MEDICAL UNIVESITY
„Prof. dr Paraskev Stoyanov”-Varna
Department of Optometry and Occupational Disease

Dr.Dimitrinka Rosenova Dimitrova

Occupational risk factors in the epidemiology of stroke

ABSTRACT

of a dissertation for the award of a scientific and educational degree "doctor"

Doctoral program: "Occupational diseases"

Supervisor:

Prof. Dr Veselinka Nestorova, PhD, DSc

Varna

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Scientific specialty: "Occupational diseases"

Code of the specialty: 03.01.55

Supervisor:

Prof. Dr Veselinka Nestorova, PhD, DSc

Scientific reviewers:

Prof. Dr. Zlatka Borisova Stoyneva-Paskaleva, PhD, DSc

Prof. Dr. Silva Peteva Andonova-Atanasova, PhD, DSc

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2024

The dissertation is presented on 87 pages and contains 17 figures, 17 tables and 3 appendices. The bibliography covers a total of 156 literary sources, of which 2 are in Cyrillic and 154 are in Latin.

The dissertation was discussed and directed for defense by the Department of Optometry and Occupational Diseases, Medical University "Prof. Dr. Paraskev Stoyanov" - Varna.

All studies included in the dissertation were carried out in:

• Second clinic for nervous diseases with the Department for the treatment of acute cerebral strokes (OLOMI) and the Department for the intensive treatment of neurological diseases (ILNB) and at the UMBAL "St. Marina" - Varna.

The dissertation was presented at a meeting at the Department of Optometry and Occupational Diseases, Medical University "Prof. Dr. Paraskev Stoyanov" - Varna on January 23, 2024.

The public defense of the dissertation work will take place on 27.03.2024 at 1:00 p.m. on the Webex online platform with a scientific jury composed of:

Internal Members:

Prof. Dr. Silva Peteva Andonova-Atanasova, PhD, DSc - Reviewer

Prof. Dr. Zornitsa Ivanova Zlatarova-Angelova, PhD, DSc , Chair

Spare internal member:

Assoc. Dr. Mariyana Mihailova Krasteva - Ruseva, PhD

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Prof. Dr. Zlatka Borisova Stoyneva - Paskaleva, PhD, DSc, Reviewer

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Spare External Member:

Assoc. Dr. Irena Yordanova Stoilova, PhD

Abbreviations used

SCA Stenosis of the carotid artery

PFO Persistent foramen ovale

AP Arterial pressure

BMI Body Mass Index

DM Diabetes mellitus

OSA Obstructive sleep apnea

CVD Cardiovascular diseases

CVD Cerebrovascular disease

POPs Persistent organic solvents

HAIE Chronic arterial insufficiency of the extremities

PM Dust particles

NPC Non-dust particles

WHO World Health Organization

CT Computer Tomography

MRI Magnetic resonance imaging

DM Diabetes mellitus

HD Hypertensive disease

CHD Ischemic heart disease

Pb Lead

Hb Mercury

Cd Cadmium

Mn Manganese

WSO World Stroke Organization

AF (AF) Atrial fibrillation

AVM Arteriovenous malformation

TOAST Trial of Org 10172 in Acute Stroke Treatment

ANA American Heart Association

ASA American Stroke Association

HDL High-density lipoproteins

LDL Low-density lipoproteins

NAC N-Acetyl Cysteine

ALA Alpha- lipoic acid

GSH Glutathione

TNF Tumor necrosis factor

NO Nitric oxide

PCBs Polychlorinated biphenyls

OS Organochlorine

DDT Dichlorodiphenyltrichloroethane

PFAS Perfluoroalkyl substances

TCDD 2,3,7,8-tetrachlorodibenzo-p-dioxin

CO Carbon monoxide

SO 4− sulfate

O 3 Ozone

IMT Intima-media complex

NIHSS National Institutes of Health Stroke Scale

GLCS Glasgow-Liege Coma Scale

Content:

1. Introduction

Cerebrovascular diseases occupy a major place among socially significant diseases. Globally, stroke was the second leading cause of death (out of total deaths) and the third leading cause of death and disability combined in 2019. with the greatest burden of disease in low- and middle-income countries (American Academy of Neurology, 2021). From 1990 to 2019 the burden (in terms of absolute number of cases) has increased significantly, with a 70% increase in stroke incidents, with stroke deaths accounting for 43% (WSO, 2022). During the same period, age-standardized stroke incidence rates decreased by 17%, mortality decreased by 36%, prevalence decreased by 6%. However, among people under 70 years of age, the prevalence increased by 22% and the incidence increased by 15%. The World Health Organization estimates that the absolute number of patients with a first stroke in the European Union and selected countries of the European Fair Trade Association will increase from 1.1 million in 2000. to 1.5 million in 2025 if incidence rates remain stable [Endres et al]. Ischemic stroke accounted for 62.4% of all strokes in 2019, while intracerebral hemorrhage accounted for 27.9% and subarachnoid hemorrhage for 9.7% in 2019. [Feigin et al]. Nowadays, stroke deaths reach 75.2% and stroke-related life-years lost up to 81% in developing countries [Radu et al.].

According to the World Stroke Organization (WSO, 2022), stroke is the "epidemic of the 21st century". Globally, 1 in 4 adults over the age of 25 will have a stroke in their lifetime. Bulgaria is in one of the first places in the world in terms of morbidity and mortality from cerebrovascular diseases. In Bulgaria, about 82,398 cases of MSB are registered annually, of which about 40,000 are cerebral strokes. Of these, 8,000 patients die, and 28,600 survive the stroke with varying degrees of disability (National Consensus on the Prevention, Diagnosis, and Treatment of Cerebrovascular Diseases, 2020).

With the large-scale changes in the modern working life of the working part of the population globally, a "rejuvenation" of a large part of socially significant diseases such as cerebrovascular and cardiovascular diseases is noticeable. They represent one of the greatest threats to human health and well-being worldwide and a major burden on the health system and society as a whole. It is known that the consequences of most socially significant diseases include temporary or permanent loss of work capacity and continued significant financial investment in prognostic, treatment and rehabilitation measures. Many questions arise related to whether occupational risk factors are sufficiently well studied and what weight they have relative to standard risk factors in the etiopathogenesis and epidemiology of vascular diseases. Can they be influenced, thereby reducing their negative impact on human health and work capacity? Around the world there is evidence of the importance of occupational risk factors in the epidemiology of brain strokes, while in Bulgaria they still remain poorly studied.

2. Purpose and tasks

2.1. Target

To investigate the role of occupational risk factors in the epidemiology of stroke in working age patients.

2.2. Tasks

• To identify stroke patients of working age and analyze the results of imaging and laboratory tests;
• To specify the risk factors of MSB - gender, age, accompanying diseases, harmful habits;
• To study the harmful effects of the working environment having a direct or indirect influence on cerebrovascular diseases;
• To compare the risk of stroke in workers performing mainly physical or mainly mental work;
• To determine the impact of workplace stress on the risk of cerebrovascular diseases;
• To study the occupational factors that cause ischemic and hemorrhagic strokes;
• To carry out statistical processing of the received data.

3. Working hypotheses

• There is dependence in patients with a total work experience of more than 30 years. and stroke risk
• There is an increased risk of stroke in those who work mainly in manual labor.
• An increased incidence of stroke is reported in patients reporting harmful habits (smoking and alcohol consumption)

4. Materials and methods

4.1. Materials

The object of the study is a total of 351 patients hospitalized in the Second Neurological Clinic with OLOMI and OILNB of the UMBAL "St. Marina" - Varna, in the period of November 2021. – January 2023.

Inclusion criteria – stroke patients:

• All diagnosed and hospitalized patients of working age during the period of November 2021. – January 2023, hospitalized in the Second Clinic for Nervous Diseases with OILNB and OLOMI in UMBAL "St. Marina" EAD- Varna with a specified diagnosis of cerebral stroke;

• Patients of working age from 18 years to 64 years;

• Working at the time of the study;

• Patients with signed informed consent.

Exclusion criteria:

• Patients under the age of 18 and over 64;

• Unemployed at the time of the survey;

• Lack of signed informed consent.

4.2. Methods

4.2.1 Survey

For the purposes of the study, the participants (or if the patient was unable to do so, their relative) filled out a questionnaire (Appendix 1) developed by the researcher. The form contains the following sections:

- demographic data – gender, marital status, education;
- accompanying diseases according to medical documentation - data were collected on the vascular risk profile of the patients (CHD, DM, Dyslipidemia, rhythm-conduction disorders, chronic heart failure, CHD, etc.);
- harmful habits - data were collected on the behavioral risk factors of the patients - alcohol use and smoking;
- occupational risk factors

- Professional route - years of work experience, profession (held position), current job;

- Factors of the labor process - weight, tension, work posture, work movements, work and rest regime;

- Factors of the working environment - microclimate, mechanical fluctuations, dust, presence of chemical hazards;

- Level of professional stress;

- Working with harmful substances

4.2.2 Clinical study

In order to achieve the set goals and objectives of the patients meeting the inclusion criteria, the patient was examined - a complete somatic and neurological status was taken.

4.2.3 Laboratory studies

The laboratory tests were carried out in the clinical laboratory of the "St. Marina" UMBAL - Varna, using ADVIA 2120 and Sysmex XN 1000 automatic hematological analysis devices, automatic biochemical analysis using the ADVIA 1800++ consolidating system and the ACL TOP-500 automatic coagulometer.

Dyslipidemia was accepted in patients undergoing treatment with antilipemic drugs premorbidly or in those with established high levels of lipids during hospitalization.

4.2.4 Neuroimaging studies

Imaging studies (CT and/or MRI) were performed on a Siemens Spirit and Siemens Definition computed tomography machine according to a standard protocol for native head scanning. The studies were carried out on a Siemens Magnetom Verio 3T magnetic resonance imaging machine.

4.2.5 Scale for assessing the severity of strokes - National Institute of Health Stroke Scale – NIHSS

The National Institute of Health Stroke Scale (NIHSS) stroke severity scale is used to determine stroke severity to predict clinical outcome. Scores can range from 0-42 points, with higher scores indicating greater stroke severity. Stroke severity can be stratified based on NIHSS scores as follows:

- 0 points – absence of neurological symptoms;
- 1-4 points – mild neurological deficit;
- 5-15 points – moderate neurological deficit;
- 16-20 points – severe neurological deficit;
- over 21 points – very severe neurological deficit

(Application 2)

4.2.6 Level of consciousness assessment scale - Glasgow-Liege Coma Scale (GLCS)

The Glasgow-Liege Coma Scale (GLCS) was specifically developed in 1982. a new coma scale that combines the Glasgow scale with quantitative analysis of 5 brainstem reflexes. It is used to assess the level of consciousness in patients with traumatic brain injury and acute brain injury, as well as in the chronically ill and terminally ill. It is considered a factor with a very high prognostic ability. The maximum number of points is 20 points, and the more points, the greater the probability of a good recovery and the smaller the violations.

(Application 3)

4.2.7 Statistical methods for data processing

The statistical processing of the data was carried out using a specialized software product SPSS v. 26.0.

The present dissertation work includes a set of descriptive and analytical statistical methods.

- **Descriptive methods**

Descriptive methods are directly related to the distribution of statistical units according to the meanings of their signs, revealing their character and internal structure.
Descriptive methods establish central tendencies, degree of difference between individual units of observation (patients) and degree of deviation of the empirical distributions of the observed units from reference distributions. For each separate group of characteristics, different indicators are applied, such as average values, mode, to establish differences between units (mean square deviation), to establish deviations from reference distributions (asymmetry coefficient, kurtosis coefficient) are used to establish central tendencies).
Graphical representation of the empirical distribution is an essential part of descriptive statistical methodology. The following graphical representations are applicable: histogram, structure diagram.

• Analytical methods

Correlation analysis was applied in the dissertation by using the parametric correlation coefficients of Brave and Spearman. They are applied to quantitative data, and in addition to the strength and direction of the relationship, their statistical significance is also examined. In particular cases, a non-parametric contingency correlation coefficient was applied to qualitative data.

Emphasis in the dissertation work is given to the method of interpenetrating samples. This method is applied in cases where a given study must be conducted in several stages (patients before and after treatment). For this purpose, it is expedient to divide the broadcast sample of volume (n) from a general statistical population of volume (N) into two or more independent samples, as also applied in this dissertation work. As a rule, each of the samples must be formed by the same selection of units placed in the same conditions in order to comply with the rule of comparability of data. The resulting two independent subsamples are called interpenetrating and make it possible to obtain separate, independent estimates of characteristics of the studied population. In this way, the effectiveness of different treatment methods in similar groups of patients can be measured.

Statistical hypothesis testing is directly related to sample research. Statistical hypothesis testing includes procedures for defining specific assumptions about the parameters of studied populations (patients), raising a main (null) hypothesis and an alternative hypothesis. The null hypothesis H_0 expresses an assumption of a null effect, that is, that there is no difference between the compared quantities. The alternative hypothesis H_1 is accepted if the null hypothesis is rejected. A t test was applied to test for statistically significant differences between means and variances.

5. Results

5.1 Study population

The object of the study is a total of 351 patients with stroke, hospitalized in the Second Neurological Clinic with OLOMI and OILNB of UMBAL "St. Marina" - Varna, in the period of November 2021. – January 2023.

5.2 Comparative characteristic

5.2.1 Demographic characteristics – age, gender, marital status and education

Analysis of the demographic data of the participants in our study showed that the mean age of the stroke patients was 55.8 ± 7.092 years, approximately 56 years (Fig. 1).

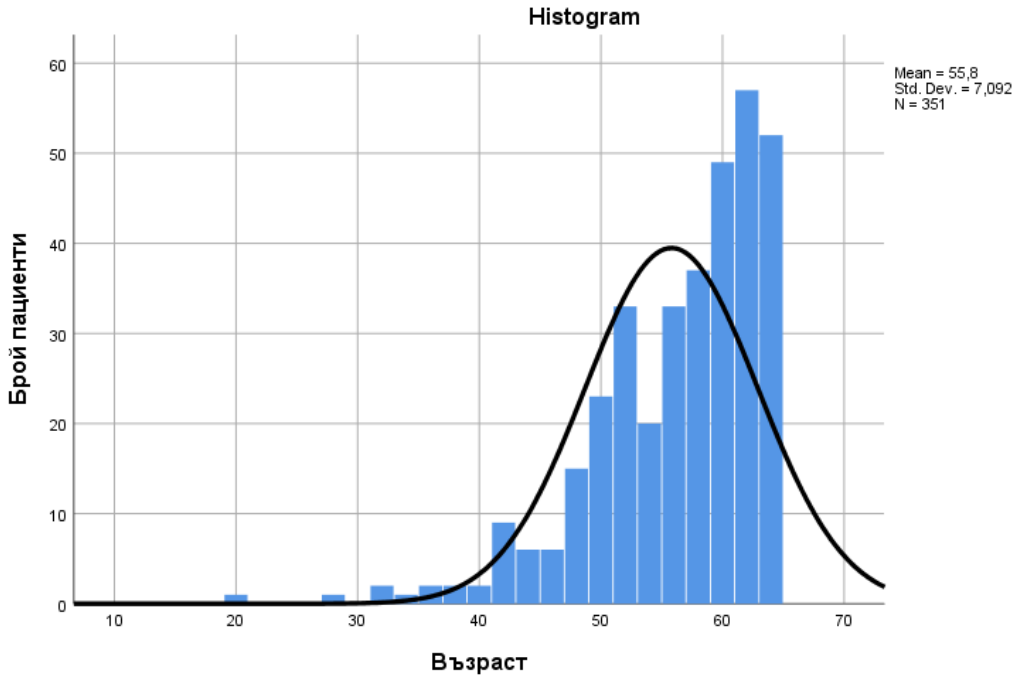

Fig.1 Distribution of patients according to age

The youngest patient was 20 years old and the oldest was 64 years old, with the most common age among stroke patients being 63 years old.

A statistically significant direct relationship was found regarding the age of the patients, with those aged between 52-64 years being the most at risk (r=0.285, p=0.000). The second most frequent is the age group 41-51 years, in third place the group 30-40 years and the least affected are those aged 18-29 years.

There is a trend for haemorrhagic stroke (HS) at a younger age, with increasing age the relative proportion of HS decreases and ischemic stroke (IS) increase.

Fig. 2 and table 1 show the distribution of patients by age intervals.

Fig.2 Distribution of patients by age intervals according to diagnosis
Legend: Blue- Ischemic stroke, orange - haemorrhagic stroke, grey – subarachnoid hemorrhage
Age groups: 18-29 years, 30-40 years, 41-51 years, 52-64 years

		Diagnosis			Total (N)
		IS (N)	Intraparenchymal hemorrahage (N)	Subarachnoid hemorrhage (N)	
Age gropus	18-29 y	0	0	2	2
	30-40 y	5	3	1	9
	41-51 y	50	15	9	74
	52-64 y	209	42	15	266
Total		264	60	27	351

Table 1 Distribution of patients by age intervals according to the diagnosis

Our stroke patients are predominantly male - 68.9% men and 31.1% women. The percentage distribution by gender is presented in Fig. 3, and Table 2 shows the distribution according to gender and diagnosis. It is noteworthy that the largest share of men suffered an ischemic stroke - 188.

Our correlation analysis found a statistically significant direct relationship between gender and diagnosis, with males being more at risk of having a stroke (r= 0.16, p=0.017).

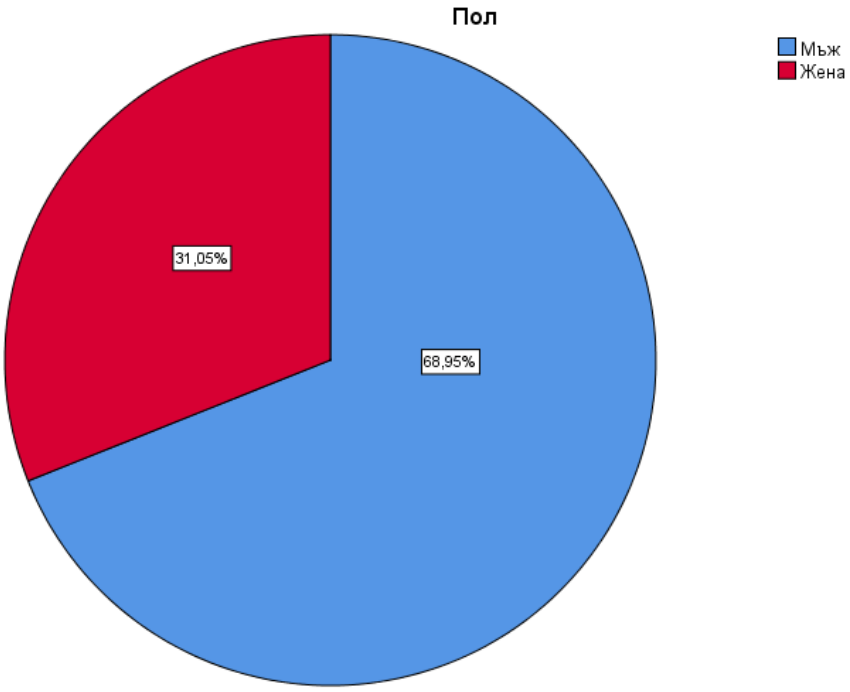

Fig.3 Distribution of patients according to gender
Legend: blue – men, red – women

Gender * Diagnosis					
		Diagnosis			
		Ischemic stroke	Intraparenchymal hemorrahage	Subarachnoid hemorrhage	Total
gender	men	188	40	14	242
	women	76	20	13	109
Total		264	60	27	351

Table 2 Distribution of patients according to gender and diagnosis

According to the marital status of the stroke patients, the leading share is married - 240 (68.4%), followed by single - 37 (10.5%), widowed - 13 (3.7%). divorced/divorced – 45 (12.8%), other – 16 (4.6%).

The distribution of stroke patients according to their marital status is shown in Fig.4.

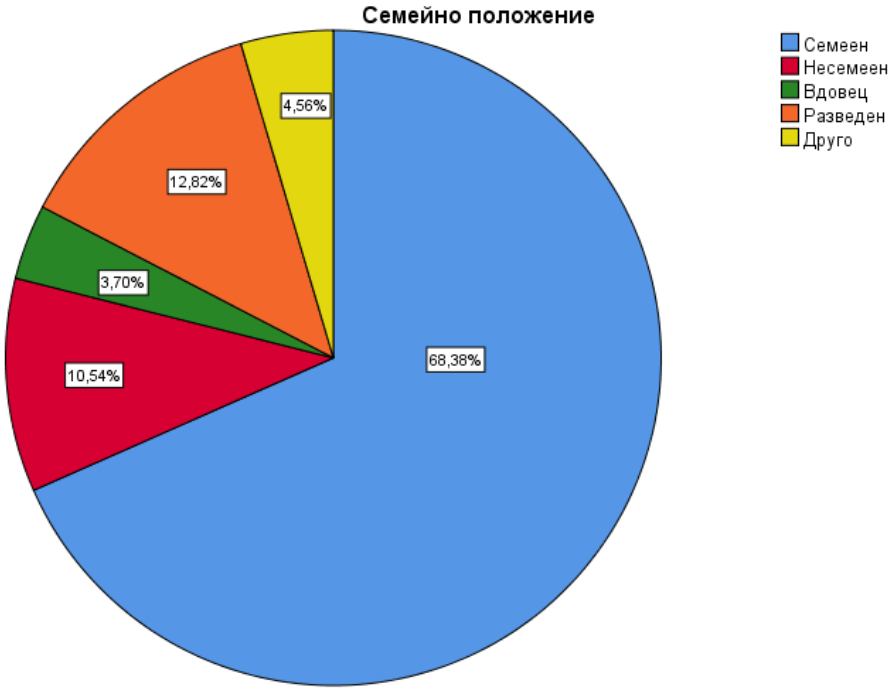

Fig.4 Distribution of patients according to their marital status

Legend: blue- married, orange - divorced/divorced, red – single, yellow – other, green - widowed

Among the patients, the largest share of those with secondary education was found - 236 (67.2%), followed by those with higher education - 47 (13.4%), secondary education - 42 (12%), primary education - 26 (7.4%).

The distribution of stroke patients according to their level of education is shown in Fig. 5.

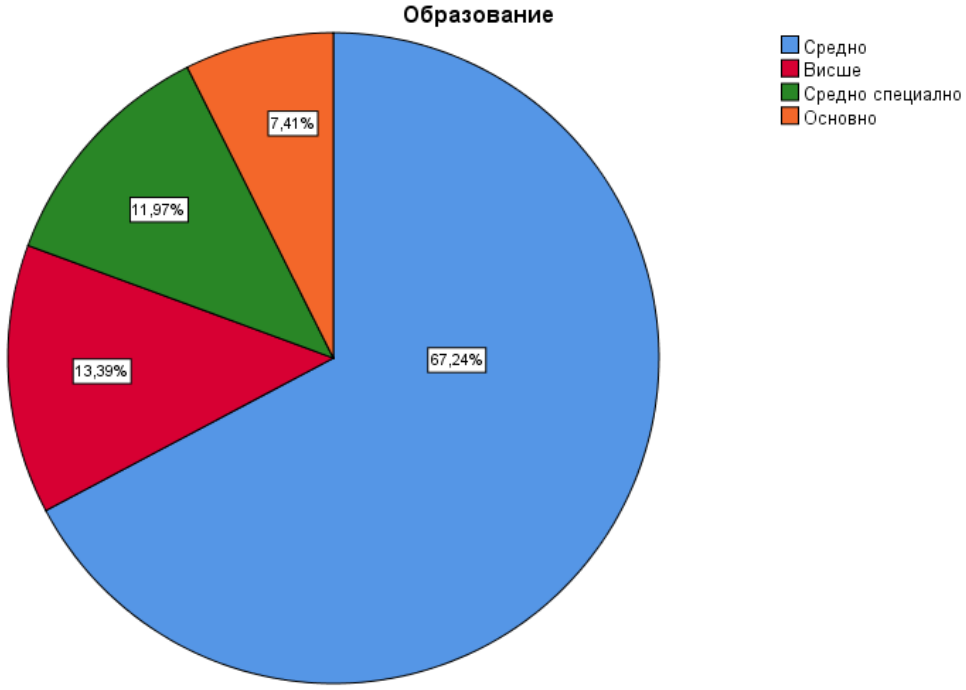

Fig.5 Distribution of patients according to their level of education

Legend: blue - secondary education, red - higher education, green - secondary specific education, orange - primary education

The patients in our study were classified by group and according to the type of realized stroke. The most significant was the share of those with ischemic stroke - 264 (75.21%), followed by the share of those with intraparenchymal hemorrhage - 60 (17.09%) and the least was that with realized subarachnoid hemorrhage - 27 (7.69 %).

Table 3 and Fig. 6 show the distribution of patients according to the type of stroke.

Table 3 Distribution of patients according to the type of stroke

Diagnosis			
		Frequency (N)	**%**
	IS	264	75,2
	Intrapar. Hemor.	60	17,1
	Subarachnoidal hemor.	27	7,7
	Total	351	100,0

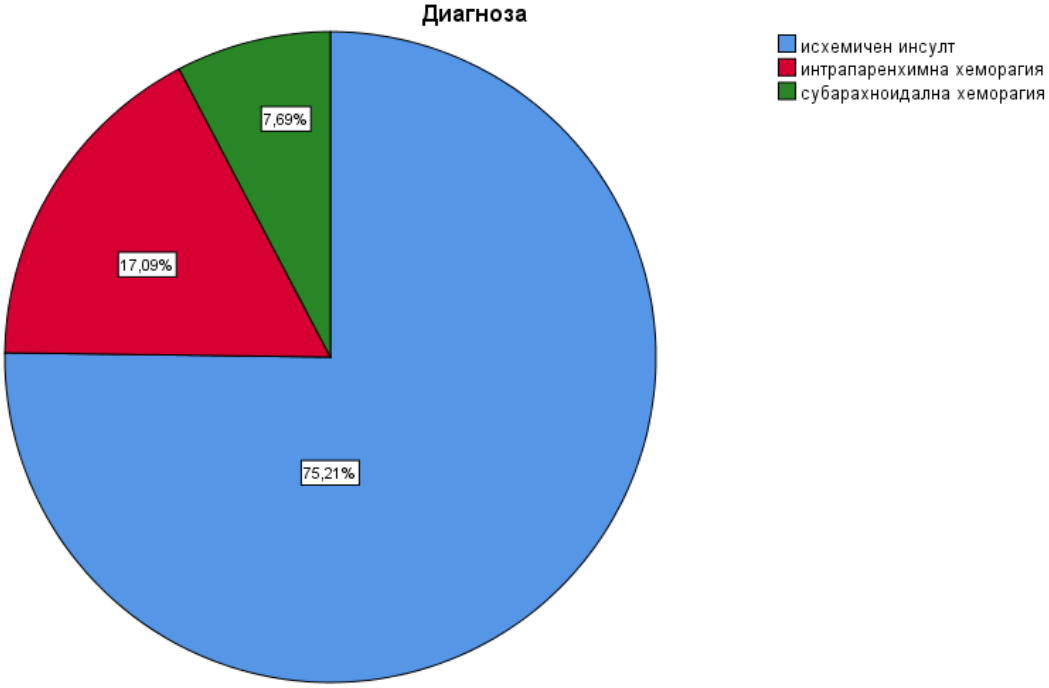

Fig.6 Distribution of patients according to diagnosis
Legend: blue – IS, red – intraparenchymal hemor., green – subarachnoidal hemor.

5.2.2 Major modifiable behavioral and vascular risk factors

Smoking is a common risk factor, and according to our study, there was a preponderance of smokers with stroke - 144 (41%), and the proportion of non-smokers was 116 (33%). The patients who reported this harmful habit in the past (former smokers) are respectively – 91 (25.9%). Their percentage distribution by groups and frequency (N) is reflected in Table 4 and Fig. 7.

Table 4 Distribution of patients by smoking group

Smoking			
		Frequency N	**%**
	smoker	144	41,0
	Never smoked	116	33,0
	Former smoker	91	25,9
	Total	351	100,0

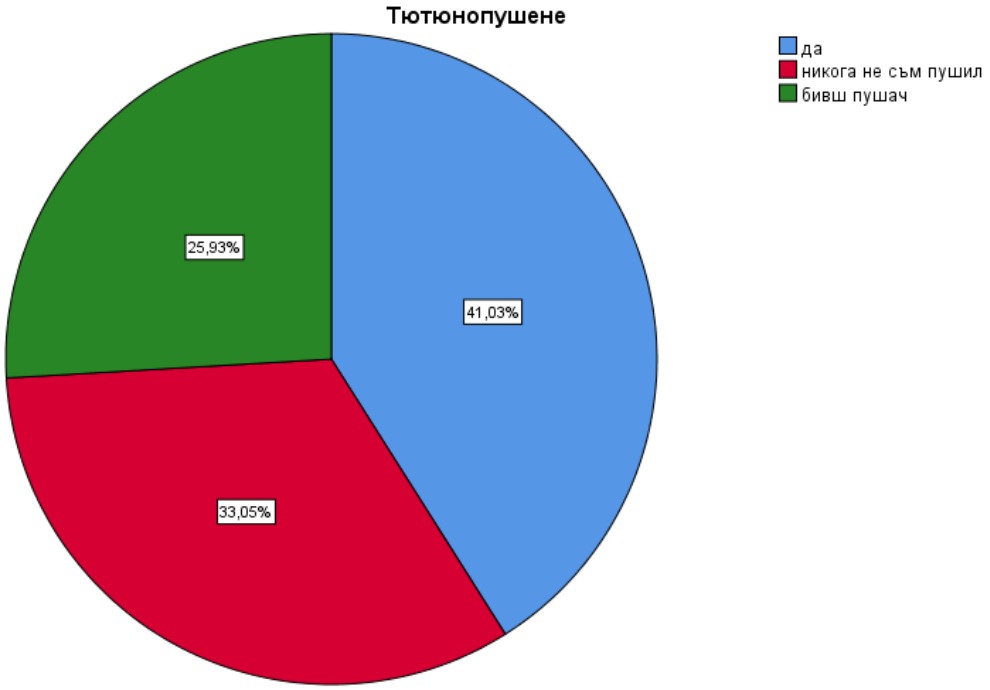

Fig.7 Distribution of patients according to smoking
Legend: blue- smoker, red – never smoked, green – former smoker

Another common risk factor is alcohol intake. Our statistical data from the conducted survey indicate that the number of patients who indicated that they use alcohol "yes, sometimes" - 263 (74.9%), followed by the group of those who consume alcohol "daily" - 39 (11, 1%).

The percentage distribution and frequency (N) of stroke patients according to their alcohol consumption is shown in Table 5 and Fig. 8.

Table 5 Distribution of patients according to alcohol consumption

Alcohol use			
		Frequency N	**%**
	Yes, everyday	39	11,1
	Yes, sometimes	263	74,9
	Not consume	22	6,3
	Consumed in the past	27	7,7
	Total	351	100,0

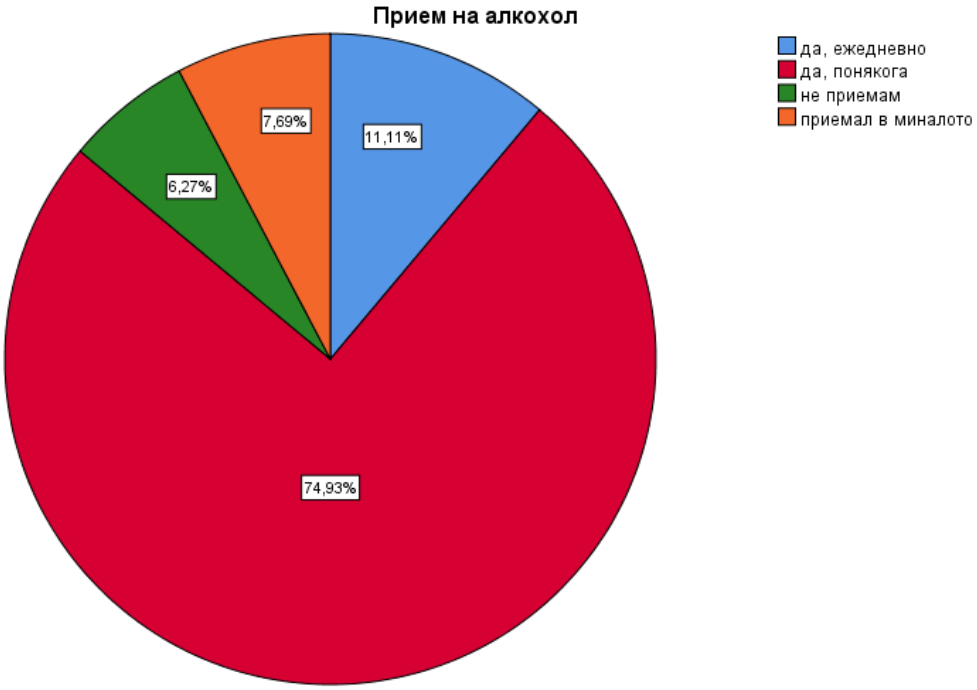

Fig.8 Distribution of patients according to alcohol intake

Legend: red – yes, sometimes, blue- yes, everyday, orange – consumed in the past, green – not consume

In the studied population, it was found that both studied behavioral factors (alcohol consumption and smoking) showed a statistically significant correlation dependence with the diagnosis of stroke, and in those using alcohol it was more pronounced (r=0.207, p=0.015). Current and former smokers were also associated with a higher incidence of stroke (r=0.186, p=0.014) - table 6.

	Alcohol intake	**Smoking**
r	0,207	0,186
p-value	0,015	0,014

Table 6 Correlation between behavioral risk factors and stroke

The most common modifiable risk factor for stroke among the studied population was hypertensive disease – 328 (N) people, followed by dyslipidemia – 292 (N) and diabetes mellitus – 95 (N) patients.

The table (Table 7) presents our results for the modifiable risk factors for stroke and their frequency in relation to the total number of patients:

Indicator	**Patients N=351**		**Patients N=351**	
	yes (N)	%	No (брой N)	%
HD	328	93,4	23	6,6
Dyslipidemia	292	83,2	59	16,8
Diabetes melitus	95	27,1	256	72,9
Heart failure	93	26,5	258	73,5
IHD	73	20,8	278	79,2
Atrial fibrillation	33	9,4	318	90,6
neoplasms	19	5,4	332	94,6
coagulopathies	3	0,9	348	99,1
Foramen ovale	2	0,6	349	99,4

Table 7 Distribution of patients according to the studied modifiable risk factors

From the correlation analysis of modifiable vascular risk factors and the diagnosis of stroke, we found that only dyslipidemia had a statistically significant direct relationship with the diagnosis (r=0.199, p=0.001).

The correlation data between the main vascular risk factors and the diagnosis are presented in Table 8.

	HD	**DM**	**AF**	**Heart failure**	**dyslipidemia**
r	0,106	0,083	0,075	0,060	0,199
p-value	0,136	0,297	0,367	0,532	0,001

Table 8 Correlations between modifiable risk factors and diagnosis

5.2.3. Occupational risk factors

According to our study, the largest share of patients with work experience between 30-40 years - 168 (47.86%), followed by the group of patients who indicated work experience between 20-30 years - 101 (28.77%), while patients 51 (14.53%) have the longest working experience – more than 40 years.

Table 9 and Fig. 9 show the distribution of stroke patients by frequency (N=number) and percentage (%) according to their total work experience.

Table 9 Distribution of stroke patients according to their total work experience

total work experience			
		Frequency (N)	**%**
	Under 5 years	4	1,1
	between 5 и 10 y	10	2,8
	between 10 и 20 y	17	4,8
	between 20 и 30 y	101	28,8
	between 30 и 40 y	168	47,9
	over 40 y	51	14,5
	Total	351	100,0

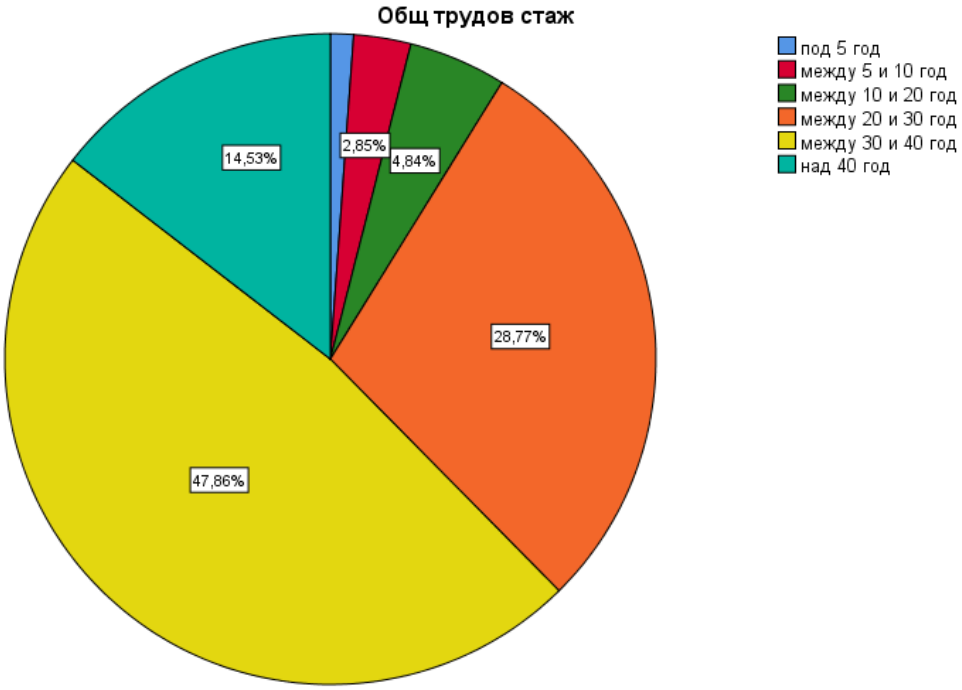

Fig.9 Distribution of patients according to their total work experience

Legend: yellow - between 30 и 40 y , orange - between 20 и 30 y , petrol green - over 40 y, green- between 10 и 20 y , red- between 5 и 10 y , blue- Under 5 years

Table 10 Distribution of patients according to their specific work experience by frequency (N=number) and percentage %

specific work experience			
		(N)	%
	under 5 y	79	22,5
	between 5 и 10 y	157	44,7
	between 10 и 15 y	81	23,1
	between 15 и 20 y	29	8,3
	over 20 y	5	1,4
	total	351	100,0

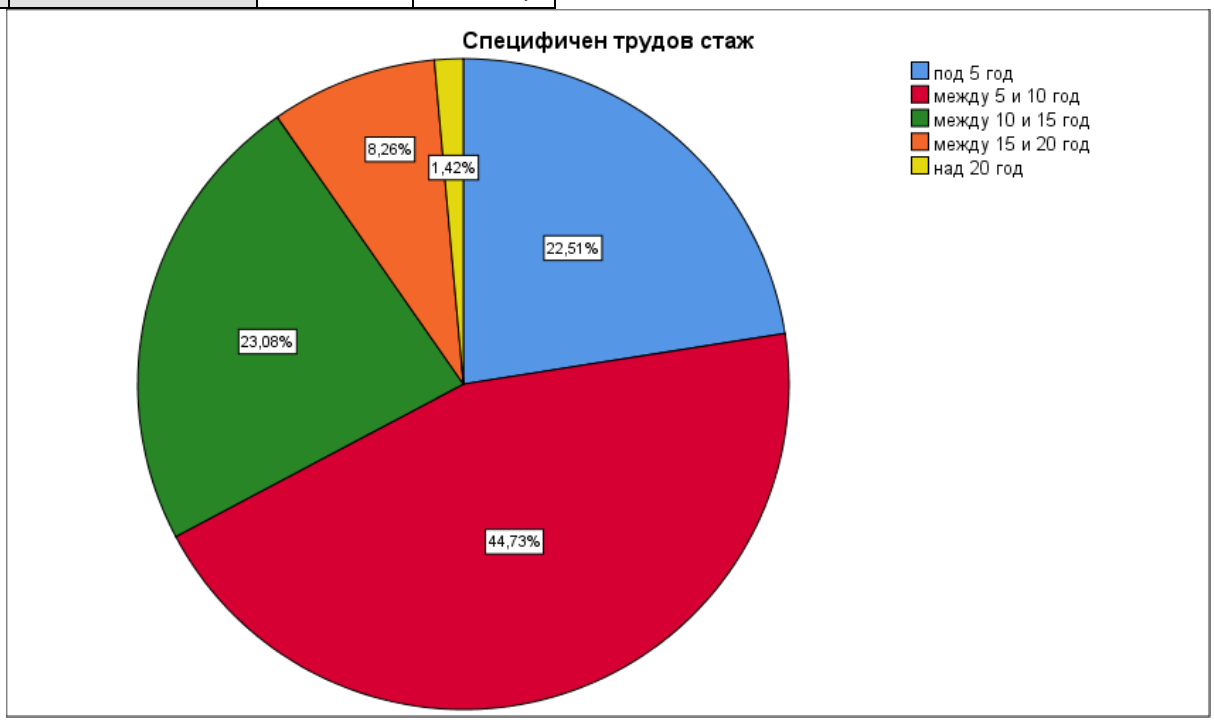

Fig.10 Distribution of patients according to their specific work experience

Legend: red - between 5 и 10 y , green- between 10 и 15 y, blue - under 5 y, orange - between 15 и 20 y , yellow - over 20 y

Among the occupational risk factors studied by us, the total work experience showed the most significant correlation dependence with the diagnosis of stroke (r=0.238, p=0.020), and the patients with work experience between 30-40 years are most at risk of having a stroke.

Among our patients, there is a significant preponderance of those who stated that their profession is mainly physical work - 281 (80.06%), compared to those who indicated that they mainly do mental work - 70 (19.94%).

Table 11 and Fig. 11 show the distribution of stroke patients according to the type of work (profession) they perform - by number and %.

Table 11 Distribution of stroke patients according to profession

Profession			
		(N)	**%**
	mainly physical work	281	80,1
	Mainly mental work	70	19,9
	Total	351	100,0

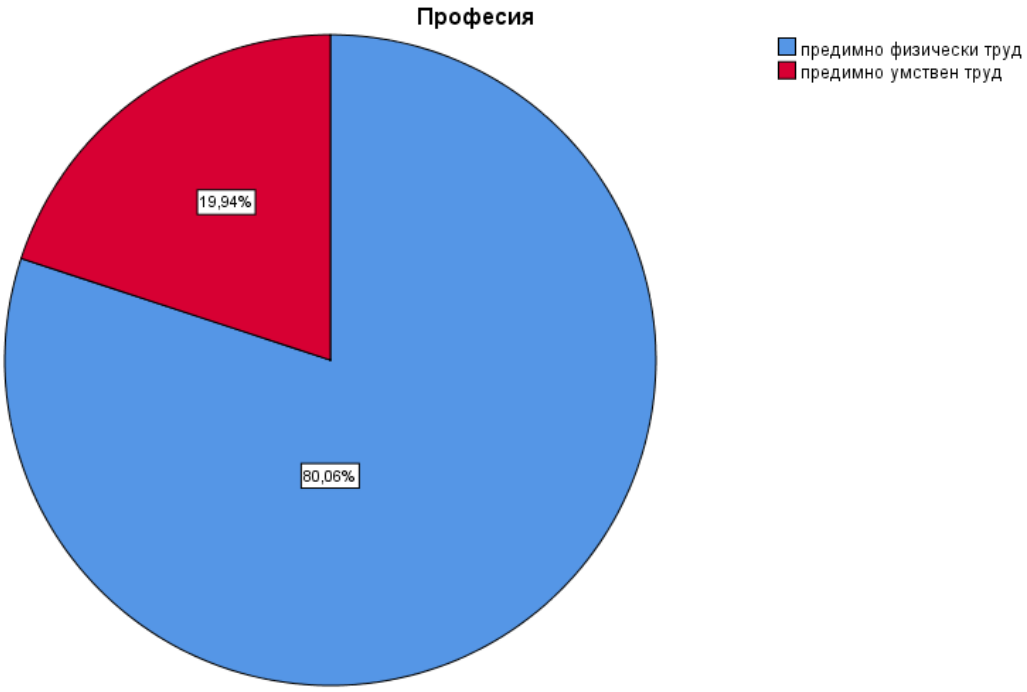

Fig.11 Distribution of patients according to profession
Legend: blue - mainly physical work , red - Mainly mental work

Our data analysis shows that occupation is also related to the likelihood of stroke among workers, with the relationship being directly proportional (r=0.158, p=0.011). Those working mainly in physical labor are the most at risk.

Occupational hazards were also studied, with a significant proportion of patients reporting that they work in an environment with a predominance of physical hazards (factors) - 257 (73.22%), while those who indicated chemical hazards were only 70 (19.94%) , and the least biological hazards – 20 (5.7%). We failed to find a statistically significant correlation between occupational hazards and stroke (r=0.092, p=0.807>α=0.05).

Table 12 and Fig. 12 show the percentage distribution and frequency (N) of stroke patients according to their occupational hazards.

Table 12 Distribution of occupational risk factors (occupational hazards) among stroke patients

Occupational hazards			
		(N)	%
	chemical	70	19,9
	physical	257	73,2
	biological	20	5,7
	other	4	1,1
	Total	351	100,0

Fig. 12 Distribution of patients according to occupational risk factors (occupational hazards)

Legend: red – physical, blue – chemical, green – biological, orange – other

Our results show significant differences between the patients regarding the work mode, with 305 (86.89%) of them reporting a normal work mode, compared to 46 (13.11%) - a shift work mode - table 13 and fig. 13.

Table 13 Distribution of patients according to type of work

Type of work			
		(N)	%
	Normal work mode	305	86,9
	Shift work mode	46	13,1
	other	351	100,0

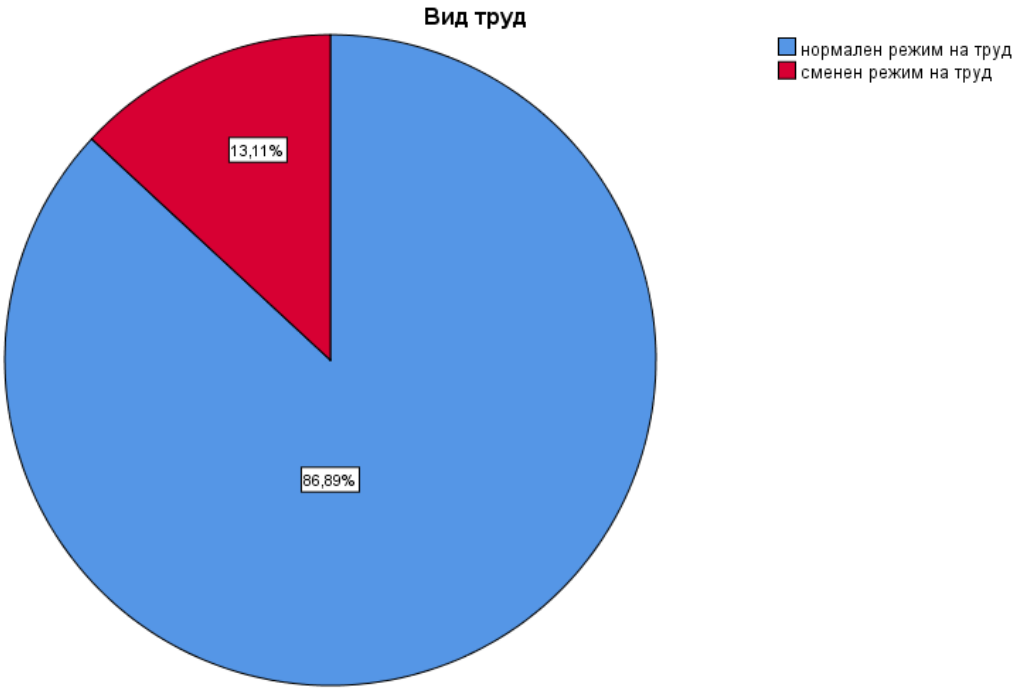

Fig.13 Distribution of patients according to work mode
Legend: blue – normal work mode, red- shift work mode

A weak relationship was found, without significant statistical value (r= 0.023, p=0.912).

Regarding the length of the working day, the group of patients reporting an 8-hour working day is the leading group - 283 (80.63%), followed by that of a 12-hour working day - 40 (11.4%), on an irregular working day time - 19 (5.41%), on a 4-hour working day - 7 (1.99%) and over a 12-hour working day - 2 (0.6%) - table. 14 and fig.14.

Table 14 Distribution of stroke patients according to the length of the working day

The length of the working day			
		(N)	**%**
	8 hours	283	80,6
	12 hours	40	11,4
	over 12 hours	2	,6
	4 hours	7	2,0
	irregular working hours	19	5,4
	Total	351	100,0

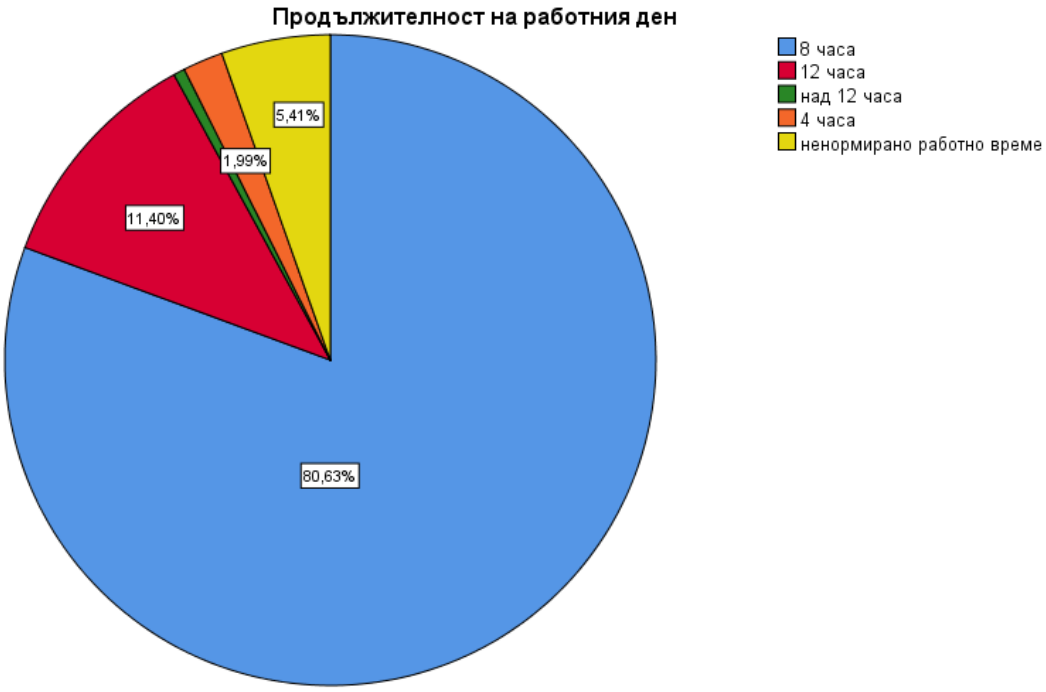

Fig.14 Distribution of patients according to the length of the working day

Legend: Blue – 8 hours, red – 12 hours, yellow – irregular working hours, orange – 4 hours, green- over 12 hours

The analysis of our data showed no correlation between the length of the working day and the risk of stroke (r=0.096, p=0.84).

Regarding the factors of the work process - location, the largest proportion of our stroke patients working "indoors" - 215 (61.3%), followed by the proportion of those working in a "combined" (outdoor and indoor) location - 104 (29.6%) and the smallest is the share of those working "outdoors" - 32 (9.1%) - table 15. A statistically significant direct relationship was found between the diagnosis and the work location (r=0.179, p=0.020), with those working indoors being the most at risk of having a stroke - table 15.

Our research data show a significant proportion of stroke patients working in a dynamic work posture (49%) and a positive correlation with the diagnosis of stroke (r=0.182, p=0.017) - table 15 and table 16.

The predominant part of the participants shared about "uniform" work movements - 207 (59%), and 144 (41%) of them - about "diverse" - table 15.

The share of patients from our study who reported that they do not work "normally" is significant - 289 (82.3%), compared to those who work "normally" - 62 (17.7%) - table 15. A positive correlation was found between those who do not work "normally" and an increased frequency of stroke (r=0.162, p=0.041) - table 16.

Factors of the labor process		Patients N=351	
		N	%
Location	Outdoor	32	9,1
	Indoors	215	61,3
	Combined	104	29,6
Working posture	Hypodynamic	108	30,8
	Dynamic	172	49
	Forced	71	20,2
Work movements	Uniform	207	59
	Diverse	144	41
Norma	yes	62	17,7
	no	289	82,3

Table 15 Distribution of patients according to the factors of the labor process

	Total work experience	Profession	Workflow location	Work posture	Work movements	Performance rate	Mode of work	Stress at work (survey)
r	0,238	0,158	0,179	0,182	0,164	0,162	0,023	0,118
p-value	0,020	0,011	0,020	0,017	0,008	0,041	0,912	0,292

Table 16 Correlations between occupational factors and stroke

In their survey, the patients also reflected their levels of work stress, with a significant proportion of those denying being under stress at work - 196 (55.8%), followed by the second who reported stress " during less than 50% of the working day" - 143 (40.7%) and the least are those working "under stress, more than 50% of the working day" - 12 (3.4%) - table. 17 and fig.15.

Table 17 Distribution of stroke patients according to stress levels at work (survey)

Workplace stress			
		(N)	**%**
	yes, more than 50%	12	3,4
	yes, less than 50 %	143	40,7
	no	196	55,8
	Total	351	100,0

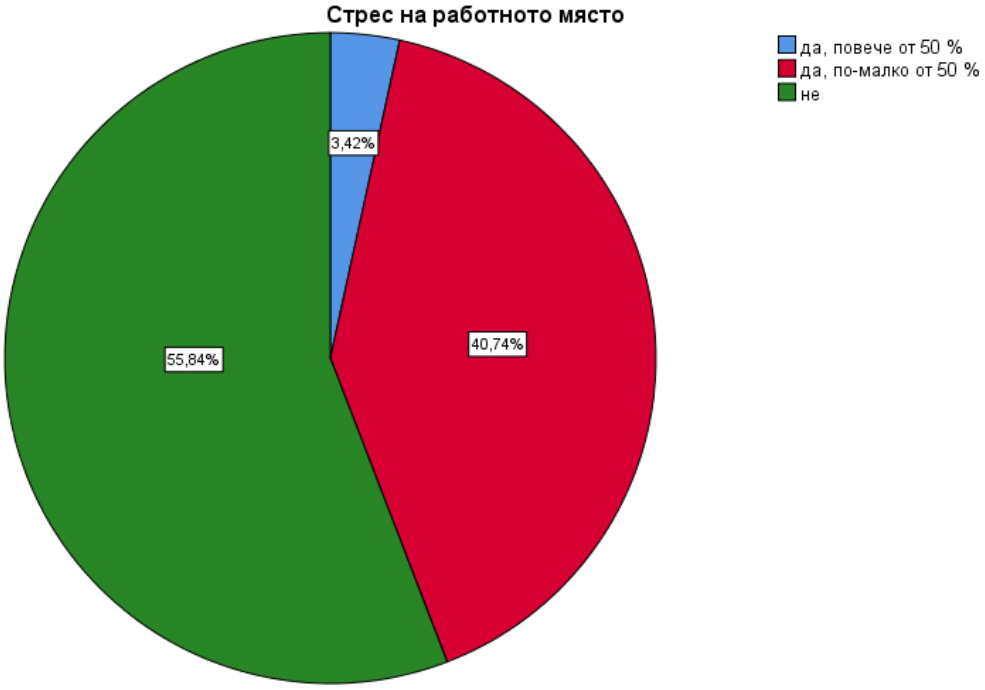

Fig.15 Distribution of patients according to stress levels at work (survey)
Legend:green – no, red - yes, less than 50 %, blue - yes, more than 50%

5.2.4. Scale for assessing the severity of strokes - National Institute of Health Stroke Scale – NIHSS

According to the NIHSS - the generally accepted scale for assessing the severity of stroke, the average stroke severity of patients at admission was higher - 9.95 ± 8.85 (points) compared to that at discharge - 3.28 ± 4.64 (points). A detailed distribution of patients according to stroke severity at hospitalization and discharge is presented sequentially in Fig. 16 and fig.17.

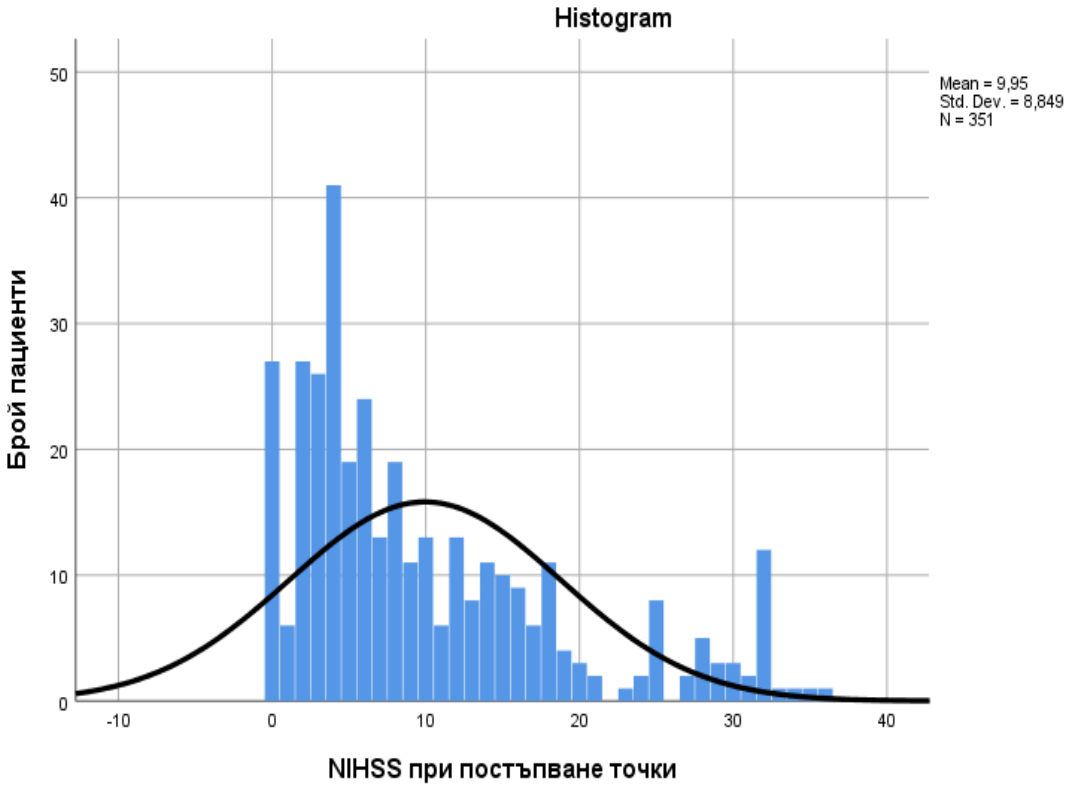

Fig.16 Distribution of patients according to NIHSS-assessed stroke severity at admission

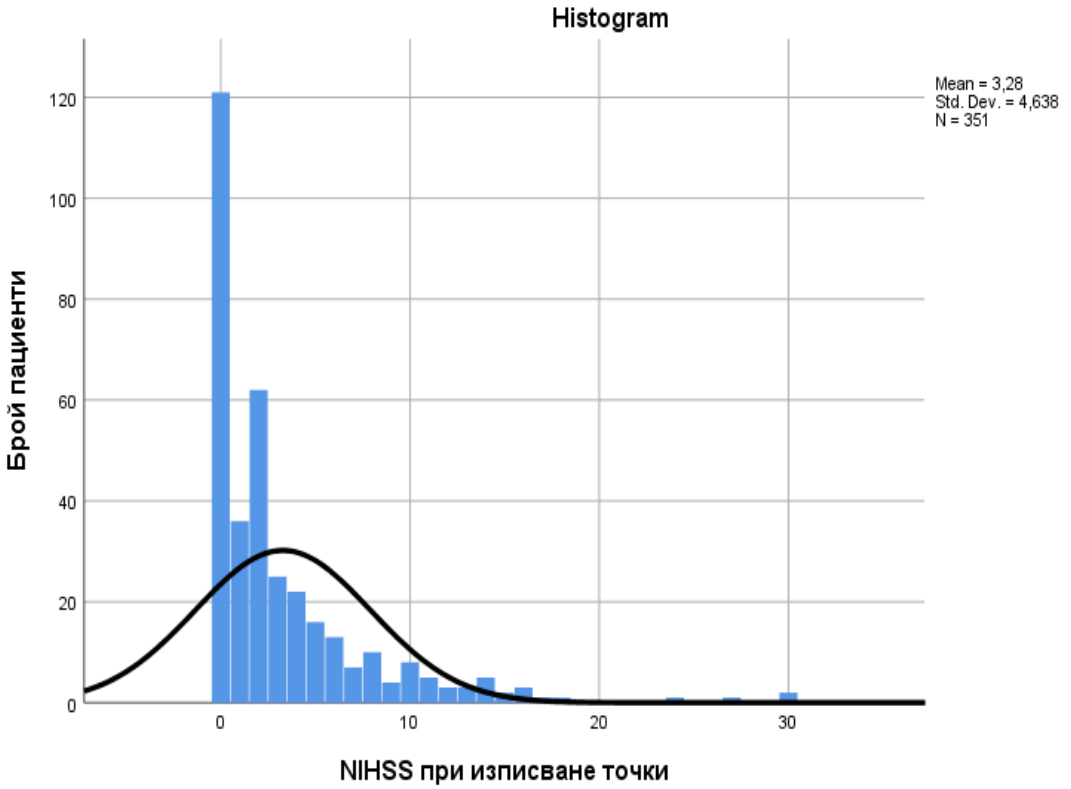

Fig.17 Distribution of patients according to NIHSS-assessed stroke severity at discharge

Discharged patients in stable general condition (n=230) according to NIHSS were analyzed. A mean NIHSS at admission was found to be 7.77 points, with a standard deviation of 5.552, while a mean NIHSS at discharge was 5.00 points, with a variation of 4.921. The difference in the average values of the NIHSS index at admission and discharge is 2.722 points. The difference can be considered statistically significant ($p=0.000< \alpha=0.05$).

6. Discussion

In recent decades, a large number of studies related to the incidence of stroke in the world population have been published. It has been established that the frequency of strokes increases with advancing age, but a significant proportion of them also affect "younger people" of working age under 65 (Daniel et al.).

The results of our study show that the mean age of our patients at working age is 55.8 ± 7.092 years, approximately 56 years. These data are consistent with those reported in the world literature for an increase in the absolute number of stroke patients over the last two decades and the increasing incidence among young people (Potter et al.), the main contributor to this being the increase in vascular risk factors (CB, DM, dyslipidemia, CHF, cardiac arrhythmias) and harmful habits (alcohol, smoking), and their increasing severity is a prerequisite for shortening the productive years of life (Feigin et al.). Our results closely approximate the results of a study by Kersten P. et al., which reported a mean age of working-age participants of 55 years (Kersten et al.), as well as that of Walters R. et al., citing an average age of participants in their study of 58 years (Walters et al.).

Our stroke patients are predominantly male - 68.9% men and 31.1% women. It is noteworthy that the largest share of men suffered an ischemic stroke - 188.

The results of our study showed the presence of a straight relationship with statistical significance between gender and diagnosis ($r= 0.16$, $p=0.017<\alpha=0.05$). Stroke remains the second leading cause of death worldwide and the third leading cause of death and disability combined (Feigin et al.). In the population studied by us, a greater frequency of morbidity is reported among men (68.9%), which is also a confirmation with the opinion on a global scale that with increasing age (especially after 35 years), the frequency of stroke among men also increases. gender (Potter et al.). In the study by Walters R. and co-authors, a higher proportion of the male sex was similarly reported among the studied population of working age – 73% (Potter et al.), as well as by Kersten P. (Kersten et al.). Our data also correspond to data from the world literature on the increased incidence of stroke among males.

Smoking is a well-established behavioral risk factor for all stroke subtypes. The prevalence of tobacco use has remained largely unchanged over the past quarter century, with a trend to increase despite current rates of population growth (Shah and Cole et al.).

The likely mechanisms by which tobacco smoke exposure may increase the risk of stroke and heart disease are numerous and include carboxyhemoglobinemia, increased platelet aggregation, increased fibrinogen levels, decreased HDL-cholesterol, and direct toxic effects on the vascular endothelium with progression of atherosclerosis (Shah and Cole et al.).

Our study data also recorded a higher risk of stroke among current and ex-smokers compared to non-smokers, with a correlation of $r=0.186$ and $p=0.014$. Various researchers have also reported the strong association between stroke and smoking (Bonita et al.), (Qureshi et al.), (Tse et al.).

Another behaviorally modifiable risk factor for acute cerebrovascular accident is alcohol consumption. However, the findings are conflicting, with most considering the effect of alcohol to be

dose-dependent. In a study by Xin Liu and coauthors summarized their data, moderate alcohol consumption was associated with a lower risk of stroke compared to non-drinkers (Liu et al.). Another analysis (Reynolds et al.) also concluded that light or moderate consumption may protect against stroke, while heavy alcohol consumption increases the relative risk. Controversial are the interpretations of a study by Sara B Jones and co-authors who reported that light to moderate alcohol consumption in middle age was not associated with a reduced risk of stroke compared to abstainers in the 20-year follow-up study Atherosclerosis Risk in Communities (Jones et al.). A cohort study in the US middle-aged population also showed that light to moderate alcohol consumption did not significantly reduce the risk of ischemic or hemorrhagic stroke (Rotondo et al.).

Our data report a statistically significant correlation between alcohol consumption and increased incidence of stroke in the study population ($r=0.207$, $p=0.015$), but do not confirm most claims in the world literature that light to moderate consumption reduces the risk of stroke compared to severe . These controversies may be due to the heterogeneity of stroke subtypes, potential differences in the effect of alcohol across ethnic groups (racial characteristics) and gender, and different types and amounts of alcohol consumption (Liu et al.).

In the study of the modifiable vascular risk factors (CHD, DM, atrial fibrillation, heart failure) and the diagnosis, a weak direct relationship was found without reaching statistical significance ($p>0.05$), and only dyslipidemia was found to have a statistically significant correlation with the diagnosis ($r=0.199$, $p=0.001$).

Risk factors can be classified as non-modifiable and modifiable. The first group includes: gender, age, race, genetic predisposition, and the second group: hypertension, diabetes mellitus, hypercholesterolemia, lifestyle factors, as well as those related primarily to one of the subtypes of stroke. For example, atrial fibrillation is a known risk factor for ischemic stroke but not for hemorrhagic stroke (Endres et al.).

Hypertension has been identified as the single most important modifiable risk factor for both ischemic and hemorrhagic stroke (Prabhakaran and Chong). In the present study, it was found that a significant proportion - 93.4% of our stroke patients were hypertensive. Numerous studies also prove the leading role of arterial hypertension in the etiopathogenesis of stroke (O'Donnell et al.), (Prabhakaran and Chong), (Tsai et al.).

Dyslipidemia was the second most frequent modifiable risk factor among our participants, with a share of 83.2%. It is an important risk factor for cardiovascular disease (Prospective Studies Collaboration et al.), but still the relationship between cholesterol and stroke remains controversial, possibly due to the heterogeneity of stroke. A large meta-analysis (Prabhakaran and Chong) found that low-density lipoprotein (LDL) cholesterol, high-density lipoprotein (HDL) cholesterol, and very-low-density lipoprotein (but not HDL) - cholesterol and triglycerides) are associated with ischemic stroke. Two other studies ("Cholesterol, diastolic blood pressure, and stroke," 1995) on the contrary - did not establish a relationship between cholesterol levels and cerebrovascular disease. Lewington S. and co-authors concluded that there is no clear relationship between blood cholesterol level and stroke, except in people aged 40-60 years and with normal blood pressure (Prospective Studies Collaboration et al.). The Berlin "Cream&Sugar" study (Ebinger et al.) reported that cholesterol was probably associated with an increased risk at least in the subgroup of atherothrombotic strokes.

Analysis of data from our participants reported a weak linear relationship with statistical significance between dyslipidemia and stroke ($r=0.199$, $p=0.001$). It is likely that the differences in results between individual studies can be related to the difference in the age ranges of the study populations, the lack of differentiation between stroke subtypes, the comorbidity of the patients, the difference in the lifestyle and dietary habits of the different communities.

The third most frequent modifiable risk factor among patients in our current study was diabetes mellitus - 27.1%, which is a well-known risk factor for neurovascular disease. A significant proportion of hospitalized stroke patients have comorbid diabetes mellitus, and the trend over time is for the disease to affect 642 million people worldwide by 2040 (Lau et al.). A large international, multicenter, case-control study in 32 countries (O'Donnell et al.) found diabetes to be present in 26% of hospitalized acute stroke patients. Other studies (Gray et al.), (Zahra et al.) have estimated that approximately 20-33% of hospitalized acute stroke patients may have diabetes. These data converge to a very large extent with our results on the prevalence of diabetes mellitus in the analyzed stroke population.

Heart failure is another known risk factor for ischemic stroke of suspected cardioembolic origin. The proportion of our patients with ischemic stroke and chronic heart failure was 26.5%, which is close to the reported by Kolominsky-Rabas P L and co-authors (Kolominsky-Rabas et al.) in their study of 10-24% patients with existing heart failure. The variability in epidemiologic data on the incidence of heart failure among stroke survivors is possibly due to the heterogeneity of published studies, as well as the fact that the clinical characteristics of patients with chronic heart failure can vary (Haeusler et al.).

Atrial fibrillation is the most common sustained cardiac arrhythmia, which is associated with a fivefold increase in the risk of ischemic stroke, and strokes are more often fatal or result in severe disability (Choi et al.). Its frequency among the stroke population studied by us is 9.4%, and the proportion of patients with ischemic stroke and existing AF is 10.6%. Our data differ from those reported in a large Chinese study conducted by Tsai F. et al. (Tsai et al.) – 23.8% patients with AF and ischemic stroke. It is possible that our lower rate is related to the lower average age of the patients we studied, comorbidity (valvular/nonvalvular AF, coagulopathies, neoplasms), and the quality of secondary prophylaxis of already known premorbid AF.

Of the modifiable vascular risk factors analyzed by us, only dyslipidemia showed a statistically significant correlation dependence ($r=0.199$, $p=0.001$). Among the other studied modifiable vascular risk factors (CHD, DM, HF and AF), although a high percentage of frequency, respectively a higher risk of stroke was found, no statistically significant correlation with stroke was found. The differences between the correlations mentioned in the world literature and the results of our analysis may be related to differences between the demographic characteristics of the studied populations, the genetic predisposition to diseases, the comorbidity of the patients, the difference in lifestyle, the culture of nutrition, the spread of harmful habits , migration, etc.

Stroke is the leading cause of long-term disability among adults, making it a major public health problem (Katan and Luft). Categorizing stroke risk factors into modifiable and non-modifiable ones has a leading role in the prevention and control of cerebrovascular diseases. The Global Burden of Disease Study estimates that 33.4% of the burden of stroke (measured in disability-adjusted life years) is attributable to potentially modifiable environmental and occupational risk factors worldwide (Feigin et al.). Therefore, reducing exposure to these factors should be a priority to reduce the burden of stroke in many countries. The workplace has been reported in the world literature as an important area of focus for stroke prevention and treatment.

Our data analysis shows that occupation is also related to the likelihood of stroke among workers, with the relationship being directly proportional ($r=0.158$, $p=0.011$). Those working mainly in physical labor are the most at risk.

The type of work (occupation) is an important modifiable risk factor from the work environment. Authors in world literature broadly divide it into primarily physical and primarily mental. The terms "blue collar" and "white collar" were introduced for the first time in the 20s of the

20th century in the USA and are interpreted respectively as "blue collars - working mainly physical labor" and "white collars - working mainly mental work" (" Blue-collar worker," 2023). The interpretations of the results of our analysis show a significant proportion of patients with stroke working mainly in physical labor - 80.1%, and we have established a statistically significant association between the type of work and the diagnosis of stroke. A large Japanese study examining the impact of occupational stress and stroke across occupational classes and genders (Tsutsumi et al.) reported a significantly higher risk of acute stroke among blue-collar workers compared to white-collar workers. which is also consistent with our results. In this type of workers, a higher risk of stroke is reported, probably due to a number of factors - a higher risk of hypertension, dyslipidemia and diabetes mellitus, obesity is more often found, due to low physical activity in free time and an unhealthy diet. In addition, they are more prone to harmful habits such as alcohol abuse and smoking (Crane et al.). A higher proportion of patients with hypertension, dyslipidemia, diabetes mellitus, and harmful habits was also found in our studied stroke population.

Occupational hazards were also studied, with a significant proportion of patients reporting that they work in an environment with a predominance of physical hazards (factors) - 257 (73.22%), while those who indicated chemical hazards were only 70 (19.94%) , and the least biological hazards – 20 (5.7%).

Exposure to different types of occupational hazards and their impact on human health is also a widely discussed topic in numerous studies. The negative impact of physical, chemical and biological hazards on the body is known, even more so if they are also part of his working environment, where he spends a large part of his time. In our study, the largest share of workers exposed to physical harm was found (73.2%). Various researchers ("Erikson:Biological mechanisms related to cardiovascular, Google Science," n.d.), (Yang et al., 2023), (Weihofen et al.), (Teixeira et al.) in large-scale studies proved the role of noise as a risk factor for cardiovascular and cerebrovascular diseases, which also corresponds to the data of our study. A significant percentage of our patients reported occupational exposure to chemical hazards (19.9%), for which in the world literature there are also many studies proving that they increase the risk of vascular diseases and stroke (Yen et al.), (" Gustavsson: Occupational exposure and stroke, Google Science," n.d.), (Yang et al.), ("Kim:Related factors of diagnosis of chronic carbon, Google Science," n.d.), (Kulick et al.). However, we failed to find a statistically significant correlation between occupational hazards and stroke ($r=0.092$, $p=0.807>\alpha=0.05$), possibly due to our small number of participants (N=351) compared to other studies.

Our results show significant differences between patients regarding work mode, with 305 (86.89%) of them reporting a normal work mode, compared to 46 (13.11%) reporting a shift work mode.

In modern societies, about 20% of the workforce works in shifts ("Working time and the future of work, Google Science," n.d.), and numerous studies show that shift work can also have adverse health effects, including brain- vascular diseases (Vyas et al.), (Bigert et al.). Our results failed to show a regularity between work mode (normal or shifted) and stroke risk, possibly due to the small number of patients included (N=351), comparable to the significantly larger number reported in the literature. A weak relationship was found, without significant statistical value ($r= 0.023$, $p=0.912$).

There is a lot of evidence in the world literature (Kivimäki et al.), (Virtanen et al.), (Kang et al.) about long working hours and the risk of CVD and MSDs. In a large meta-analysis (N=528,908) by Kivimaki M. et al. reported that those working ≥ 55 hours per week had a 1.3 times higher risk of stroke compared to those working standard hours (35-40 hours per week). Possible pathophysiological mechanisms are associated with chronic stress, increased risk of hypertension,

diabetes mellitus, low physical activity and obesity, tendency to harmful habits among workers (Kivimäki et al.).

Our data analysis showed no correlation between the length of the working day and the risk of stroke (r=0.096, p=0.84), probably due to the small number of patients included (N=351), comparable to the significantly larger number of those in other reported global studies, as well as possible differences in length of employment at the last job, occupation, social status and age.

The characteristics of the participants' work process were also studied. According to the location of the work process, the number of patients working indoors is the largest - 215 (61.3%), while the number of those working in a "combined" (open and closed) location is twice as small - 104 (29.6%), and the smallest number of those working "outdoors" – 32 (9.1%). We found a positive correlation between the location of the work process and the diagnosis (r=0.179, p=0.020), with those working "indoors" being most at risk of stroke. Being “outdoors” is known to be associated with greater exposure to air pollutants associated with an increased risk of stroke (Xu et al.). Our data do not correspond to the opinion in the world literature, which may be due to the different number of patients included in ours compared to other studies.

Regarding the working posture, almost half of our patients reported a dynamic working posture - 172 (49%), 108 (30.8%) - a hypodynamic one, and the least - 71 (20.2%) of the patients reported a forced working posture pose. Work posture was associated with a higher incidence of stroke (r=0.182, p=0.017) in our study population, with a predominance in patients adopting a dynamic work posture during the work process.

The predominant part of the participants shared about "uniform" work movements - 207 (59%), and 144 (41%) of them - about "diverse".

The proportion of patients from our study who reported that they do not work "normally" is significant - 289 (82.3%), compared to those who work "normally" - 62 (17.7%). A positive correlation was found between those who do not work "normally" and an increased frequency of stroke (r=0.162, p=0.041).

A review of the literature shows conflicting data on the health effects associated with physical activity, with occupational physical activity positively associated with the incidence and mortality of cardiovascular disease, including stroke, while leisure-time physical activity reduces risk (Hall et al.). (Hu et al.). These studies also looked at the dynamic and upright work posture, which is respectively associated with higher occupational physical activity and makes it also an occupational risk factor for cerebrovascular and cardiovascular diseases. This health paradox Hall C. and co-authors explain with a longer increase in heart rate and blood pressure, the mediation of prolonged inflammatory reactions in the vascular wall and the development of atherosclerosis underlying vascular diseases. Our study data showed a significant proportion of stroke patients working in a dynamic work posture (49%) and a positive correlation with stroke diagnosis (r=0.182, p=0.017), which is consistent with the thesis in the cited global studies. The nature of work movements was also investigated, as the majority of patients indicated to us that they performed "uniform" ones - 59%, we also registered a statistically significant correlation between them and the diagnosis of stroke (r=0.164, p=0.008). According to global studies, this type of movement is associated with more fatigue, is associated with more chronic work stress and respectively leads to vascular disorders (Hall et al.), (Collins), (Chaharaghran et al.). Although a dynamic work posture is theoretically associated more often with the performance of "more diverse" movements, our data found that "uniform" work movements predominated among our patients. It is possible that this dissociation is also due to our relatively large number of patients who reported a "forced work posture" (20.2%), which is also associated with performing mostly "uniform" movements.

Workplace stress is a significant occupational risk factor for stroke. Multiple extensive studies have reported the relationship between stress and increased risk of cardiovascular and cerebrovascular diseases (Fransson et al.), (Huang et al.), (Lee and Kim). In a large meta-analysis by Fransson E. et al with N=196,380 working-age individuals, it was noted that workplace stress was associated with an approximately 20% increased risk of acute ischemic stroke. No association was observed with overall risk of stroke or hemorrhagic stroke (Fransson et al., 2015). Determining the level of stress among the participants in our study was carried out on the basis of a survey, in which each of them self-determined how much of their working day is related to exposure to stress. Our results showed that the majority of patients - 55.8% denied being exposed to stress at work, but the proportion of those who reported a stress level < of 50% of the working day was also not small (40 .74%). Higher levels of stress at work (survey) showed a weak relationship, with no statistical significance (r=0.118, p=0.292). Although our analysis did not show a statistically significant correlation between stress and an increased incidence of stroke, it could be noted that these results could be due on the one hand to the insufficient number of patients included in our study (N=351) in compared to the other studies cited (N= 138,782, N= 50,114, N=190,000). On the other hand, our patients were concerned only with the level of stress at their last workplace, and as we know, chronic stress has a cumulative nature and is also influenced by the length of total work experience, and a large percentage of our patients have work experience between 30 and 40 years (47.86%). We calculated a statistically significant correlation between total work experience and the risk of stroke (r=0.238, p=0.020), and it has already been discussed that with increasing age, other modifiable risk factors such as hypertension, dyslipidemia, diabetes, etc. increase.

We compared NIHSS scores at admission and discharge, which are considered an important predictor of stroke outcome and functional recovery. Our results showed a downward trend in NIHSS, with mean stroke severity at discharge of 5.00 ± 4.921 points. According to the NIHSS scale, this score corresponds to a mild to moderate neurological deficit, which could be associated with a greater likelihood of our patients returning to work, which has a significant impact on their quality of life after an acute cerebrovascular accident (Tan et al.).

7. Conclusion

In the course of the present work, we analyzed the risk profile of patients with realized acute stroke. We assessed the influence of non-modifiable and modifiable vascular risk factors, as well as occupational factors and harms, on the incidence of stroke. We investigated the level of occupational stress and its impact among our patients. We monitored and compared in dynamics the degree of recovery of the functional deficit - during hospitalization and dehospitalization.

We found a statistically significant correlation between age, gender and diagnosis. By analyzing the vascular risk profile of our patients, we found a high incidence of hypertension, dyslipidemia, diabetes mellitus, heart failure and coronary artery disease, atrial fibrillation, and dyslipidemia confirmed a positive statistically significant correlation with stroke. The main aim of our study was to determine the effect of occupational factors on stroke. In the analysis, we found an increased risk of stroke with increasing age and total work experience, and a positive correlation dependence was also confirmed. We found an increased frequency of stroke among patients working "mainly physical work", in a "closed" work room, with a normal work regime, dynamic work posture and uniform movements, without a performance norm. A statistically significant relationship was calculated between the stroke and "mainly physical work", work "indoors", dynamic work posture,

"uniform" movements and lack of performance norm. We found a high frequency of patients exposed to physical occupational hazards.

We investigated the level of stress, and our results did not show a high prevalence of high level of stress among the study population.

With regard to behavioral risk factors (alcohol and smoking), we found an increased risk of stroke among smokers and drinkers, reflecting a statistically significant correlation between them and stroke.

We compared participants' NIHSS scores at admission and discharge, finding a trend toward lower scores being associated with better prognosis, greater likelihood of recovery, and faster return to work.

8. Conclusions

1). The frequency of stroke increases statistically significantly among men and with increasing age of patients;
2). Dyslipidemia from vascular risk factors increases the incidence of stroke;
3). The frequency of stroke is statistically significantly increased in patients with smoking and alcohol use.;
4). Longer working experience (>30 years), work related to "mostly physical work", work "indoors", dynamic work posture, monotonous movements, lack of performance norm, statistically significantly increase the frequency of stroke;
5). The length of the working day, stress and work mode were not found to increase the incidence of stroke in the study population;
6). Analysis of NIHSS data at admission and at discharge showed a downward trend that corresponded with a better prognosis and potential for long-term recovery.

9. Contributions

Contributions of original character

1). For the first time in our country, a study was conducted on the influence of occupational risk factors in the epidemiology of cerebral strokes in patients of working age;

2). The relationship between levels of occupational stress and stroke in patients of working age was analyzed;

3). A comparative analysis of the degree of recovery of the functional deficit from the stroke during hospitalization and dehospitalization in patients of working age was carried out.

Contributions of a confirmatory nature

1). The role of the vascular risk factor dyslipidemia and the demographic risk factors age and gender in increasing the frequency of stroke is confirmed;

2). The positive relationship between longer working experience, dynamic work posture, work related to "mostly physical work", monotonous work movements, lack of norm and stroke was confirmed.

10. Publications and scientific events related to the dissertation work

Publications:

1. Dimitrinka Rosenova Dimitrova, Aleksandra Yankova, Vladina Dimitrova-Kirilova, Veselinka Nestorova, Occupational risk factors in the epidemiology of cerebral strokes, Izvestiya na Union na uchitenite - Varna, Medicine and Ecology Series, '2022;27:16-20;
2. Vladina Dimitrova-Kirilova, Alexandra Yankova, Dimitrinka Rosenova, Mihael Tzalta-Mladenov, Veselinka Nestorova, Influence of the work regime on the risk factors for cerebrovascular disease-review; Varna Medical Forum, Vol 11, No 2 (2022);
3. Aleksandra Yankova, Kristiyan Georgiev, Dimitrinka Dimitrova, Vladina Dimitrova-Kirilova, Veselinka Nestorova, A patient with insomnia due to restless leg and periodic limb movement syndrome after stroke – A clinical case, Electronic Journal of General Medicine, 2023, 20(2), em445.

Scientific events:

1. Dimitrinka Rosenova, Alexandra Yankova, Vladina Dimitrova, Veselinka Nestorova, Occupational risk factors in the epidemiology of cerebral strokes, Jubilee scientific conference of MU Plovdiv, 2020 - poster;
2. Klara Dokova, Virginia Atanasova, Mihael Tsalta-Mladenov, Dimitrinka Rosenova, Gabriela Antonova, Vilian Gabrovski, Silva Andonova, Population-based stroke registry in Varna, Bulgaria: Feasibility and pilot data, Neuroepidemiology 2021;55(suppl 1):1 -106;
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In connection with the development of this dissertation, the author would like to thank:

- To his supervisor - Prof. Dr. Veselinka Dimitrova Nestorova, d.m. for guidance in practical work and help in writing the dissertation;
- To the members of the Department of Optometry and Occupational Diseases at the Medical University-Varna and to the staff of the Second Neurological Clinic with OLOMI and OILNB of the UMBAL "St. Marina" - Varna for the support and assistance provided;
- To all patients who agreed to participate in the present study;
- To the family

13. Applications

(Application 1) Survey

QUESTIONNAIRE

Identification number-.....
date:.....

1. DEMOGRAPHIC AND GENERAL DATA

1.1 Name: ....
/first name/ /surname/

1.2 Gander: M/F

1.3 Address: .....

1.4 Phone number:.....

1.5 Marital Status:

- ❑ Married/
- ❑ unmarried
- ❑ Widower/Widow
- ❑ Divorced
- ❑ Unable to answer

1.6 Education:

- ❑ No education
- ❑ Primary education
- ❑ Basic education
- ❑ Secondary education
- ❑ Secondary special education
- ❑ Secondary education
- ❑ Higher education

1.7 Wight- .....кg

1.8 Height-.....cm

2. DIAGNOSIS

- ❑ Ischemic stroke
- ❑ Hemorrhagic stroke

2.1 Level of consciousness assessment scale: GLCS……. т.;

2.2 Stroke severity rating scale: NIHSS…….т.

3. Clinical symptoms

3.1 Please indicate which of the following complaints were present and cause you to seek urgent medical attention?:

- ❑ distortion of the face, "hanging" of one corner of the mouth, numbness of the face;
- ❑ feeling of weakness (paralysis) or numbness in one arm and/or leg;
- ❑ speech disorders - slurred, slow or "broken" speech or loss of speech, difficulty understanding foreign speech;
- ❑ visual disturbance - sudden onset of blurred vision, double vision, blurring of vision or complete loss of vision;
- ❑ gait disorder - unstable gait, loss of balance, impaired coordination of movements, feeling dizzy;
- ❑ onset of headache - sudden onset of headache, accompanied by nausea, vomiting, impaired consciousness;
- ❑ swallowing problems – difficulty swallowing

3.2 Accompanying diseases according to medical records:

- ❑ Hypertension
- ❑ Diabetes melitus
- ❑ Dyslipidemia
- ❑ Atrial fibrilation

4.Diseases

Do you suffer from any of the following diseases?:

4.1 Hypertension

- ❑ Yes and I am being treated
- ❑ Yes, but I am not being treated
- ❑ No

4.2 Diabetes melitus

- ❑ Yes and I am being treated
- ❑ Yes, but I am not being treated
- ❑ No

4.3 Atrial fibrilation

- ❑ Yes and I am being treated
- ❑ Yes, but I am not being treated
- ❑ No

4.4 Heart failure

- ❑ Yes and I am being treated
- ❑ Yes, but I am not being treated
- ❑ No

4.5 Ischemic heart disease

- ❑ Yes and I am being treated
- ❑ Yes, but I am not being treated
- ❑ No

4.6 Other heart diseases?

- ❑ Yes ⟶ Specify a disease:.....
- ❑ *No*

4.7 Have you ever had high cholesterol (high blood fats)?

- ❑ Yes and I am being treated
- ❑ Yes, but I am not being treated
- ❑ No

4.8 Have you experienced a stroke in the past - when and what kind?.....

4.9 Other diseases? (For example, malignant, hematological, etc.)
.....

(please fill in if you suffer from other diseases)

5. Bad habits

5.1 Smoking

5.1.1 Do you currently smoke??

- ❑ Yes Specify number of years.....
- ❑ No, but I am an ex-smoker Specify number of years.....
- ❑ I have never smoked

5.2 Alcohol

3.2.1 Do you take alcohol?

- ❑ Yes, daily
  Please specify an average quantity:
  Wine, beer.....ml/day
  "Hard" alcohol.....ml/day
- ❑ Yes, sometimes
  Please specify an average quantity:
  Wine, beer.....ml/week
  "hard" alcohol.....ml/week
- ❑ I do not accept
- ❑ In the past I accepted, but at present I do not

6.Free time

6.1 How do you spend most of your free time?

- ❑ I work
- ❑ Sport
- ❑ A walk in nature
- ❑ In front of the TV
- ❑ „on the table“
- ❑ In houswork
- ❑ other.....

6.2 Do you think you are exposed to harmful substances during your free time or hobbies??

- ❑ Yes Specify type:.....
- ❑ No
- ❑ I am not familiar

7.Proffesional route

7.1 Моля посочете общия брой години на трудовия Ви стаж:

- ❑ under 5 years
- ❑ Between 5 и 10 years
- ❑ Between 10 и 20 years
- ❑ Between 20 и 30 years
- ❑ Between 30 и 40 years
- ❑ over 40 years

7.2 Please describe the positions held since the beginning of your work experience:

	Type of position held	Number of years
1.		
2.		
3.		
4.		
5.		

8. Current job

8.1 Please indicate the type of position held:

- ❑ Manager specify position.....
- ❑ Worker specify position.....

8.2 Please indicate how many years you have held your current position: .....
……

8.3 Please indicate your mode of employment:

- ❑ Daily
- ❑ Shifted (day and night)

8.4 Please indicate the length of your working day:

- ❑ 4 hours
- ❑ 8 hours
- ❑ 12 hours
- ❑ over 12 hours
- ❑ Irregular working hours

8.5 Please indicate the type of your work activity:

- ❑ Mostly physical labor

If you choose this answer, please indicate the level of your physical activity?

- Heavy
- average
- easy

❑ Mostly mental labor

8.6 Please describe your workflow:

Location	❑ Outdoor labor ❑ Indoor work
Working posture	❑ Seated ❑ Upright ❑ Forced Posture specify.....
Working movements	❑ Uniform ❑ Diverse
Performance norm	❑ Yes ❑ No

8.7 Are you stressed at work?

❑ Yes, during more than 50% of the working day
❑ Yes, during less than 50% of the working day
❑ No

9. CONTACT WITH HARMFUL MATERIALS

9.1 Chemical (heavy metals, organic solvents, gases, plastics and resins, pesticides):

❑ Yes Specify.....
❑ No
❑ I am not familiar

9.2 Physical (high levels of dust, noise, vibrations):

❑ Yes Specify.....
❑ No
❑ I am not familiar

9.3 Biological (professional contact with sick people and animals or contact with products from biological factors):

❑ Yes Specify.....
❑ No
❑ I am not familiar

9.4 Other harmful materials.....

(Application 2)

NIHSS-8 Item	Scoring Definition	Score
1. LOC	0-alert (A) 1-rousable to minor stimulation (V) 2-rousable only to painful stimulation (P) 3-reflex response or un-rousable (U)	
2. LOC Questions – Ask patient's age and current month (Must be exact)	0-Both correct 1-one correct or dysarthria, foreign language 2-Neither correct	
3. Commands – opens/close eyes, grip and release non paretic hand Other 1 step commands or mimic ok)	0-Both correct (Ok if impaired by weakness) 1-One correct 2-Neither correct	
4. Best Gaze – Test horizontal eye movements tracking object/face	0-Normal 1-partial gaze, abnormal gaze in 1 or both eyes 2- Forced eye deviation or total paresis which cannot be overcome	
5. Facial Palsy – Show teeth, close eyes tight, raise eyebrows. If stuporous, check symmetry of grimace to pain	0-Normal 1-Minor paralysis, flat NLF, asymmetrical smile 2-Partial paralysis (lower face) 3-Complete paralysis (upper & lower face)	
6. Motor Arm - arms outstretched 90deg (sitting or 45 deg (supine) for 10secs. Encourage best effort. Score for Left and then Right arm.	0-No drift for 10 secs 1-drift but does not hit bed 2-Some antigravity effort but can't sustain 3-Unable to overcome gravity, minimal proximal movement present 4-No movement at all X-Unable to assess due to amputation, fusion,fx etc	Left: Right:
7. Dysarthria – read or repeat list of words (see reverse of page)	0-Normal 1-mild-mod slurred speech but intelligible 2- Unintelligible or mute X-intubation or mechanical barrier	
8. Extinction / Neglect – simultaneously touch patient on both hands or legs with their eyes closed, show fingers in both visual fields.	0-Normal none detected 1-neglect or extinction to double simultaneous stimulation in any modality (sensory, visual) OR visual/sensory loss on one side 2-profound neglect in both visual and sensory modalities	
Total Score		

Figure 1. NIHSS-8 scale. *Abbreviations: LOC = level of consciousness; NLF = nasiolabial fold.*

(Application 3)

Glascow Coma Scale

	Child	Score
Eye Opening	Spontaneous	4
	To Speech	3
	To Pain	2
	No Response	1
Best Verbal Response	Oriented, Appropriate	5
	Confused	4
	Inappropriate Words	3
	Incomprehensible Sounds	2
	No Response	1
Best Motor Response	Obeys Commands	6
	Localizes to Pain	5
	Withdraws from Pain	4
	Abnormal Flexion to Pain	3
	Abnormal Extension to Pain	2
	No Response	1

Minor Brain Injury = 13-15 points; **Moderate Brain Injury** = 9-12 points; **Severe Brain Injury** = 3-8 points

*If patient is intubated, unconscious, or preverbal, the most important part of this scale is motor response. Motor response should be carefully evaluated.