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Screening Research of Population Concerning the Prevalence of Diabetes and its Complications in Ukraine

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ABSTRACT

Aim: To examine the prevalence of diabetes and to identify risk factors for the progression of diabetic retinopathy among the population of Volyn region (Ukraine). Materials and methods: the research was conducted in 2-interrelated directions: 1) complex free examination of the people with the definition of anthropometric data and level of HbA1c (n=500) and 2) an anonymous respondents' questionnaire (n=681). Results: It has been determined, that patients, who have increased or high HbA1c from cohort of people, who consider themselves to be healthy, belong to risk group and may have diabetes ($\chi 2$=218.12, p<0.05). It is proved that the town residents are much more likely to be examined by an ophthalmologist, compared with rural residents – during the last 3 months: 13.6% vs 8.7% ($\chi 2$=4.27, p<0.05); over 1 year ago – 52.6% vs 37.4% ($\chi 2$=15.88, p<0.05). Conclusion: We have revealed a number of problems that need urgent solutions in the modern conditions of health care development of Ukraine, in particular, the necessity to inform constantly the population about diabetes and its potential complications, early diagnosis of patients who are at risk for the diabetes and increasing the availability of ophthalmological care, especially among the rural residents.

KEYWORDS SCREENING, DIABETES, DIABETIC RETINOPATHY, QUESTIONNAIRE.

Introduction

Diabetes mellitus is the most common socially significant diseases of present [1-3, 6]. According to the WHO and the International Diabetes Federation statistics, in 2010 there were 285 million patients with diabetes [8], in 2011 – 346 million [4, 6], in 2030 it is forecasted that the number will rise to 438 million people (4.4% of world population) [5, 8], and the number of deaths due to diabetes will take the 7th place [6].

Diabetes leads to a metabolic disorder, that contributes to the development of late vascular complications [2], which subsequently become a major cause of disability and death of patients with diabetes [1, 2]. In particular, in 2004, 3.4 million diabetic patients died, besides 80% of deaths have been recorded in low- and middle-income level countries [6]. In the US, patients with diabetes each year miss 120 million of working days that cost up to 58 billion dollars [3, 7]. Still, diabetes is one of the major causes of disability among the patients [2], in particular, due to diabetic retinopathy (DR), which was first described over 100 years ago by MacKenzie (1879), however, even nowadays it remains a serious global problem of health care and Ukraine in particular [1, 2]. The results of a multicenter randomized research, which has been conducted for 6.5 years, involving 1441 patients with 1 type diabetes showed that intensive glycemic control, compared to conventional, reduces the risk of DR by 76% and progression of this pathology by 54% [4].

The leading role in reducing the risk of DR appearance, and thus – blindness, belongs to early diagnosis and screening [4, 5], however, most cases of DR are not diagnosed in time [2]. According to the latest results of the British scientists' systematic review (2015), the patients with diabetes have to have screening for DR at least 1 time per year [9].Therewith, an important aspect is the mandatory notification of patients with diabetes and their families about the fact, that the level of glycosylated hemoglobin (HbA1c) ≤ 7% reduces the frequency and progression of DR (level of evidence – A) [10].

Thus, diabetes is an actual medical-social problem both in the world and in Ukraine (primarily due to late diagnosis of this disease, when complex irreversible complications have been formed), what was determinative in selection of the aim, strategies and tactics of our screening research.

Materials and methods

The research has included 681 people – population of different age, gender, education, place of residence, selected randomly among the residents of Volyn region. Demographic description of the respondents, included in the research according to the main parameters, as well as comparative characteristics of town and village residents are presented in Tables 1 and 2. The research was conducted in 2-interrelated directions: 1) complex free examination of the people with the definition of anthropometric data and level of HbA1c. It should be noted, that the sampling of blood from the vein was performed only among those examined people, who have signed a written informed consent for this medical intervention (n=500) and 2) an anonymous respondents' questionnaire (n=681) according to the specially worked out single protocol. The research was conducted on the basis of irrevocable random sampling. The questionnaire consisted of 9 questions, concerning respondents' awareness about diabetes and their own health. For data processing and analysis, the initial amount of information has been transformed into a tabular electronic format.

The statistical analysis of the research results was carried out with the help of the program "Statistic v 8.0" (Stat. Soft Inc., USA). The methods of descriptive statistics have been used during the research results' analyzes. The standard deviation (SD) of the sample was determined for each of the researched parameters. The type of the statistical distribution of the quantity data was determined by the Shapiro-Wilk test. To compare 2 samples according to categorical variables we used Pearson's χ^2 test. The results were considered authentic at a significance level $p<0.05$. The research has not been carried out on order of physical or legal persons. The conflict of the interests in the course of the research is absent. The Conclusion of Ethics Committee is minutes No 3413, 8th March 2012. The system analysis, standardization, analytical and comparative, laboratory analysis, sociological (questionnaire) and statistical methods have been applied.

Table 1: Basic research parameters descriptive statistics

Characteristics	Value
Respondents' number, N	681
Gender, M, abs. (%) F, abs. (%)	230 (33.8) 451 (66.2)
Age, min-max, years	20-80
Respondents' average age, years ±SD	50.0±11.3
Education*: secondary, abs. (%) higher, abs. (%) unfinished secondary, abs. (%)	 415 (60,9) 208 (30.5) 40 (5.9)

* in 18 questionnaires (2,7%) the information about residents' education is absent

Table 2: Town and village residents' comparative characteristics

Coefficient	Town	Village
Amount, abs.	323	358
Height (min-max), m	1.10-1.91	1.44-1.84
Average height coefficient, m ±SD	1.68±0.10	1.62±0.08
Weight (min-max), kg	40-122	46-148
Average weight coefficient, kg ±SD	78.26±15.58	79.19±17.09
Age (min-max), years	30-70	20-80
Age, years ±SD	48.46±10.57	51.38±11.71

Results and discussion

The first stage of our research involved the determination of HbA1c by sampling vein blood from 500 research subjects. It was revealed, that 193 people have increased value of this index, 272 people – normal and 35 of them – a high one. As from 500 respondents, who had been examined for the level of HbA1c, only 483 replied on the questionnaire's question: "Do you have diabetes?", so, for the future we have divided these respondents into 2 groups for a more detailed comparative analysis:

1) those, who are aware of their diabetes – Group A;

2) those, who are convinced , that they don't have diabetes – a Group B.

The results of the distribution of HbA1c among patients, depending on their awareness that they have diabetes are presented in Table 3.

Table 3: Level of patients' HbA1c depending on awareness about presence of diabetes in their organism

Patients	HbA1c level			
	Norm< 5.7%	Increased value 5.7% to 6.0%	High value 6.1% to 6.4%	Total
Group A (Diabetes +)	0 (0.0%)	1 (5.9%)	16 (94.1%)	17 (100.0 %)
Group B (Diabetes –)	266 (57.1%)	184 (39.5%)	16 (3.4%)	466 (100.0%)
Total	266	185	32	483

In group A (Diabetes +) actually all patients have high level of HbA1c (94.1%). At the same time among the patients of group B (Diabetes -) high value of this indicator was found in 3.4%. However, 39.5% of patients in group B have increased HbA1c level, whereas among patients of group A – only 5.9%.Still, no case of level HbA1c within the normal range in group A has been found. The differences of 2 groups of patients according to HbA1c value is confirmed statistically (χ^2=218.12, $p<0.05$). It has been proved significantly, that patients with diabetes the HbA1c level is increased or high, compared to those respondents who believe that they don't have this disease (χ^2=218.12 $p<0.05$). Thus, according to the results of the screening we can state, that those patients who have increased or high HbA1c from healthy cohort of respondents are at risk and may have diabetes.

Later we have made a comparative analysis of HbA1c level of respondents according to their place of residence (Table 4). It has been determined, that town residents much more often have normal HbA1c level, compared with the rural population (63.4% vs 50.7%). Increased value of HbA1c a bit more often is revealed among the patients from the village 42.5% vs 29.0%. However, the ill people, living in the village, are more often in the risk group of increased level of HbA1c. At the same time, high value of HbA1c was quite more frequently revealed among the town patients. Thus, patients who live in rural areas, are at risk of increased values of HbA1c (χ^2=8.08, $p<0.05$).

Table 4: Comparative analysis of HbA1c level among the respondents, according to their place of residence

Patients	HbA1c level			
	Norm< 5.7%	Increased value 5.7% to 6.0%	High value 6.1% to 6.4%	Total
Town	92 (63.4%)	42 (29.0%)	11 (7.6%)	145 (100.0%)
Village	180 (50.7%)	151 (42.5%)	24 (6.8%)	355 (100.0%)
Total	272	193	35	500

Statistically significant results were received at comparing our respondents' answers for the question "How do you treat diabetes?" (Table 5). For statistical treatment of data, in this case Fisher's exact test was used, as the value of the expected frequency in the table 2x2 is less than 5.

Table 5: Comparative analysis of confirmative answers of the respondents for the question "How do you treat diabetes?"

Variant of answers	Answer yes		p-level
	Town	Village	
Pills for sugar decreasing	12	5	<0.05
Pills for sugar and insulin decreasing	0	1	>0.05
Insulin	2	2	>0.05
Only a diet	0	4	<0.05
I don't take anything	1	0	>0.05

Thus, it has been proved the existence of statistically significant difference between the village and the town residents according to some methods of diabetes treatments, particularly in the town they are more likely to use pills to reduce the sugar, and in the countryside more often, compared to town, try to achieve normoglycemia only thanks to diet ($p<0.05$).

The next stage of the research was to compare the prevalence of diabetes among the respondents, depending on their education. From the analysis there were excluded 20 questionnaires due to lack of information concerning respondents' education or answers for the question "Are you sick for diabetes?". It was established that diabetes is equally common among the patients with higher and secondary education (3.9% each) and less frequently – among the patients with incomplete secondary education (2.6%), but without statistically confirmed difference (χ^2=0.16, $p>0.05$). Thus, we can affirm that education level has no effect on the prevalence of diabetes, because no correlation between education level of respondents and the incidence of diabetes has been found (χ^2=0.16, $p>0.05$).

It was revealed, that 81.7% of respondents with higher edu-

cation, 89.6% with secondary and 95% with incomplete secondary education appeal to the doctor or for medical assistant of state medical health care facility in case of certain health problems (χ^2=10.11, p<0.05). However, education level does not influence the frequency of patients appeals to the doctor in private health care facility (χ^2=2.45, r>0.05), pharmacies (χ^2=0.30, r>0.05), as well as Internet (χ^2=1.22, p>0.05), newspapers, magazines (χ^2=1.20, p>0.05) and other sources of information (χ^2=1.19, p>0.05).

At the same time, the village residents are much more likely seek medical assistant / doctor's consultation in case of certain health problems, compared with town residents (93.9% vs 78.3%), which is confirmed statistically (χ^2=35.03, p<0.05). Town residents, however, prefer pharmacies, to which 11.5% of respondents of this group refer to. Among the village residents no respondent indicated that he appeals for help to the pharmacies (χ^2=43.36, p<0.05). Town residents also significantly more often appeal with their health problems to neighbors, friends and relatives (5.0%) and the Internet (5.0%). In the village the following information resources are not used at all (χ^2=18.16, p<0.05).

During the research it was found, that the frequency of delivery of blood sugar is affected by the diagnosis of diabetes, as it was definitely proved that patients with this disease much more often conduct a laboratory analysis, in particular during the 1st (χ^2=47.74, p<0.05) or the last 3 months (χ^2=11.32, p<0.05) before the research (Table 6).

Table 6: The results of comparison of blood sample frequency for sugar depending on the presence among the patients diagnosed diabetes (n=661)

Variant of answers	Patients with diabetes (n=26)	Patients without diagnosed diabetes (n=635)	Value
During the last month	57.7%	11.2%	χ^2=47.74, p<0.05
During last 3 months	30.8%	9.9%	χ^2=11.32, p<0.05
During last year	3.8%	27.4%	χ^2=7.12, p<0.05
More than a year ago	7.7%	21.3%	χ^2=2.80, p>0.05
I never checked	0%	9.1%	χ^2=2.60, p>0.05
I don't remember	0%	21.3%	χ^2=6.95, p<0.05

Further a comparative analysis of the responses for the question "When was the last time you saw the ophthalmologist?" was made among the patients, suffering from diabetes and respondents who believe that they don't have diabetes. The required information for making analysis was detected in 661 questionnaires. It has been revealed, that the proportion of patients who applied to an ophthalmologist, in particular not later than 3 months before the time of the questionnaire, was significantly higher among patients with diabetes, compared to those patients who do not suffer from diabetes (χ^2=26.35, p<0.05) (Table 7).

Table 7: The results of oculist visits' frequency depending on the presence of diagnosed diabetes among the patients

Variant of answers	Patients, suffering from diabetes (n=26)	Patients without diagnosed diabetes (n=635)	Value
During last 3 month	42,3%	9,9%	χ^2=26.35, p<0.05
During last 6 months	23,1%	16,7%	χ^2=0.72, p>0.05
More than 1 year ago	23,1%	46,6%	χ^2=5.58, p<0.05
The resident doesn't remember his last visit of oculist	11,5%	24,3%	χ^2=2.23, p>0.05
The resident has never seen the oculist	0,0%	1,9%	χ^2=0.50, p>0.05

Moreover, it is proved that the town residents are much more likely to be examined by an ophthalmologist, compared with rural residents, during the last 3 months: 13.6% vs 8.7% (χ^2=4.27, p<0.05); over 1 year ago 52.6% vs 37.4% (χ^2=15.88, p<0.05); do not remember when they were examined 12.1% vs 33.5% (χ^2=43.63, p<0.05). The received results may testify inaccessibility of ophthalmological care among the rural population and the low awareness of the need for its annual examination by an ophthalmologist.

Regarding the respondents' answers for questions about the consequences of diabetes, among the patients with diagnosed diabetes there is significantly higher level of awareness of the possible complications of the disease, particularly in the nervous system (χ^2=10.73, p<0.05), eyes (χ^2=5.89, p<0.05) and other undesirable effects (χ^2=5.24, p<0.05) (Table 8).

Table 8: Comparative research of the respondents' opinion concerning the possible consequences of diabetes (n=661)

Variant of answers	Patients, suffering from diabetes (n=26)	Patients without diagnosed diabetes (n=635)	Value
Heart attack or a stroke	34.6%	25.4%	χ^2=1.12, p>0.05
Vessel affection	38.5%	23.5%	χ^2=3.08, p>0.05
Nervous system affection	53.8%	25.0%	χ^2=10.73, p<0.05
Eyes affection	53.8%	31.2%	χ^2=5.89, p<0.05
Other	7.7%	1.6%	χ^2=5.24, p<0.05
I don't know	3.8%	40.9%	χ^2=14.39, p<0.05

However, it was found out that the proportion of patients who do not know anything about the complications of diabetes, was significantly higher among the patients who don't suffer from diabetes (χ^2=14.39, p<0.05).

It should be noted that the villagers are much more aware about possible complications of diabetes, compared with residents of the city: heart attack or stroke: 33.24% vs 16.1% (χ^2=26.53, p<0.05); eye diseases: 36.0% vs 26.0% (χ^2=7.94, p<0.05); other 2.8% vs 0.6% (χ^2=4.36, p<0.05); I do not know 31.0% vs 47.4% (χ^2=19.15, p<0.05).

Conclusion

As a result of a screening research we have revealed a number of problems that need urgent solutions in the modern conditions of health care development of Ukraine, in particular, the necessity to inform constantly the population about diabetes and its potential complications, early diagnosis, identification

of patients who are at risk for the development of the disease and increasing the availability of ophthalmological care, especially among the rural residents. The received results can be used in the preparation of advanced development programs and improving the quality of health care for patients with diabetes in Ukraine. According to the results of the carried out screening we can affirm, that patients who have increased or high HbA1c level from the cohort of people who consider themselves to be healthy are at risk and may have diabetes (χ^2=218.12, p<0.05).

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