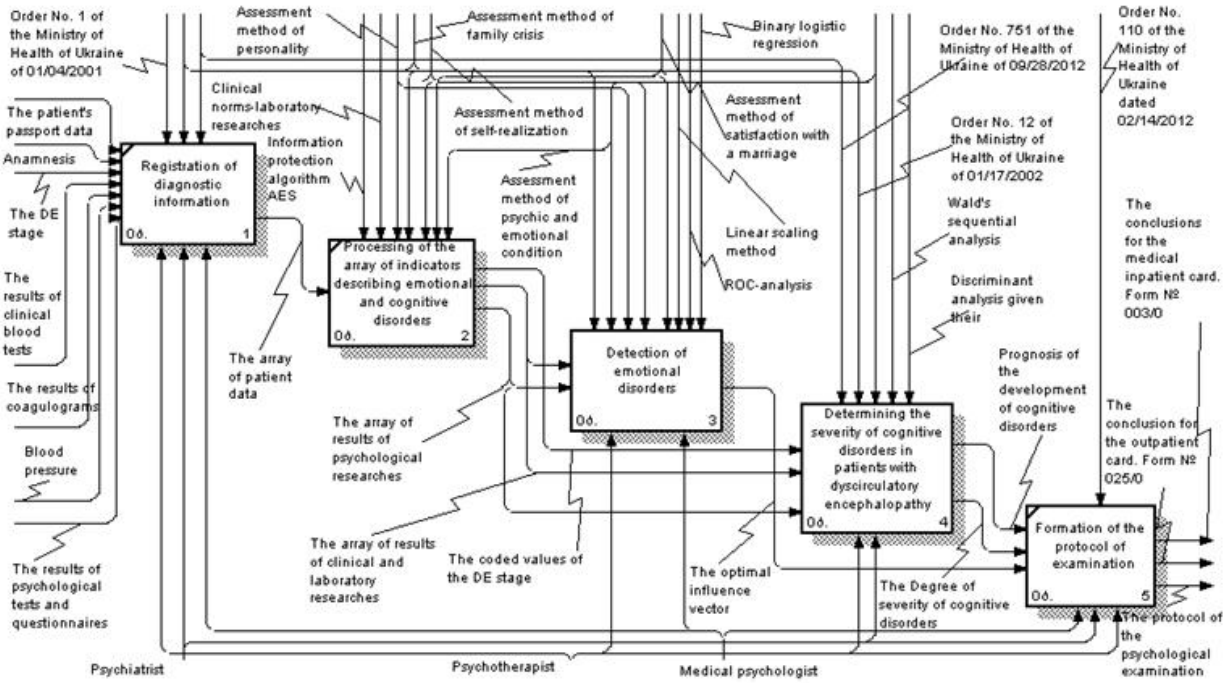

FIGURE 2. DECOMPOSITION OF THE 1ST LEVEL INFORMATION PROCESS FOR THE DETECTION OF EMOTIONAL AND COGNITIVE DISORDERS IN PATIENTS WITH DE

Detection of emotional and cognitive disorders in patients with DE includes five important business-processes: "Registration of diagnostic information", "Processing of the array of indicators describing emotional and cognitive disorders", "Detection of emotional disorders", "Determining the severity of cognitive disorders in patients with dyscirculatory encephalopathy","Formation of the protocol of examination".

At the initial stage of the provision of medical care, the passport data of a person, the history of the disease and hemodynamic parameters, the results of the clinical analysis of the blood and the coagulogram, the data of questionnaires of the psychological tests and questionnaires, the DE stage are submitted.

According to the received information, the conclusion is drawn about the presence and severity of emotional and cognitive disorders in patients with DE.

The result of the work "Registration of diagnostic information" is the information about the state of the patient, which comes to the entrance of the work "Processing of an array of indicators describing emotional and cognitive disorders", which deals with the processing and encoding of psychological data of the patient, as well as encoding the values of the DE stage. Selected data is presented as quantitative, categorical and ordinal indicators. During the determination of the severity of cognitive disorders, coding was used for 4 diagnostic parameters: the DE stage (encoding occurred in relation to the three stages of the disease), the level of development of emotional disorders (these indices, which to varying degrees corresponded to the third, fourth, fifth, and sixth levels of emotional functioning , adjusted to a 3-dimensional vector), systolic and diastolic pressure (coding takes place taking into account the presence and magnitude of the pathological sign). The beginning of the work "Detection

of emotional disorders" is an array of results of psychological research and the results of clinical and laboratory research, obtained from previous work, and the result - is a method of identifying emotional disorders and determining the vector of optimal impact on the state of the patient with DE. At the entrance to the work "Determination of the severity of cognitive disorders in patients with DE" data from the work "Processing the array of indicators describing emotional and cognitive disorders ", is an array of results of psychological and clinical and laboratory studies and coded values of the DE stage, and at the exit we get the degree of severity cognitive disorders and a forecast of its further development. At the last stage of the "Formation of the protocol of examination", in accordance with the standards of medical care, the laws of Ukraine and registration medical forms, conclusions are drawn for the patient's medical card (form number 003/0) or an outpatient card (form number 025/0), as well as extracts from the protocol of psychological examinations.

Thus, the process of "Detection of emotional disoreders", indicated in the first-level diagram, is divided into six functions in the second-level diagram. The second-level decomposition diagram is shown in Figure 3.

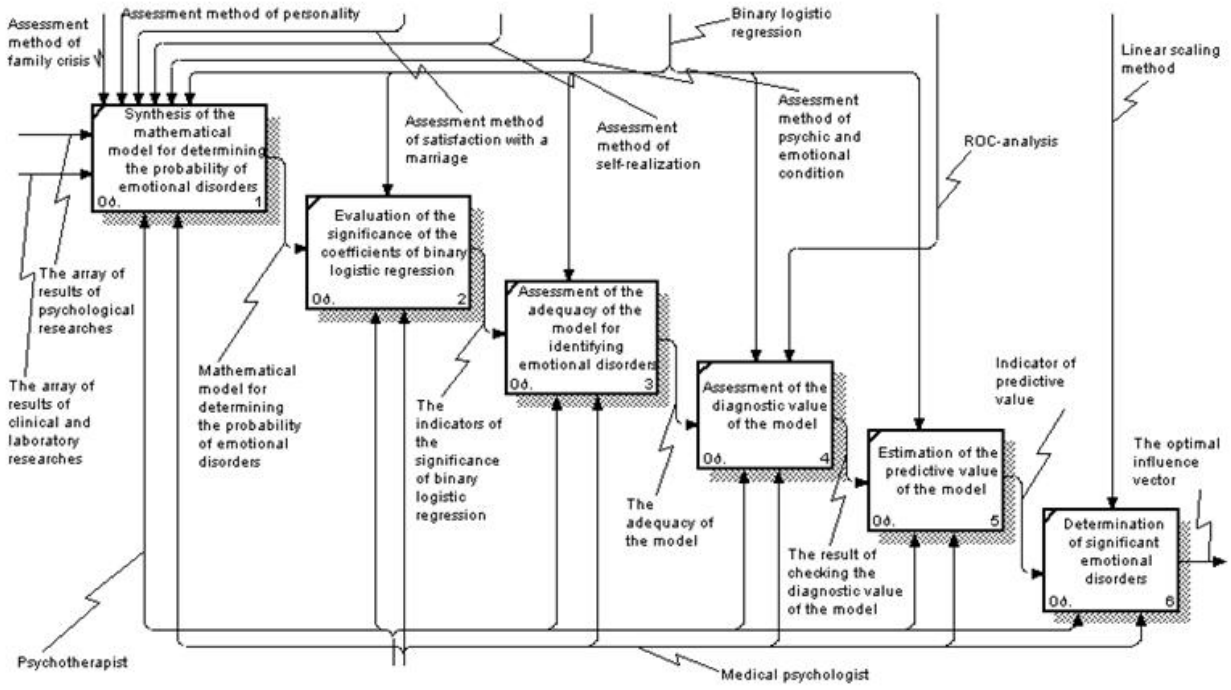

FIGURE 3. DECOMPOSITION OF THE 2ND LEVEL INFORMATION PROCESS FOR THE DETECTION OF EMOTIONAL AND COGNITIVE DISORDERS IN PATIENTS WITH DE (DECOMPOSITION OF THE PROCESS OF "DETECTION OF EMOTIONAL DISORDERS")

This process includes the following six works: "Synthesis of the mathematical model for determining the probability of emotional disorders", "Evaluation of the significance of the coefficients of binary logistic regression", "Assessment of the adequacy of the model for identifying emotional disorders", "Assessment of the diagnostic value of the model", "Estimation of the predictive value of the model", "Determination of significant emotional disorders". The listed works are related to each other.

The result of the first work "Synthesis of the mathematical model for determining the probability of emotional disorders" is the mathematical model for determining the probability of emotional disturbances, which is the input information for the work

"Assessment of the significance of the coefficients of binary logistic regression". At the output of the second work we get indicators of the significance of binary logistic regression. Then the data goes to the entrance "Assessment of the adequacy of the model for determining emotional disorders" and at the exit we get the indicators of adequacy of the model. At the output of the fourth work, the result of checking the diagnostic value of the model, which comes to the fifth paper "Estimation of the predictive value of the model" is formed. The output of the fifth work is to determine the indicator of the predictive value of the constructed model, which is aimed at the input of the latest work, "Definition of important for the development of emotional disorders of characteristics." At the end of the last work, we get the signs that most affect the emotional disorders of each patient with DE.

The second-level decomposition diagram presented in Figure 4 is a decomposition of the process of "Determining the severity of cognitive disorders in patients with dyscirculatory encephalopathy".

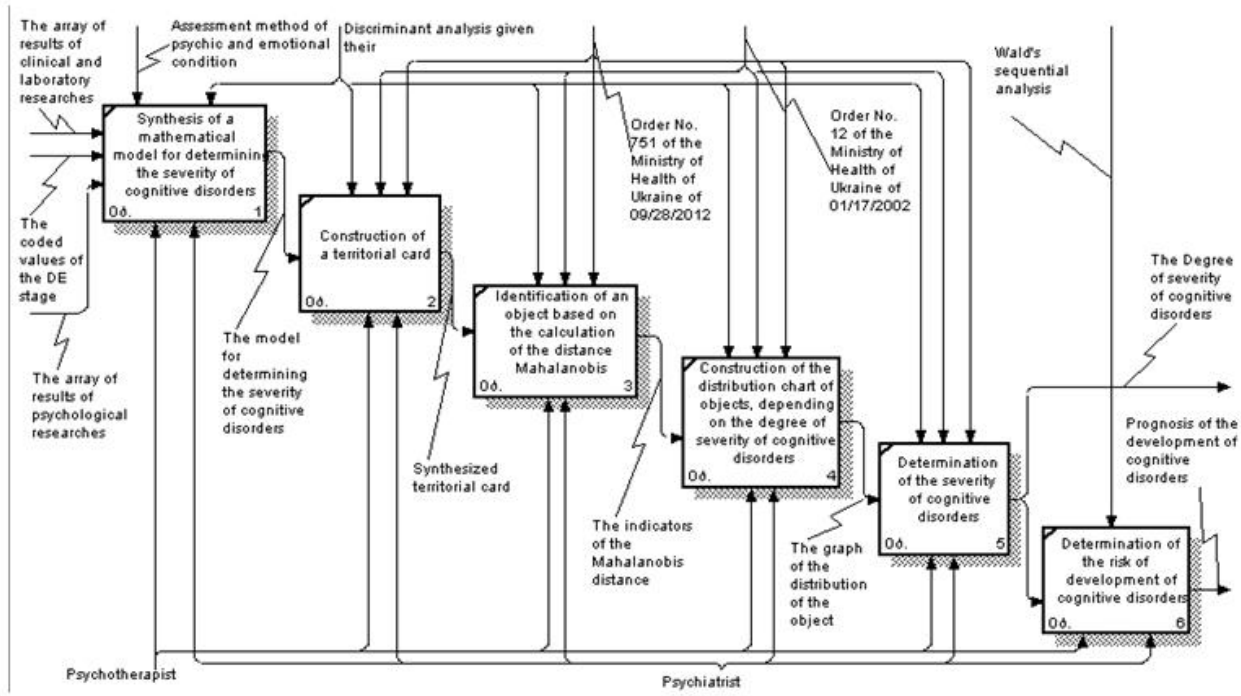

FIGURE 4. DECOMPOSITION OF THE 2ND LEVEL INFORMATION PROCESS FOR THE DETECTION OF EMOTIONAL AND COGNITIVE DISORDERS IN PATIENTS WITH DE (DECOMPOSITION OF THE PROCESS "DETERMINATION OF THE SEVERITY OF COGNITIVE DISORDERS IN PATIENTS WITH DYSCIRCULATORY ENCEPHALOPATHY")

This process includes the following six works: "Synthesis of a mathematical model for determining the severity of cognitive disorders", "Construction of a territorial card", "Identification of an object based on the calculation of the distance Mahalanobis", "Construction of the distribution chart of objects, depending on the degree of severity of cognitive disorders","Determination of the severity of cognitive disorders", "Determination of the risk of development of cognitive disorders". All these stages are interconnected.

The result of the first work "Synthesis of the mathematical model for determining the severity of cognitive disorders" is a synthesized mathematical model for determining the severity of cognitive disorders, which forms the territorial map that arrives at the beginning of the work "Identification of the object on the basis of distance

calculation" in the next paper "Construction of a territorial map" Mahalanobis. " At the output of the third work, we obtain the distance from Mahalanobis. The received data arrives at the beginning of the work "Construction of the schedule of objects distribution, depending on the severity of cognitive disorders", which creates a schedule for the distribution of objects. In the next paper "Determination of the severity of cognitive disorders" we get the degree of severity of cognitive disorders, after which the obtained data are included in the last work "Determine the risk of development of cognitive disorders", which results in a prognosis of the risk of development of cognitive disorders.

Thus, the process "Detection of emotional and cognitive disorders in patients with dyscirculatory encephalopathy", indicated in the first level of the decomposition of the chart, is detailed using twelve works at the second level of the decomposition of the chart.

The information technology presented in the article is the basis for the development of the information system "KognitiveDE", which is implemented using the object-oriented Java programming language using the MySQL database management system.

With the help of the developed technology, people were investigated with a probability of emotional and cognitive disorders, experiencing a crisis in family relationships and having a diagnosis of DE.

Here is an example. Patient M., 54 years old, appealed with complaints of medical genesis, namely, complaints of general weakness, headache, dizziness, memory loss, periodic sleep disturbance, choking on walking, fluctuations in blood pressure. This patient was previously diagnosed with DE stage II.

The patient was interviewed by a psychotherapist and passed several tests. The psychological study revealed the following values of indicators: trust-suspiciousness (A_1 = 8), straightforwardness-diplomacy (A_2 = 9), fibrinogen level (A_3 = 7.7), anxiety (A_4 = 9), depression (A_5 = 8), psychosocial stress index (A_6 = 2.3), blood glucose (A_7 = 8,2). The probability of having an emotional disorder was P = 0.97. Subsequently, using the method of identifying emotional disorders, it was discovered that most of the patient's unstable psycho-emotional state is influenced by indicators of trust-suspiciousness and psychosocial stress indicators.

To confirm the psycho-emotional disorder, the patient was subjected to an additional examination using methods and techniques: M. Luscher (choice of color); T. A. Nemchyna (diagnosis of nervous-psychic stress) - 67 points; V.N. Rusalov (definition of temperament) [19]. Also, to assess the severity of depression, Beck questionnaire was used for 18 points, and for Spielberg-Khanin's anxiety rating of 45 points *(Moskovko, Tsybulskaya, Kostyuchenko, 2014)*. The severity of asthenic disorders was evaluated on the basis of the questionnaire MFI-20 - the sum of points on five subscales is equal to 63 *(Tishchinskaya, 2014)*. In the study of emotions, vegetative reactions are of great significance, which is why the skin-galvanic reaction (SHGR) was investigated.

An additional psychodiagnostic survey confirmed the presence of the patient's exact psycho-emotional disorders that were detected using the technology presented.

Further, taking into account: the stage DE (X_1 = 2); the results of psychological studies of depression (X_2 = 4), anxiety (X_3 = 4), physical functioning (X_4 = 26), mental health (X_6 = 19); risk of emotional disorders (X_5 = 1.84); indicators of systolic and diastolic pressure (X_7 = 1 and X_8 = 1, respectively); The results of clinical and laboratory studies of erythrocyte sedimentation rate (X_9 = 1), erythrocyte count (X_{10} = 1), prothrombin index (X_{11} = 2), discriminant functions were calculated: DF_1 (X) = 4,243, DF_2 (X) = -1,266 . The patient on the territorial map takes place in a group with a moderate degree of cognitive disorders among patients with DE,

which additionally was confirmed by the MMSE scale. To predict the development of cognitive disorders, the diagnostic factor of the successive Wald analysis has established DK = 13.06, which suggests an unfavorable outlook for the disease.

In order to confirm the presence of cognitive disorders in this patient, neuropsychological methods, representing special tests and tasks for the purpose of identifying memory disorders, attention, intelligence, etc. were additionally applied. The Montreal Cognitive Test (MCA) - 24 points was used, the drawing of the clock - 6 points, the technique of "Minikog" - the difficulties were encountered in drawing the clock and repeating the words *(Golovacheva, Zakharov, 2015; Lobzin, Emelin, Vorobev, Lupanov, 2014)*. Also, an instrumental examination was performed using a computer tomograph - subcortical leukoarrhea. An additional survey confirmed the presence of moderate cognitive disorders.

Conclusions

Thus, the IDEF0 designed diagrams are one of the initial stages of the process of developing an information system for detecting emotional and cognitive disorders. The functional model "Detection of Emotional and Cognitive Disorders in Patients with Dyscirculatory Encephalopathy" presented in the article describes the work of the information system "KognitivDE", which promotes the improvement of the accuracy of emotional and cognitive disorders in patients with DE, reducing the time spent and reducing the cost of the survey.

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