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Trends in glaucoma morbidity in the population of Ukraine and the city of Kyiv

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Аналіз динаміки показників захворюваності на глаукому населення України та м. Києва

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Introduction

According to WHO estimates, in 2020 there were expected to be 76 million (51.9–111.7 million; 95% confidence interval) people aged 40 to 80 years living with glaucoma worldwide [1]. According to the Glaucoma Research Foundation (USA), the global prevalence of glaucoma in 2020 was approximately 80 million people, of whom 60 million were affected by primary open-angle glaucoma (POAG) – the most rapidly progressive type of glaucoma leading to irreversible vision loss and disability. Its share all types of glaucoma accounts for 72–96% [2]. The global prevalence of glaucoma individuals aged 40–80 years is estimated at 3.5% [3]. The main risk factors for glaucoma development are age and elevated intraocular pressure [4]. Considering the increasing number and proportion of elderly people in the population, it is projected that by 2040 the number of people with glaucoma will reach 111.8 million [5].

In Europe, approximately 12.3 million people are affected by glaucoma, including 6.9 million with undiagnosed disease. By 2050, this number is expected to increase by another 1 million due to population aging, with a predominance of POAG cases [6]. It is estimated that 57.5 million people worldwide suffer from primary open-angle glaucoma [7]. In 2022, the global incidence rate of POAG was 23.46 per 10,000 person-years individuals aged 40–79 years, ranging from 5.51 at ages 40–44 to 64.36 at ages 75–79 [2].

According to a conducted meta-analysis, the overall global prevalence of POAG as of 2020 was 2.4% and showed no significant changes during 2000–2020. It was also found that men are more likely to develop POAG than women (RR = 1.28; $p < 0.01$). Overall, the male-to-female prevalence ratio ranged from 0.39 to 2.61 [8].

Glaucoma represents a major public health problem, being the second leading cause of blindness after cataract, and this blindness is usually irreversible [7]. The overall prevalence of visual impairment and blindness adults aged 50 years and older has remained consistently high, reaching 95.8 cases per 1,000 population in 2019 [9].

The leading causes of blindness in 2020 were cataract (15.2 million cases) and glaucoma (3.6 million). The global age-standardized prevalence of blindness and vision loss due to glaucoma was 75.6 per 100,000 population (in 2017), increasing markedly with age – from 0.5 per 100,000 in the 45–49 age group to 112.9 individuals aged 70 years and older [10].

Thus, epidemiological studies that provide the foundation for determining the scope of ophthalmologic care and developing preventive and therapeutic measures remain highly relevant. Continuous monitoring and regular updates of glaucoma data are required.

The lack of up-to-date statistical data on glaucoma in Ukraine, the predominance of clinical over epidemiological studies, and their localized nature served as the main rationale for conducting this study.

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The lack of up-to-date statistical data on glaucoma in Ukraine, the predominance of clinical over epidemiological studies, and their localized nature served as the main rationale for conducting this study.

Purpose. Study objective: To examine the 30-year dynamics of glaucoma morbidity indicators the population of Ukraine and residents of the city of Kyiv.

Object, materials and research methods

The study was based on official statistical data from the Public Health Center of the Ministry of Health of Ukraine, the Kyiv City Information and Analytical Center for Medical Statistics, and the Institute for Health Metrics and Evaluation (IHME, USA) regarding glaucoma prevalence, primary incidence, and the disease burden indicator (DALY) for the period 1993–2024.

Following the transformation of the national health data collection and reporting system in 2018, consistent national reporting on glaucoma morbidity in Ukraine has been discontinued, as glaucoma was excluded from the list of mandatory notifiable diseases under national epidemiological surveillance. Aggregated morbidity data generated by the electronic health system (eHealth) are still being developed, and access to them remains limited. However, data from the Kyiv City Information and Analytical Center for Medical Statistics are available up to and including 2024. Statistical analysis was complicated by the absence of reliable population data for Ukraine and Kyiv – particularly for the adult population – since 2022, due to the ongoing large-scale military aggression.

The study also utilized data from the IHME, including the DALY (Disability-Adjusted Life Years) indicator,

which reflects the number of healthy life years lost due to glaucoma in both the global and Ukrainian populations. Differences between IHME prevalence estimates and official national statistics arise from variations in data sources and methodological approaches. IHME calculates prevalence using a statistical modeling framework (DisMod-MR 2.1), integrating numerous international and national data sources, adjusting for underreporting, and applying standardized global case definitions. In contrast, ministries of health generally rely on current administrative data. Consequently, IHME estimates may differ from official statistics but ensure internal consistency and international comparability of indicators over time.

This comprehensive approach enabled a statistical analysis of glaucoma morbidity dynamics under the extremely challenging conditions currently faced by Ukraine. Bibliographic, statistical, and analytical methods were applied in the study.

Research results

The analysis of the dynamics of registered glaucoma cases in Ukraine is presented in Figure 1. The total number of registered glaucoma cases in Ukraine gradually increased between 1993 and 2017, reaching its peak in 2013, and overall doubled during this period. The number of newly diagnosed cases increased 1.58 times. A similar trend was observed in Kyiv: during the same period, these indicators rose 3.3-fold and 1.8-fold, respectively. However, after 2013, both indicators began to decline and continued to do so until 2023.

Figure 2 presents the dynamics of glaucoma prevalence and primary incidence rates. Between 2008

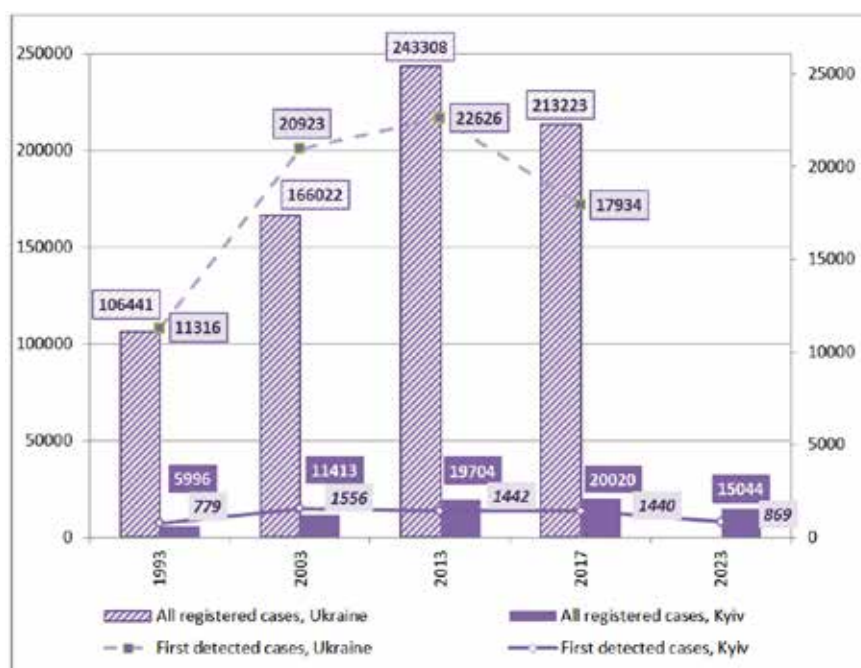


Fig. 1. Dynamics of the total number of registered and newly diagnosed cases of glaucoma the adult population of Ukraine and the city of Kyiv during 1993–2023 (absolute numbers)

and 2017, glaucoma prevalence in Ukraine increased by 8.2%, while primary incidence decreased by 24.4%. A similar pattern was recorded in Kyiv, although in 2017 both indicators remained higher than the national average (prevalence 856.9 and incidence 61.6 per 100,000 adult population). Overall, between 2008 and 2024, glaucoma prevalence in Kyiv decreased by 8%, and primary incidence by 23.7%. It should be noted, however, that these indicators were calculated using the city's population size as of 2022; since then, the actual number of Kyiv residents has certainly increased but remains uncertain.

Importantly, in 2024, the number of newly registered glaucoma cases in Kyiv increased 1.5-fold (up to 1,344 cases), which can be attributed to the presence of a significant number of internally displaced persons and the extensive capacity of ophthalmologic care services available in the capital.

Diseases of the eye and its adnexa, which constitute a distinct class of disorders, are characterized by substantial heterogeneity. Myopia and hypermetropia account for a considerable proportion of their overall structure. During the period 2008–2017, this structure did not undergo major changes; however, the proportion of glaucoma slightly increased from 6.5% to 7.6% (Fig. 3).

The dynamics of prevalence and primary incidence of glaucoma different population groups had a negative trend, with the exception of the population older than working age, where the prevalence decreased slightly (Table 1).

Glaucoma is most common the population older than working age, the least common the working age population.

The negative dynamics is characterized by an increase in the prevalence of glaucoma the rural population (by 20%) and the working age population (by 15.5%). Primary morbidity decreased in all groups, but most noticeably in the population older than working age (by 31.3%), where at the same time the level of primary morbidity was the highest.

Analysis of regional characteristics of the spread of glaucoma (2017) revealed the highest rates in Chernihiv region (prevalence – 1135.0 and primary incidence – 112.9 cases per 100,000 adult population), these rates registered in Odessa region were almost three times lower (387.6 and 34.1, respectively).

This difference may be related to the different age composition of the population, as it is known that age is one of the leading risk factors for glaucoma. Therefore, a correlation analysis was conducted to determine the relationship between glaucoma incidence rates and age characteristics of the regions of Ukraine (median age of the population, specific weight of people over 60 years old) in 2017. After all, the regions differ significantly in these indicators: the oldest regions in Ukraine were Luhansk, Donetsk and Chernihiv regions, where the average median age of the population exceeded 43 years, and the specific weight of people over 60 years old was more than 26%. The “youngest” regions were Rivne, Zakarpattia, Volyn, where these indicators were within 35.7-36.4 years and 16.9-18.2%, respectively. However, contrary to expectations, the relationship between prevalence, primary glaucoma incidence and the above-mentioned age characteristics across regions of Ukraine turned out to be direct, weak and unreliable – from $r=+0.3216$ ($p=0.1098$) between glaucoma prevalence and median age to $r=+0.258$

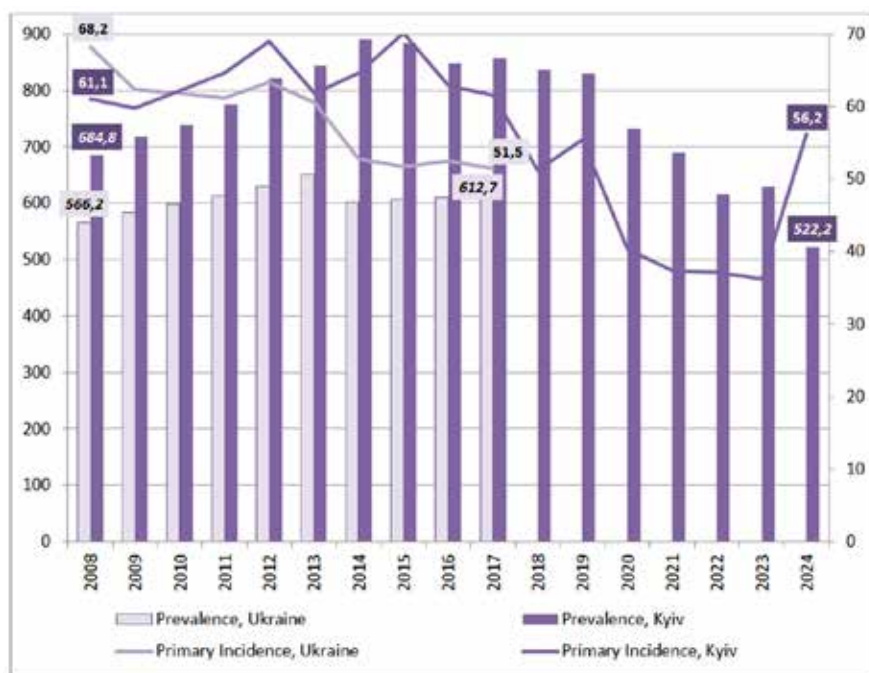


Fig. 2. Dynamics of glaucoma prevalence and incidence rates in Ukraine and Kyiv during 2008–2024 (per 100,000 adult population)

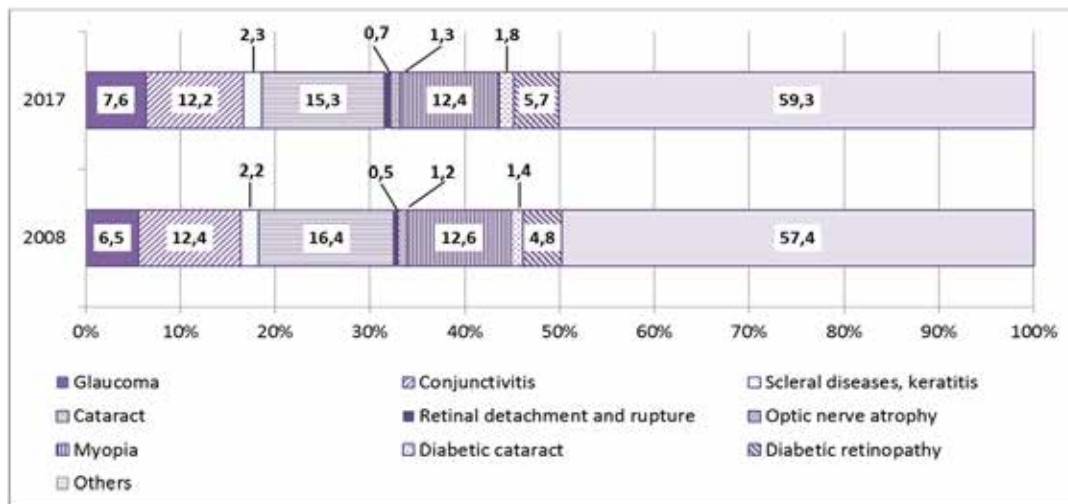


Fig. 3. Comparative characteristics of the prevalence structure of eye diseases and their adnexa the adult population of Ukraine during 2008–2017 (%)

Table 1

Comparative characteristics of the dynamics of primary incidence and prevalence of glaucoma in different population groups of Ukraine during 2008–2017 (per 100,000 of the corresponding population)

Population group	Prevalence		Incidence	
	2008	2017	2008	2017
Adult population 18 years and older	566,2	612,7	68,2	51,5
Working age population (15–64 years)	94,9	109,6	20,5	16,1
Adult population over working age	1483,9	1436,8	180,9	124,2
Rural population	398,0	481,0	56,4	45,9

($p=0.2031$) between primary incidence and the percentage of people over 60 years old.

It should be noted that the age composition of the population of Ukraine has changed over the years towards aging. Thus, for the period 2010–2021, the average median age increased from 39.1 to 42.2 years, and the proportion of people over 60 years of age increased from 17.0% to 24.8%. Similar trends were observed in the city of Kyiv: during this period, the average median age increased from 37.2 to 40.3 years, and the proportion of people over 60 years of age increased from 14.1% to 21.9%. The results of the correlation analysis were unexpected: a direct, but weak and unreliable relationship ($r=+0.245$; $p=0.4428$) was established only between the prevalence of glaucoma in the capital and an increase in the percentage of people over 60 years of age. The remaining relationships were inverse. Thus, a strong inverse relationship was established between the increase in median age and primary glaucoma incidence ($r=-0.775$; $p=0.0031$). The results obtained to some extent cast doubt on the thesis of a significant impact of population aging on glaucoma incidence. On the other hand, they encourage the search for other reasons for the decrease in glaucoma incidence, and first of all, these are the volume, availability and quality of ophthalmological care.

In the absence of official statistics on the prevalence of glaucoma in Ukraine after 2017, it was advisable to analyze data from the IHME Institute (Table 2).

According to the presented data, the prevalence of glaucoma in Ukraine in 2023 did not exceed the global levels the adult population aged 20–54 years. However, for the total population aged 20 years and older, it was 52% higher, particularly women – by 82.3%. The prevalence of glaucoma was higher in the older age group (55+) compared to those aged 20–54 years. Analysis of glaucoma prevalence by sex showed a predominance of women over men in all age groups in Ukraine, whereas the global trend was the opposite – except for the 20+ population, where gender differences in glaucoma prevalence were almost absent.

Analysis of the dynamics of the DALY indicator (the number of years of healthy life lost due to ill health, disability, or premature death per 100,000 population) demonstrates a positive trend in all age and sex groups both globally and in Ukraine, except the adult population aged 20+ in Ukraine, particularly women (an increase of 10.1%).

A special population group remains the cohort of individuals affected by the Chernobyl Nuclear Power Plant accident. Despite the decrease in the number of persons registered in the State Register of those affected, particularly in Kyiv, the prevalence of glaucoma them increased from 1.1 cases per 100 affected individuals in 2014 to 1.49 in 2021, and in 2024 it reached 1.2. The percentage of patients newly diagnosed with glaucoma during this period ranged from 3.4% to 11.9% in certain years.

Table 2

Glaucoma prevalence and burden rates (DALYs) the adult population of Ukraine and the world in 1993–2023 (according to IHME, per 100 thousand population)

Age	Gender	Ukraine World				World			
		Prevalence		DALY		Prevalence		DALY	
		1993	2023	1993	2023	1993	2023	1993	2023
20–54	Male	4,54	4,34	0,64	0,59	6,08	5,34	0,86	0,7
	Female	4,52	4,39	0,59	0,55	5,00	4,75	0,67	0,6
	Together	4,53	4,36	0,61	0,57	5,55	5,05	0,76	0,6
55 and older	Male	420,4	407,1	46,6	44,6	547,5	432,4	66,4	41,2
	Female	517,5	465,8	51,7	41,9	481,3	397,0	55,2	39,2
	Together	481,5	443,3	49,8	41,7	512,1	413,7	60,4	41,7
Total 20 and older	Male	124,3	150,2	13,9	15,3	116,9	124,5	14,3	12,9
	Female	206,4	221,9	20,7	20,1	116,2	125,3	13,4	12,4
	Together	169,8	189,8	17,7	17,9	116,6	124,9	13,8	12,7

In Ukraine, glaucoma is the leading cause of disability resulting from partial or complete blindness. However, the disability rate (number of cases per 10,000 population) showed a decreasing trend between 2013 and 2020: from 0.8 to 0.4 in Ukraine overall, and from 0.8 to 0.4 cases per 10,000 population in Kyiv.

Discussion of research results

The results of studies on the prevalence of glaucoma worldwide vary considerably, particularly regarding the overall prevalence rate and gender distribution. However, all researchers emphasize the influence of age on glaucoma prevalence. According to a survey conducted Colombian patients, the prevalence of glaucoma was 5.67%, with a higher rate in women (OR = 1.22; p = 0.003) and in older age groups (OR = 1.02) [11]. In the Korean Gangnam Eye cohort study, the prevalence of glaucoma was 2.8% overall – 3.4% in men and 2.1% in women – and increased significantly with age (P < 0.001) [12]. A German study reported higher prevalence and incidence rates women compared to men [13].

A South Asian study highlighted the considerable burden of glaucoma in South Asia, particularly older adults and men, with primary open-angle glaucoma identified as the most common subtype [14]. A European epidemiological study reported an age-standardized prevalence of glaucoma of 2.99%. Older age (OR = 1.32; P < 0.001) and male sex (OR = 1.18; P < 0.001) were associated with higher prevalence rates [6].

An Iranian study estimated the overall prevalence of glaucoma at 1.92%, with 1.4% women and 2.62% men. The effect of age on glaucoma prevalence was also confirmed by differences observed across age groups: 0.9% individuals aged 40–44 years, increasing to 3.55% those aged 60–64 years (OR = 1.08) [15]. Danish researchers found that glaucoma affects slightly less than 2% of the general population and increases with age, reaching a prevalence of more than 10% people over 80 years of age [16].

Glaucoma is difficult to detect, and therefore it may remain undiagnosed for a long time, leading to irreversible vision loss. The implementation of screening programs can reduce the rate of undiagnosed glaucoma by almost half, allowing patients to begin treatment in a timely manner and to lower the risk of bilateral blindness later in life [7]. For example, a study 70-year-old Swedish individuals showed a glaucoma prevalence of 4.8%, with 56% of cases previously undiagnosed [17]. Another study reported that up to 80% of undiagnosed glaucoma cases occurred in individuals younger than 55 years [6].

Late presentation is a common phenomenon, particularly in patients with primary angle-closure glaucoma, often associated with severe and advanced visual field defects. Unilateral blindness or severe visual impairment is observed in 38.5% of such cases. Therefore, to reduce the burden of blindness due to glaucoma, it is essential to improve public awareness and implement population screening programs [18]. Screening for glaucoma in all individuals over 40 years of age is a crucial public health objective. Ophthalmologic examination should include measurement of intraocular pressure, as well as assessment of the optic nerve and the iridocorneal angle [19].

Unfortunately, there are currently no strong preventive measures for glaucoma, and existing treatment methods cannot restore glaucomatous vision loss. However, early diagnosis and timely treatment can prevent the progression of the disease and subsequent blindness [20].

Prospects for further research

Future research should focus on the organization of ophthalmic care delivery, particularly for patients with glaucoma.

Conclusions

The obtained data indicate diverse trends that partially align with the findings of published international studies. Between 2008 and 2017, the prevalence of glaucoma

in Ukraine increased by 8.2%, while the incidence rate decreased by 24.4%. In Kyiv, however, both indicators declined – by 8% and 23.7%, respectively. Within the overall structure of eye diseases, the proportion of glaucoma cases showed a slight increase. Glaucoma most frequently affects individuals older than working age, confirming that its incidence increases with age and that age is a major risk factor for its development.

The prevalence of glaucoma shows substantial regional variation, partly due to differences in population age structures. However, the correlations between glaucoma prevalence and incidence and the demographic indicators (median age, proportion of persons aged 60+) across Ukrainian regions were found to be positive but weak and statistically insignificant. The population of Ukraine is evidently aging. A correlation analysis for the period 2010–2021 revealed a direct but weak and insignificant relationship between glaucoma prevalence in the capital and the proportion of individuals aged over 60 years, whereas a strong and significant inverse correlation was found between increasing median age and the incidence of glaucoma.

These findings to some extent call into question the assumption that population aging is the main driver of glaucoma incidence. On the other hand, they suggest

the need to explore other potential factors underlying the decline in incidence – primarily the volume, accessibility, and quality of ophthalmic care.

Analysis of data from the Institute for Health Metrics and Evaluation (IHME) showed that in 2023, the prevalence of glaucoma in Ukraine the population aged 20 years and older exceeded the global level by 52%, particularly women – by 82.3%. The assessment of glaucoma prevalence by sex revealed a predominance of women over men in all age groups in Ukraine, while the global trend was reversed, except for the 20+ population, where gender differences in glaucoma prevalence were almost negligible.

The burden of disease, expressed as DALY per 100,000 population, demonstrated a positive trend across all age and sex groups both globally and in Ukraine, except the adult population aged 20+ in Ukraine, particularly women (an increase of 10.1%).

However, the current and future burden of glaucoma in Ukraine may be significantly higher than it appears at present due to the considerable proportion of undiagnosed cases in the general population. Additionally, the rapidly aging population, limited access to qualified ophthalmic care, and insufficient public awareness further contribute to the potential underestimation of the true magnitude of the problem.

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Purpose: to analyze the 30-year dynamics of glaucoma morbidity in Ukraine and Kyiv.

Materials and methods. The study used official data from the Public Health Center of the Ministry of Health of Ukraine, the Kyiv City Information and Analytical Center for Medical Statistics, and the Institute for Health Metrics and Evaluation (IHME, USA) on glaucoma prevalence, incidence, and disease burden (DALY) for 1993–2024. Disability data due to blindness and statistics on glaucoma Chernobyl-affected persons in Kyiv were also analyzed using bibliographic, statistical, and analytical methods.

Results. Between 2008 and 2017, glaucoma prevalence in Ukraine increased by 8.2%, while incidence declined by 24.4%; in Kyiv, both indicators decreased (by 8% and 23.7%, respectively). Older adults were most affected, confirming age as a major risk factor. Regional variations in prevalence were partly explained by demographic differences, yet correlations between age structure and glaucoma indicators were weak and statistically insignificant. IHME data for 2023 showed that glaucoma prevalence Ukrainians aged 20+ exceeded the global rate by 52% (by 82.3% women). Ukrainian women had higher prevalence across all age groups, in contrast to the global pattern. DALY rates improved globally and nationally except Ukrainian adults aged 20+, particularly women (+10.1%).

Conclusions. The findings reveal mixed trends that partly align with global evidence but question the assumed strong impact of population aging on glaucoma morbidity. Declining incidence may reflect issues of access, quality, and coverage of ophthalmologic care. Given the rapidly aging population and underdiagnosis, the actual burden of glaucoma in Ukraine may be substantially underestimated.

Key words: glaucoma, epidemiology, morbidity, dynamics, trends, DALY, Ukraine, Kyiv, public health.

Мета: дослідити 30-річну динаміку показників захворюваності на глаукому населення України та жителів м. Києва.

Матеріали та методи. Матеріалами дослідження слугували офіційні дані Центру громадського здоров'я МОЗ України, Київського міського інформаційно-аналітичного центру медичної статистики та дані Інституту вимірювання показників і оцінки стану здоров'я (IHME, США) щодо поширеності, первинної захворюваності та показника тягаря хвороб DALY за період 1993–2024 років. У роботі також проаналізовані дані про інвалідність через сліпоту та дані про хворих на глаукому з числа постраждалих внаслідок аварії на ЧАЕС населення м. Києва. У дослідженні використані бібліографічний, статистичний і аналітичний методи.

Результати. За 2008–2017 роки по Україні поширеність глаукоми зросла на 8,2%, первинна захворюваність зменшилась на 24,4%. Проте в Києві обидва показники зменшились – відповідно на 8% та на 23,7%. В структурі хвороб ока питома вага глаукоми дещо зросла. Найчастіше хворіють люди старші за працездатний вік, що підтверджує тезу про те, що з віком захворюваність на глаукому зростає, а вік є чинником її розвитку.

Поширеність глаукоми має значні регіональні особливості, у т.ч. і через різний віковий склад населення. Але зв'язок між поширеністю, первинною захворюваністю на глаукому та віковими характеристиками (медіанний вік, % осіб 60+) по областях України виявився хоч і прямим, але слабким і невірогідним. Вочевидь населення України старіє. Проведений кореляційний аналіз за період 2010–2021 років встановив прямий, але слабкий і невірогідний зв'язок лише між поширеністю глаукоми в столиці і збільшенням відсотка осіб старше 60 років, а між збільшенням медіанного віку і первинною захворюваністю на глаукому встановлено зворотній сильний вірогідний зв'язок.

Аналіз даних Інституту IHME показав, що поширеність глаукоми у 2023 році в Україні для населення віком 20+ перевищувала світову на 52%, зокрема в групі жінок – на 82,3%. Оцінка поширеності глаукоми за статтю продемонструвала перевагу жінок над чоловіками в усіх вікових групах в Україні та зворотну світову тенденцію, за винятком населення 20+, де статеві розбіжності у рівнях поширеності глаукоми практично відсутні. Показник тягаря хвороб DALY (на 100 000 населення) продемонстрував позитивну динаміку в усіх віково-статевих групах, як у світі, так і в Україні, за винятком дорослого населення України віком 20 років і старше, зокрема жінок (зростання на 10,1%).

Висновки. Отримані дані свідчать про різноспрямовані тенденції, які частково збігаються з результатами опублікованих досліджень у світі. Результати дослідження певною мірою ставлять під сумнів тезу про значний вплив старіння населення на захворюваність на глаукому. Водночас вони спонукають до пошуку інших причин зменшення захворюваності на глаукому, насамперед таких, як обсяги, доступність та якість офтальмологічної допомоги. Поточний та майбутній тягар глаукоми в

Україні може бути значно вищим, ніж здається нині, через значну частку випадків у загальній популяції, котрі залишаються невиявленими. Крім того, потрібно враховувати стрімке старіння населення України, труднощі з доступом до кваліфікованої офтальмологічної допомоги та санітарно-просвітницької інформації.

Ключові слова: глаукома, епідеміологія, захворюваність, динаміка показників, тенденції, тягар хвороби, Україна, м. Київ, громадське здоров'я.

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