Improving the Quality of Medical Care and Prevention in Patients with Type 2 Diabetes on the Basis of Remote Medical Service

Poprawa jakości opieki medycznej i prewencji u pacjentów z cukrzycą typu 2 w sytuacji porad medycznych świadczonych na odległość

Vladyslav A. Smiianov¹, Nataliia O. Dryha¹, Lesia A. Rudenko²

¹Sumy State University, Sumy, Ukraine
²Aluna Publishing House, Konstancin-Jeziorna, Warsaw, Poland

SUMMARY

Aim: To analyze the effectiveness of implementation of remote medical service, involving patients with type 2 diabetes mellitus in dynamic monitoring of their health and treatment, designed to optimize the quality of medical care and prevention at the primary health care level.

Materials and Methods: The study included adults aged 18 to 70 years, residents of Sumy who suffer from diabetes. They took part in a medical and sociological survey before introduction of the ICS and gave consent for processing and using of their personal data. A total of 96 patients were involved. We conducted a survey form of the study, using a closed questionnaire for medical and sociological research, conducted during December 2019. The study included such methods as systematic approach, bibliosemantic, comparative and statistical analyses, logical generalization.

Results: During the following medical and sociological survey, 96 questionnaires from Sumy residents aged 18 to 69 years, 58 women (60,42±3,53%) and 38 men (39,58±3,53%)) were studied. Analysis of re-monitoring results showed that during the period of implementation of the ICS at the level of primary health care, the indicators of MCQ and health status of respondents have improved. The proportion of patients, who regularly control the level of blood pressure, increased by 32.29%, and those, who control the level of blood glucose – by 31.24%. The incidence of hypoglycemia and/or ketoacidosis states has decreased by 4.17%. During the survey, the part of respondents with targeted blood pressure level increased by 25.00% and the number of respondents with satisfactory level of diabetes compensation increased by 29.18%. The survey showed that more respondents (12.5%) began to regularly take prescribed medications; the number of those, who began to follow diet and dietary regimen has increased by 28.12%; 5.19% of respondents abandoned bad habits (smoking). The number of respondents who have a body mass index ≥ 30.0 has decreased by 4.69%.

Conclusions: The introduction of information and communication system (ICS) with feedback between patient and provider of medical services at the primary health care institution level has shown a positive impact on involvement of patients in dynamic monitoring of their health, responsible attitude to prevention of chronic non-communicable diseases` development and their complications, awareness of the impact of modified risk factors on their health.

Key words: prophylaxis, healthcare quality, diabetes mellitus, information-communicative systems, behavioral economics

Słowa kluczowe: profilaktyka, jakość opieki zdrowotnej, cukrzyca, systemy informacyjno-komunikacyjne, ekonomia behawioralna

INTRODUCTION

Type 2 diabetes mellitus (DM) and its prevention is a global health system problem, which annually keeps being increasingly relevant. According to the World Health Organization (WHO), there are about 425 million patients with DM in the world. Over the past 50 years, the prevalence of DM has increased 10 times and continues to grow at an alarming rate. Despite the presence of effective drugs, modern technologies, new educational and preventive methods, the level of disability and disability loss increse due to complications; at the same time the duration and quality of life of patients decrease. Every year 3 million deaths, caused by DM, are registered in the world, that is, every 10 seconds 1 diabetic patient dies [1, 2].

Unlike DM 1, type 2 diabetes is mainly a consequence of the modern lifestyle and nutrition in population. Sedentary lifestyle, fast food, bad habits combined with excess body weight increase the risk of developing DM 2 type [3]. In

accordance with international recommendations and guidelines for prevention of type 2 DM (International Diabetic Federation – IDF; American Diabetic Association – ADA) all patients who have a high risk of type 2 DM (IFG (impaired fasting glycaemia), IGT (impaired glucose tolerance)), are required to carry out primary prevention measures: diet, controled physical activity, lifestyle correction, taking metformin [4, 5]. The recommendations are based on the results of several large-scale randomized clinical studies, which demonstrated that lifestyle change/behavioral therapy and using a metformin are the most effective methods of primary and secondary prevention of diabetes and its complications [6].

Effective application of mechanisms of "behavioral economics" and psychological well-being are fundamental to achieve the goals in treating people with diabetes. Patients` training and support with diabetes self-control, diet and dietary regimen, routine physical activity, advising on quitting smoking when necessary, and psychosocial care are important to achieve these goals [7, 8].

Optimizing the medical care quality (MCQ) for people with diabetes is in creating and maintaining conditions that encourage them to make right decisions for prevention of modified risk factors, self-service/self-control and, just as important, active cooperation with healthcare team to improve clinical outcomes, health and well-being in a cost-effective way. After initial comprehensive medical assessment, patients and providers of medical services are recommended to participate in prevention of diabetes and its complications; that is, medical care should be personality-oriented and guided by joint decision-making in choosing a treatment regimen, facilitating the access to necessary medical and psychosocial resources and joint monitoring of agreed regime and lifestyle [9-12]. Reexamination during routine care should include not only assessing the state of health, but also behavioral and mental outcomes, especially during the deterioration of health [13].

The main tasks of health care systems in the organization of medical care in people with diabetes, both worldwide and in Ukraine, are to increase life expectancy, improve its quality, which is estimated by proper compensation of disease. One of the WHO's strategic plans to solve these problems is development of information and communication technology (systems) (ICS) for prevention and continuous monitoring of health indicators in people with chronic non-infectious diseases, including diabetes. The development of new technologies is extremely fast. Every year new approaches and tools become available; by the time one study is completed, new versions of devices already appear on the market. The most important participant in all these systems is a patient, that is, the choice of technology should correspond the individual. This emphasizes the need to optimize medical services for patient in choosing a device/program and maintaining its use through constant training. However, it should be noted that yet we do not have a technology that would minimize the issue of active involving patients with diabetes to continuous monitoring of their health; create conditions and stimuli to ensure a responsible attitude to the treatment regimen, prevent complications, form

a healthy lifestyle [14-16]. Creation of the information space of health care in Ukraine with ICS involvement to preserve and strengthen health in population, ensure rights of citizens for health care is task of the top-priority. The introduction of a modern industrial model of continuous improvement of MCQ in a healthcare institution with development and implementation of automated ICS remains relevant [17, 18]. A significant point of improvement will be in introduction of ICS, which makes it possible to improve patient's responsibility for own health, optimizes the work of a doctor and, in our opinion, contributes to involvement of patients` state in the process of dynamic monitoring by holding responsibility for their health.

AIM

To analyze the effectiveness of remote medical service implementation, involving patients with type 2 diabetes mellitus for dynamic monitoring of their health and treatment, designed to optimize the quality of medical care and prevention at the primary health care level.

MATERIALS AND METHODS

The study was conducted among adults aged 18 to 70 years, residents of Sumy, suffering from diabetes. They took part in a medical and sociological survey before introduction of the ICS and gave consent for processing and using their personal data. A total of 96 patients were involved. Then, during six months of 2019, an algorithm of dynamic bilateral observation and treatment using the ICS "Remote medical service in the medical care quality management system at the primary level" was implemented. The form of the study is a survey, using a closed questionnaire for medical and sociological research, conducted during December 2019. The questionnaires were certified and approved by the Academic Council of the Medical Institute, Sumy State University. During the study we used a systematic approach, bibliosemantic, comparative and statistical analyses, logical generalization. With the functions of Google Forms and Microsoft Excel 2010, Windows, the following processing and statistical analysis of the obtained data were carried out: descriptive statistics, calculation of the error of relative value (m).

The study was approved by the ethics committee of the Sumy State University, in accordance with the requirements of the Tokyo Declaration of the World Medical Association and the International Recommendations of the Helsinki Declaration of Human Rights.

RESULTS

The medical and sociological survey concerned the identification of patients` awareness of the course of disease and prevention of its complications, the regularity of diagnostic and therapeutic measures, awareness of responsibility for their health and importance of their active participation in prevention of modified risk factors influence.

The evaluation of effectiveness of remote medical service implementation at the level of the primary health care was carried out according to the results of indicators` analysis, approved with the unified clinical protocol of medical care for

patients with type 2 DM, who are under dynamic observation of FPs (family practitioners) [19, 20].

Thus, 96 questionnaires from Sumy residents, aged 18-69 years, women – 58 (60,42±3,53%), men – 38 (39,58±3,53%)) were studied.

Patients aged 18-29 were 1,04±0,73%; aged 30-39 – 5,21±1,75%; aged 40-49 years – 9,38±2,16%, aged 50-59 – 28,13±3,23%, aged 60-69 – 56,25±3,58%. The age-sexual data of the respondents, who took part in the survey, are given further on.

In the patients who took part in the survey, the majority suffers from type 2 DM from 6 to 10 years – 34,38±6,8%; from 1 to 5 years – 31,25±6,69%; 11-15 years – 16,67±5,63%; 16-20 years – 17,71±5,39%.

Analysis of the results of re-monitoring showed that during the period of implementation of ICS at the level of primary health care, the indicators of MCQ and health status of the respondents have improved.

Thus, after ICS implementation the percentage of patients, who regularly control the level of blood pressure (BP), increased by 32.29% and amounted to 76,04±3,08%, compared to data, obtained in 2018 (43,75±3,58%),. The proportion of patients who regularly control the level of glycemia increased by 31.24% and equaled 60,41±2,93%, compared to the data, obtained in 2018 - 29,17±2,69%. Also, the part of respondents with the target level of AP has increased by 24.47%. The initial survey had found that only 21,88±2,98% of respondents had the target level of AP; after the experiment this index was 46,35±3,60%. There was an increase by 21.88% in the share of respondents, who have a satisfactory level of DM compensation. In 2018, this figure was 45,83±3,60%, and in results of the resurvey – 67,71±3,37%. With the probability of

error corresponding to the value of the chi-square criterion (p<0,001), it can be stated that change in frequency of the investigated features is reliable (Tables 1 and 2).

Analyzing the data given in Table 3, we conclude that patients began to actively visit FPs for prophylactic purposes in 2019. The proportion of patients who visited their FPs 2 times or more during the analyzed period increased from 72,92±3,58% in 2018 to 90,63±2,88% in 2019 (+ 17.71%). The share of patients who visited the doctor once a year decreased from 14,58±5,09% to 9,38±3,06% (-5.20% difference), and the number of patients who have never visited a doctor for prophylactic purposes decreased by 8.33% (after introduction of the experiment all respondents have visited FPs at least once). The share of respondents, who indicated that they had undergone a full preventive examination during the period of the study, increased by 18.23% (from 47,92±3,61% to 66,15±3,42%). The proportion of patients who received specialist advice (endocrinologist, neurologist, ophthalmologist, cardiologist, surgeon) has increased as well.

The data obtained at the time of the survey on level of glycemia and blood pressure, showed that the share of respondents who have the target level of blood pressure increased by 25.00% (from 38,54±3,56% to 63,54±3,60%). The share of respondents, who have a satisfactory level of compensation for DM (fasted glycemia), increased by 29.18%. A survey in 2018 showed that 11,45±2,20% had a satisfactory level of DM compensation; in 2019 this index was 40,63±3,37% during the survey.

Compared to the survey before the introduction of the ICS, during which 79,17±2,93% of respondents noted the regular taking of medications prescribed, this index increased by 12.50% and was equaling 91,67±1,99%.

Table 1. Questioning results in respondents with type 2 DM on glycaemia control

№	Control frequency rates	Patients` and their health state data, %		Difference, %	Significance level, p
		November 2018	December 2019		
1	2	3	4	5	6
1	Every day	8,33±1,99	20,83±2,93	+8,33	<0,001
2	2-3 times a week	16,67±2,69	39,58±3,53	+22,91	<0,001
3	Once a week	22,92±3,03	29,17±3,28	+6,25	<0,001
4	Once a month	47,92±3,61	8,85±2,05	-39,07	<0,001
5	Once per 3 months	2,08±1,03	1,56±0,89	-0,52	<0,001
6	Once per 6 months, or do not control	2,08±1,03	-	-2,08	<0,001

Table 2. Questioning results in respondents with type 2 DM on arterial pressure control

№	Control frequency rates	Patients` and their health state data, %		Difference, %	Significance level, p
		November 2018	December 2019		
1	2	3	4	5	6
1	2 times a day	22,92±3,03	31,25±3,35	+8,33	<0,001
2	Once a day	20,83±2,93	44,79±3,59	+23,96	<0,001
3	2 times a week	21,88±2,93	11,98±2,34	-10,94	<0,001
4	Once a week	13,54±3,03	5,73±1,68	-15,10	<0,001
5	Once a month	15,63±2,69	3,13±1,26	-9,37	<0,001

Table 3. Efficacy of ICS implementation, according to the data obtained from respondents with type 2 DM

№	Indicators	Patients` and their health state data, %		Difference, %	Significance level, p
		November 2018	December 2019		
1	2	3	4	5	6
1	Have BP cuffs	97,92±1,03	98,96±0,73	+1,04	<0,001
2	Have glucometers	50,0±3,61	69,79±3,31	+19,79	0,003
3	Had cases of hypoglycemia or/and ketoacidosis	6,25±1,75	2,08±1,03	-4,17	<0,001
4	Attended FP (family practitioner) 2 times a year or more (for prophylactic purposes)	72,92±3,58	90,63±2,88	+17,71	0,014
5	Attended FP only once a year (for prophylactic purposes)	14,58±5,09	9,38±3,06	-5,20	<0,001
6	Did not attend FP at all during recent year	8,33± 3,99	-	-8,33	<0,001
7	Underwent full prophylactic examination	47,92±3,61	66,15±3,42	+18,23	0,032
8	Have target AP level during survey	38,54±3,56	63,54±3,37	+25,00	<0,001
9	Satisfactory level of DM improvement (fasted glycaemia) during survey	11,45±2,20	40,63±3,37	+29,18	0,034
10	Take medicines regularly (treatment from DM and AH)	79,17±2,93	91,67±1,99	+12,50	<0,001
11	Take medicines irregularly (treatment from DM and AH)	20,83±2,93	8,33±1,99	-12,50	<0,001

After the experiment, a resurvey showed that 28.12% more respondents began to follow the diet and dietary regimen. In 2018, only 17,71±2,69% of respondents noted keeping the doctor's recommendations on diet; in 2019 this index increased to 45,83±3,60%. During the year, 5.19% of the respondents abandoned bad habits (2018 – 15,62±2,58% of the respondents, 2019 – 10,43±2,20% of the respondents). The positive impact on the conscious attitude of patients to lifestyle and control of their health is also evidenced by the data on decreasing of the number of respondents who have a body mass index ≥30.0 (from 66,67±3,40% in 2018 to 61,98±3,50% in 2019) by 4.69%.

DISCUSSION

The data obtained during our study indicate the positive impact of the developed and implemented ICS on the state of public health and level of prevention of non-infectious diseases (NIS), on creation of conditions for ensuring a responsible attitude of patients to following doctor's appointments and health monitoring; as well as on patients` awareness of the effects of modified risk factors on their health. It has been proved that for optimization of MCQ and prevention in patients with DM, it is advisable to introduce a dynamic monitoring algorithm, which provides active involvement, feedback from the doctor and additional information.

CONCLUSIONS

The introduction of the information and communication system and feedback between the patient and provider of medical services at the level of primary health care institution, involving active participation of patient, supported with additional information, has shown a positive impact on the involvement of patients in dynamic monitoring of their health, on their attitude to the prevention of the development of chronic non-infectious diseases and their complications, on awareness of the impact of modified risk factors on their health by patients.

The percentage of patients who regularly control blood pressure level increased by 32.29%, and index of those, who control the level of blood glucose – by 31.24%. The incidence of hypoglycemia and/or ketoacidotic states decreased by 4.17%.

At the time of the survey, the share of respondents with targeted blood pressure level increased by 25.00% and the share of respondents with satisfactory level of diabetes compensation increased by 29.18%.

The survey showed that 12.5% more respondents began to regularly take medications prescribed by a doctor; 28.12% more people began to follow diet and dietary regimen; 5.19% of the respondents abandoned bad habits (smoking); the number of respondents, who have a body mass index ≥ 30.0 decreased by 4.69%.

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Conflict of interest
The Authors declare no conflict of interest

ADDRESS FOR CORRESPONDENCE:
Natalia O. Dryha
Sumy State University
2 Rimskogo-Korsakova st., 40000 Sumy, Ukraine
phone: +380668026105
e-mail: n.dryha@med.sumdu.edu.ua

ORCID ID and AUTHORS CONTRIBUTION
0000-0002-4240-5968 – Vladyslav A. Smiianov (E, F)
0000-0002-1399-6834 – Natalia O. Dryha (A, B, C, D)
0000-0003-0556-8263 – Lesia A. Rudenko (B, C)

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