Research Article

Optimization approaches to dispensary observation of patients with polymorbid pathology on the metabolic syndrome background

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ABSTRACT

Objective: Development of new approaches to the implementation of dispensary observation (DO) of patients with polymorbid pathology against the background of the metabolic syndrome (MS) and the evaluation of their efficiency were considered. **Method:** The method of complex evaluation of polymorbidity, developed as an instrument of DO, evaluates polymorbidity qualitatively and quantitatively, taking into account its structure, the presence of risk factors, target organ damage, functional disorders, and provides information to the physician about the patient's signs of persistent disability, the possibility of sanatorium treatment, cardiovascular risk in the conduct of planned surgical interventions. **Results:** The innovative program of DO focuses on the modification of the lifestyle, the personified approach, and the use of the therapeutic and prophylactic potential of the patient's microsocial environment. For 6 months, 110 patients with chronic non-infectious diseases, polymorbid pathology, and MS were observed. They were divided into two groups: 1st group (n = 61) traditional (normatively approved) DO program and 2nd group (n = 49) - innovative DO program. Reliability, sensibility, and validity of the complex evaluation method of polymorbidity were reliably established. With the use of this method, the median time of patient dispensary appointment is significantly less than without its application. In the second group of the innovation DO program, statistically significant fewer cases of exacerbations of chronic diseases, the number of calls for emergency medical services and hospitalizations, and the number of days of the incapacity for work in comparison with the 1st group were registered in the six. **Conclusion:** The use of new approaches in the course of DO of the patients with polymorbid pathology on the background of MS allows to optimize and improve its implementation in medical organizations that provide assistance in outpatient and polyclinic conditions.

KEY WORDS: Comorbidity, Metabolic syndrome, Observation

INTRODUCTION

Non-communicable diseases pose a serious social and economic problem threat of a global scale, in their structure, the leading positions for causes of death are cardiovascular diseases and diabetes mellitus.[1] Metabolic syndrome, being widespread in the world and, particularly, in the Russian Federation increases the risk of their development[2] and is also a background condition for the development of polymorbid pathology.[3,4] Patients with non-infectious diseases often have polymorbid pathology and are subject to a regular medical checkup in outpatient medical organizations, where an overwhelming part of the doctor's time is spent on work with them.[5] For implementing dispensary observation (DO) of high quality, the structure and the assessment of existing concomitant diseases (polymorbid pathology) should be taken into account. At present, the generally accepted terminology of concepts and structures as well as a single method for the quantitative evaluation of polymorbidity is absent.[6] Among the existing methods for quantifying polymorbidity, the most common are systems CIRS and adjusted clinical groups, indices Kaplan-Feinstein, Charlson, index of coexistent disease, geriatric index of comorbidity, functional comorbidity index, total illness burden index, duke severity of illness scale, and scale care dependency scale. Their comparative reviews presented in papers of de Groot *et al*.,[7] Fortin *et al*.,[8] Zekry *et al*.,[9] and Huntley *et al*.[10] unite the conclusion about their narrow specialization and the need to develop a universal tool for assessing polymorbidity. Another promising direction for researchers is seen

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in the personification and activation of medical checkup, which can be achieved by upgrading the medical checkup program.[11] Being developed by P.A. Sheptun together with coauthors,[12] the innovative program of DO (IPDO), which focuses on lifestyle modification and a personified approach, using the therapeutic and prophylactic potential of the patient's microsocial environment, has shown effectiveness in the implementation of patients medical checkup with MS.

Objective

The purpose of the paper is to develop new approaches to the implementation of dispensary observation (DO) of patients with polymorbid pathology against the background of the metabolic syndrome (MS) and evaluate their efficiency.

MATERIALS AND TECHNIQUES

The method of polymorbidity complex evaluation (MPCE) was used. The main direction of the research was related to the development and validation of the automated MPCE. Its essence consisted of the simultaneous registration of anamnestic, clinical, laboratory, instrumental, functional, and psychological parameters of the patient's health (indicators), for convenience they were clustered [Table 1].

Clinical information about the patient's health by means of a scaling procedure was transformed according to the quantitative or qualitative values of the indicators into points in the range from 0 to 10. Separate formulas for each cluster were developed, with the help of which intermediate health indices were counted, expressed in c.u.: The index of unmodified health meter (I1) (Formule 1), modifiable health meter (I2) (Formule 2), comorbidity pathology (I3) (Formule 3), multimorbidity pathology (I4) (Formule 4), and functional index (I5) (Formule 5).

$$I_1 = \frac{100}{} \quad (1)$$

$$I_2 = \frac{20.3}{} \quad (2)$$

$$I_3 = \frac{31}{} \quad (3)$$

$$I_4 = \frac{62}{} \quad (4)$$

$$I_5 = \frac{20.5}{} \quad (5)$$

Table 1: The name of indicators and clusters of the MPCE

Name of indicators and clusters	Indicator code
1	2
Cluster 1: Unmodified risk factors for non-communicable diseases	
Age	1.1
Gender	1.2
The age of menopause (for women)	1.3
Family history of early CVD and oncological diseases	1.4
Cluster 2: Modifiable risk factors for non-communicable diseases	
Nicotine addiction	2.5
Eating patterns	2.6
Body weight index	2.7
Waist measurement	2.8
Level of systolic blood pressure	2.9
Level of pulse blood pressure	2.10
Ankle–brachial index	2.11
Frequency of respiratory movements	2.12
Heart rate	2.13
Total cholesterol	2.14
Low-density lipoprotein cholesterol	2.15
High-density lipoprotein cholesterol	2.16
Triglycerides	2.17
Fasting glycemia	2.18
PPG	2.19
Glycosylated hemoglobin	2.20
Urinary excretion of albumin	2.21
Proteinuria	2.22
Hypertrophy of myocardium of the left ventricle	2.23
Ultrasonic signs of thickening of the artery wall or atherosclerotic plaques of the main vessels	2.24
Cluster 3: Comorbid metabolic syndrome pathology (cardiovascular syndromes and nosology)	
Hypertensive disease stage	3.25
Cardiac infarction	3.26
Exertional angina	3.27
Heart rhythm disorder	3.28
Artificial pacemaker, coronary revascularization	3.29
Stage of chronic heart failure	3.30
Diabetes mellitus	3.31
Clinically significant lesion of peripheral arteries	3.32
Acute cerebrovascular accident or transient ischemic attack	3.33
Chronic kidney disease	3.34
Cluster 4: Multimorbid metabolic syndrome pathology (other nosologies)	
Malignant neoplasms	4.35
Non-coronary diseases of the circulatory system	4.36
Diseases of peripheral vessels	4.37
Mental and behavioral disorders	4.38
Diseases of the nervous system	4.39
Diseases of the eye and its adnexa	4.40
Diseases of the ear and mastoid process	4.41
Diseases of the respiratory system	4.42
Diseases of the digestive system	4.43
Diseases of the skin and subcutaneous tissue	4.44
Diseases of the musculoskeletal and connective tissue	4.45

(Contd...)

Table 1: (*Continued*)

Name of indicators and clusters	Indicator code
Diseases of the blood	4.46
Other diseases of the endocrine system	4.47
Diseases of the genitourinary system	4.48
Cluster 5: Functional status	
Functional class of chronic heart failure	5.49
Respiratory failure	5.50
Dysfunction of the joints	5.51
The degree of violation of the statodynamic function	5.52
Hepatic encephalopathy	5.53
Tolerance to physical activity	5.54
Degree of anxiety and depression	5.55

MPCE: Method of polymorbidity complex evaluation, DO: Dispensary observation CVD: Cardiovascular disease

Where, i - summation index and x - indicator value, point.

Intermediate indices for each cluster took values in the range of 0–1.0 c.u. The value 1.0 c.u. corresponded to the absence of a pathological effect on the patient's health indicators of this cluster, and c.u - the greatest possible pathological effect. Integrative result MPCE is calculated by the formula (formula 6) and was called the index of polymorbidity (IP), being expressed in c.u.

$$IP=\frac{100}{} \quad (6)$$

Where, i - summation index and x - indicator value, point.

IP took values in the range from 0 to 1.0 c.u. The value 0 c.u corresponded to polymorbidity, incompatible with life and 1.0 c.u - its absence. The level stratification of polymorbidity was developed with the purpose of its qualitative assessment, as well as for the formation of prognostic recommendations in the provision of outpatient medical care [Table 2].

For automation of MPCE, the program "Evaluation of patient's polymorbidity" was developed with the usage software language C++. After entering information about the patient's health in its fields, the user is provided with both qualitative and structural evaluation of the patient's polymorbidity, specific prognostic recommendations routinely performed in outpatient work in the medical checkup process.

Sensitivity, reliability, and validity of MPCE were reliably established.

MPCE was introduced in medical outpatient clinics in the Belgorod region. In the process of business processes mapping, a comparative motion-time measurement was used that was spent by the district doctor on the dispensary reception of the patient using the MPCE and without its application. Measurements of the time spent by 10 doctors of the polyclinic No. 7 "City Hospital No. 2 in Belgorod" (CH2) were carried out.

Table 2: Value stratification of the polymorbidity index

Stratification purpose	Stratification
Quantification polymorbidity	1.0–0.80 c.u. low level 0.79–0.50 c.u - middle level 0.49–0 c.u high level
Determination of the cardiovascular risk degree in planned surgical interventions	1.0-0.80 c.u. - risk of low degree, 0.79–0.50 c.u. - middle, 0.49–0.30 c.u. - high ≤0.29 c.u - extremely high degree
Spa treatment	1.0–0.70 c.u in any types of sanatorium-and-spa organizations; 0.69–0.40 c.u - only in local cardiological sanatoria 0.40–0 c.u. - contraindicated.
Express analysis of permanent incapacity for work	≤0.60 c.u presence of incapacity for work.
Prediction of the course and outcome of the disease	1.0–0.60 c.u. - favorable prognosis 0.59–0.30 c.u - suspicious 0.29–0.20 c.u. - unfavorable 0.19–0.10 c.u - very bad 0.10–0.0 c.u. - a direct indication of the lethal outcome inevitability

The second direction of the study was related to the evaluation of the effectiveness of IPDO in patients with polymorbid pathology on the background of MS. 110 patients of polyclinic No. 7 CH2 - 47 men (42.7%) and 63 women (57.3%) with polymorbid pathology, IIIa group of health status according to the results of clinical examination and MS.

All patients that were included into the examining were treated by DO for 6 months. The choice of the DO program was carried out randomly by dividing the patients into two groups, for this purpose, simple randomization was done by the random number method. Patients of the 1st group (n = 61) underwent DO according to the traditional DO program (TPDO). Patients from the 2nd group (n = 49) were treated according to the author's program - IPDO.

Patients were examined according to the classical conventional method. Laboratory (blood and clinical, biochemical, clinical urine, daily urinary albumin excretion, glomerular filtration rate according to the formula CKD-EPI, and modification of 2011) and instrumental methods (ECG, echocardiography, ultrasound of brachiocephalic arteries, oxygen

Table 3: Changes in the health status of patients after 6 months of DO occurred only in the group of IPDO

Information on the patient's health condition	Group of DO traditional program			Group of innovative DO program		
	The first stage (*n*=61)	The second stage (*n*=56)	Significance point *P*	The first stage (*n*=49)	The second stage (*n*=49)	Significance point *P*
Waist measurement, sm	99 (92–108)	98 (91–106)	0.7680/0.6117*	96 (89–105)	93 (86–98)	0.0373/0.0267*
Body weight index, kg/м^2	32.3 (29.3–35.8)	29,4 (25.9–31.7)	0.0780/0.0660*	31.9 (30.0–34.9)	27.2 (25.4–29.7)	0.0041/0.0021*
Systolic blood pressure level, millimeter of mercury	150 (140–160)	140 (130–152.5)	0.0317/0.0595*	145 (130–170)	130 (130–140)	0.0015/0.0015*
Nicotine addiction, n (%):	22 (36.1)	18 (32.1)	0.1258**	21 (42.9)	14 (31.1)	0.0158**
Albumen urinary excretion, mg/day	20 (10–20)	20 (10–20)	0.5757/0.6374*	20 (10–20)	10 (0–20)	0.0008/0.0008*
Fasting glycemia, mmol/L	6.3 (5.8–6.9)	6.1 (5.8–6.8)	0.1460/0.1336*	6.1 (5.6–6.9)	5.7 (5.5–6.0)	0.0229/0.0116*
PPG, mmol/L	7.5 (7.2–7.9)	7.5 (7.2–7.8)	0.6517/0.7648*	7.5 (6.9–7.9)	6.8 (6.7–7.3)	0.0193/0.0415*
Glycosylated hemoglobin, %	6.3 (6.2–7.1)	6.1 (6.0–7.1)	0.1985/0.1383*	6.4 (6.1–7.0)	6.0 (5.8–6.6)	0.0473/0.0386*
Diseases of the ear and mastoid process, n (%):	9 (14.8)	8 (14.3)	0.5100**	9 (18.4)	5 (10.2)	0.0087**
Slight deviations from the norm that does not require the appointment of drug therapy	9 (14.8)	8 (14.3)		6 (12.2)	5 (10.2)	
Diseases that require the prescription of drug therapy	0	0		3 (4.1)	0	
Diseases of the respiratory system, n (%)	41 (67.2)	39 (69.6)	0.9448**	35 (71.4)	30 (61.2)	0.0421**
Slight deviations from the norm that does not require the appointment of drug therapy	36 (59.0)	35 (62.5)		29 (59.2)	27 (55.1)	
Diseases that require the prescription of drug therapy	2 (3.3)	1 (1.8)		3 (6.1)	0	
Diseases that caused permanent disability	3 (4.9)	3 (5.4)		3 (6.1)	3 (6.1)	
The degree of the statodynamic function violation, n (%)	6 (9.8)	5 (8.9)	0.7458**	4 (8.2)	2 (4.1)	0.0387**
Nonthreatening	5 (8.2)	4 (7.1)		3 (6.1)	2 (4.1)	
Middle	1 (1.6)	1 (1.8)		1 (2,0)	0	
Degree of anxiety, point	9 (8–12)	9 (8–10)	0.5814/0.6117*	9 (8–11)	7 (6–9)	0.0228/0.3177*
Degree of depression, балл	8 (5–9)	8 (5–9)		8 (5–9)	6 (4–8)	

*Criteria of Kruskal–Wallis/Van der Waerden, **Chi-square method of McNemar. IPDO: Innovative program dispensary observation

saturation, daily monitoring of ECG and blood pressure, and a test with dosed physical activity) were used. Additional methods of investigation were Fagherstrom test, hospital scale of anxiety and depression, and assessment of nutritional rationality.

RESULTS

Clinical characteristics of patients

There were 47 men (42.7%) and 63 women (57.3%) of the 110 patients. The average number of nosological forms was 4.5 (3.2–5.1). The comorbid MS pathology prevailed: Hypertension (98.2%, 108/110), in more than half of cases (60%, 66/110) complicated by the presence associated clinical conditions, and in a third of cases - diabetes mellitus (27.3% 30/110). The most common are respiratory diseases (69.1%, 76/110), digestion (63.6%, 70/110), and musculoskeletal and connective tissue (69.1%, 76/110) prevailing among the multimorbid MS nosological forms.

IPDO for 6 months additionally allowed reducing the number of patients with nicotine dependence, violation of the statodynamic function, anxiety and depression, reducing median waist volume, body mass index, systolic blood pressure, carbohydrate metabolism, reducing the number and severity of ear and mastoid diseases, and organs respiration [Table 3].

Index medians Kaplan-Feinstein, Charlson, and the number of points in the system CIRS, I1 and I3 MKOP statistically did not change their values significantly [Table 4].

Statistically significant increase in medians I4 и I5 MPCE was registered regardless of the DO program, IP and I2 in the group IPDO. In the group IPDO the number of patients with "high" (from 10.2%, 5/49 to 4.1%, 2/49) and "average" (from 75.5%, 37/49 to 57.1%, 28/49) and level of polymorbidity has decreased but "low" (from 14.3%, 7/49 to 38.8%, 19/49) level has increased.

In the IPDO group, statistically significant fewer cases of exacerbations of chronic diseases, the number of calls for emergency medical services and hospitalizations, and the number of days of disability in comparison with the TPDN group were recorded for the 6 months of the observation [Table 5].

Comparative timing of the doctor's time spent on dispensary: With the use of MPCE, the median time of dispensary admission of a patient with polymorbid pathology against the background of MS was 12.5 (10.4–14.8) min and without the use of MPCE by the same doctors - 17.6 (13.9–20.8) min (P = 0.0432/0.0587).

Table 4: Indicators of the polymorbidity evaluation depending on the DO program of in dynamics (after 6 months)

Polymorbidity performance evaluations	Group of DO traditional program			Group of innovative DO program		
	The first stage (n=61)	The second stage (n=56)	Significance point P	The first stage (n=49)	The second stage (n=49)	Significance point P
Polymorbidity index, c.u.	0.69 (0.59–0.76)	0.74 (0.71–0.79)	0.0432/0.0587*	0.69 (0.60–0.76)	0.78 (0.74–0.83)	0.0158/0.0237*
Index of an unmodified indicators cluster, c.u.	0.70 (0.62–0.74)	0.71 (0.62–0.76)	0.7587/0.9127*	0.71 (0.61–0.75)	0.72 (0.63–0.76)	0.8765/0.9427*
Polymorbidity level, n (%)	-	-	0.0759**	-	-	0.0271**
Low	6 (9.8)	8 (14.3)		7 (14.3)	19 (38.8)	
Middle	52 (85.3)	46 (82.1)		37 (75.5)	28 (57.1)	
High	3 (4.9)	2 (3.6)		5 (10.2)	2 (4.1)	
Index of a modified indicators cluster (И2), c.u.	0.69 (0.61–0.74)	0.75 (0.68–0.79)	0.0287/0.0547*	0.70 (0.62–0.75)	0.81 (0.78–0.85)	0.0017/0.0104*
The cluster index of comorbid pathology (И3), c.u.	0.58 (0.56–0.67)	0.59 (0.56–0.66)	0.6687/0.4358*	0.57 (0.55–0.66)	0.58 (0.56–0.66)	0.7581/0.6758*
The cluster index of multimorbid pathology (И4), c.u.	0.63 (0.59–0.73)	0.70 (0.67–0.75)	0.0121/0.0107*	0.64 (0.60–0.75)	0.75 (0.67–0.79)	0.0025/0.0087*
Index of a functional cluster (И5), c.u.	0.65 (0.55–0.73)	0.75 (0.63–0.79)	0.0087/0.0101*	0.66 (0.56–0.74)	0.79 (0.67–0.81)	0.0058/0.0098*
Index Kaplan-Feinstein, c.u.	9 (7–11)	9 (7–12)	0.6587/0.7585*	9 (6–11)	9 (6–10)	0.8545/0.8297*
System CIRS, point	10 (8–14)	10 (7–13,5)	0.9125/0.8756*	9 (8–13)	8 (7–12)	0.7584/0.6698*
Index Charlson, point	4 (2–5)	4.5 (3–5)	0.6257/0.6178*	4 (3–5)	4 (3–5)	0.4785/0.6875*

*Criteria of Kruskal–Wallis/Van der Waerden. **Chi-square method of McNemar

Table 5: Indicators of the effectiveness of 6 months DO in accordance with the chosen program.

Indicators of the DO effectiveness	Group of traditional DO program *n*=56 (%)	Group of innovative DO program *n*=49 (%)	Significance point *P* Chi-square method of McNemar
Number of cases of temporary incapacity for work	5 (8.9)	3 (6.1)	0.0875
Number of days of temporary incapacity for work	39	18	0.0146
Number of hospitalizations, including emergency medical indications, for exacerbations and complications of diseases	8 (14.3)	4 (8.2)	0.0118
Number of cases of exacerbations of chronic diseases that did not require hospitalization	12 (21.4)	7 (14.3)	0.0204
Number of emergency calls	10 (17.9)	5 (10.2)	0.0143
Number of deceased	0	0	-

DISCUSSION

MS is a widespread background condition for the polymorbid pathology development and non-infectious diseases requiring DO. A contingent of an outpatient clinic with a polymorbid pathology against the background of MS was studied and is subject to DO: These are patients who, on average, have more than four concurrent nosological forms including hypertensive disease, in more than half of cases, it is complicated by the presence of associated clinical conditions.

The study proved the effectiveness of new approaches to the implementation of DO of these patients consisting in the expansion of the DO program and the use of the method of the comprehensive evaluation of polymorbidity (MPCE) as its tool. DO of patients with PPMS requires control over the course of several concurrent nosological forms and related functional disorders, taking into account existing and preventing the development of new target organ lesions and working with risk factors that affect the prognosis, as well as early recognition of persistent disability, evaluation of the sanatorium-spa treatment possibility, cardiovascular risk under the condition of planned surgical interventions. Using the MPCE as a DO tool effectively solves these problems by providing the clinician with structured information about the patient's health status. The computer program "Evaluation of the patient's polymorbidity" accelerates and simplifies this process by automating the actions and the possibility of creating and storing a database of patients in DO. The expansion of the DO program, which focuses on lifestyle modification, the personified approach, and the use of the therapeutic and prophylactic potential of the patient's microsocial environment, has shown efficacy in the implementation of DO patients with polymorbid pathology in the background of MS and an advantage over TDOP.

The use of new approaches in the implementation of DO patients with polymorbid pathology on the background of MS allows optimizing and improving its implementation in medical organizations that provide assistance in outpatient settings.

CONCLUSION

1. It is necessary to implement the MPCE, automated by the computer program "Evaluation of the patient's polymorbidity," as a tool for evaluating polymorbidity. In ambulatory polyclinic medical organizations for DO of patients with polymorbid pathology on the background of MS.
2. It is necessary to organize innovative schools on the basis of outpatient and polyclinic medical organizations with a group of teachers who underwent preliminary training in the "Andragogic principles of patient education" program to implement an innovative outpatient program focusing on lifestyle modification and a personified approach using the therapeutic and prophylactic potential microsocial environment of the patient.

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