

## Longitudinal changes in the incidence of glaucoma in Uzbekistan

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**Background:** Glaucoma is not only one of the most common, but also one of the most severe chronic and progressive eye diseases. Therefore, the disease is a relevant problem in ophthalmology and a leading cause of reduced vision and irreversible blindness.

**Purpose:** To assess the incidence of glaucoma in the republic and the city of Tashkent, and predict disease incidence for the subsequent decade.

**Material and Methods:** The report of the Ministry of Health “On the numbers of diseases and registered patients residing in the primary service area of the medical facility» and national statistical collections (“Statistical materials on the activities of healthcare institutions of the Republic of Uzbekistan”) for 2010–2019 were studied to determine the incidence of glaucoma and the relevant characteristics in the republic.

**Results:** These materials allowed us to obtain the data on annual incidences of newly diagnosed cases and annual incidences of first visits of previously diagnosed cases of glaucoma in adults (i.e., individuals older than age 19) in the regions of the country for 2010 to 2019 years. The prediction of the incidence of glaucoma in the republic of Uzbekistan and the city of Tashkent necessitates organizational and treatment-and-diagnostic measures for combating the disease, these measures being of a social and medical importance.

### Introduction

Glaucoma is not only one of the most common, but also one of the most severe chronic and progressive eye diseases. Therefore, the disease is a relevant problem in ophthalmology and a leading cause of reduced vision and irreversible blindness [1, 2, 3, 4, 5, 6]. Glaucoma is the leading cause of visual impairment and disability [7, 8, 9, 10, 11, 12].

Foreign studies have demonstrated an increase in the incidence of the disease among adults [1, 2, 3, 6, 7, 8]. It was predicted in 2006 that, globally, there would be 60.5 million people with glaucoma in 2010, increasing to 79.6 million by 2020, and over 8.4 million people would be bilaterally blind from primary glaucoma in 2010, rising to 11.1 million by 2020 [9]. Glaucoma is believed by Nesterov and others [6, 10] to be a multifactorial disease with a threshold effect and without clear etiology. In addition, early detection of glaucoma is challenging, and national incidence and disability due to glaucoma are regularly assessed in many countries [5].

Glaucoma screening is of crucial importance and allows early disease detection, which is beneficial for disease course and treatment outcomes [6, 7, 8]. There are scarce data on the incidence of glaucoma in the Republic of Uzbekistan for the recent decade, indicating a necessity for glaucoma screening in the country. Therefore, the purpose of this study was to assess the current incidence of glaucoma in the republic and the city of Tashkent, and predict disease incidence for the subsequent decade.

### Material and Methods

The report of the Ministry of Health “On the numbers of diseases and registered patients residing in the primary service area of the medical facility» and national statistical collections (“Statistical materials on the activities of healthcare institutions of the Republic of Uzbekistan”) for 2010–2019 were studied to determine the incidence of glaucoma and the relevant characteristics in the republic. These materials allowed us to obtain the data on annual incidences of newly diagnosed cases and annual incidences of first visits of previously diagnosed cases of glaucoma in adults (i.e., individuals older than age 19) in the regions of the country for 2010 to 2019 years. In addition, the retrospective analysis of the statistical reports from the ministry allowed predicting changes in the incidence of glaucoma in the adult population for the near and far future. A linear regression was used for prediction.

Microsoft Excel 7.0 software was used for statistical analysis. Student t test was employed to assess difference between the groups. The level of significance  $p < 0.05$  was assumed.

### Results

Our analysis based on the report of the Ministry of Health “On the numbers of diseases and registered patients residing in the primary service area of the medical facility” and national statistical collections (“Statistical materials

on the activities of healthcare institutions of the Republic of Uzbekistan”) for 2010-2019 found that, from 2010 through 2019, the annual incidence of newly diagnosed cases of glaucoma in adults increased 1.8 times, from  $31.5 \pm 0.4$  to  $56.1 \pm 0.5$  per 100,000 adult population ( $P \leq 0.05$ ), for the country in total, and much more substantially, 5.5 times, from  $61.3 \pm 1.9$  to  $339.3 \pm 4.4$  per 100,000 adult population ( $P \leq 0.05$ ), for the city of Tashkent.

The annual incidence of first visits of previously diagnosed cases of glaucoma in adults also increased during this period. Thus, from 2010 through 2019, the annual incidence of first visits of previously diagnosed cases of glaucoma in adults increased 1.3 times, from  $147.4 \pm 0.9$  to  $189.2 \pm 1.0$  per 100,000 adult population ( $P \leq 0.05$ ), for the country in total, and 2.3 times, from  $175.6 \pm 3.3$  to  $400.0 \pm 4.7$  per 100,000 adult population ( $P \leq 0.05$ ), for the city of Tashkent.

Among all patients with eye diseases, the proportion of patients with glaucoma in Uzbekistan and the city of Tashkent is within the same range as in other Asian countries. Thus, among all patients with eye diseases, the mean proportion of patients with glaucoma in Uzbekistan and the city of Tashkent for the decade was 13.2% and 5.6%, respectively (Table 1). In addition, during 2010 through 2019, among all newly diagnosed cases of eye diseases detected annually, the proportion of patients with glaucoma in the city of Tashkent increased three times, from  $3.1 \pm 0.4\%$  to  $10.5 \pm 0.5\%$ , and in Uzbekistan decreased from  $7.5 \pm 0.7\%$  to  $4.5 \pm 0.5\%$ , and these changes were statistically significant ( $p \leq 0.05$ ). However, among all newly diagnosed cases of the diseases of the eye and ocular adnexa detected annually, the proportion of patients with glaucoma in Uzbekistan increased from  $12 \pm 0.7\%$  in 2010 to  $14.5 \pm 0.7\%$  in 2019, and in the city of Tashkent increased from  $4.1 \pm 0.3\%$  in 2010 to  $7.2 \pm 0.4\%$  in 2019 ( $p \leq 0.05$ ). A linear regression equation was used to calculate the predicted changes in the annual incidence of newly diagnosed cases of glaucoma and in the annual incidence of first visits of previously diagnosed cases of glaucoma in adults in Uzbekistan and in the city of Tashkent for the period until 2029.

It is estimated that by 2029, the annual incidence of glaucoma in adults would increase several times, all other factors held constant (Table 2). Particularly, it is estimated that the annual incidence of newly diagnosed cases of glaucoma in adults in Uzbekistan will increase 3.7 times, from  $31.5 \pm 0.4$  per 100,000 adult population in 2010, to  $116.7 \pm 0.7$  per 100,000 adult population in 2029 (Fig. 2). In addition, the annual incidence of first visits of previously diagnosed cases of glaucoma in adults in the country will increase 2.5 times, from  $147.4 \pm 0.9$  per 100,000 adult population in 2010, to  $361.7 \pm 1.3$  per 100,000 adult population in 2029 ( $p \leq 0.05$ ).

Moreover, the annual incidence of newly diagnosed cases of glaucoma and the annual incidence of first visits of previously diagnosed cases of glaucoma in adults in Tashkent will increase more substantially, 12.6 times

(from  $61.3 \pm 1.9$  to  $773.7 \pm 6.2$ ) and 4.9 times (from  $175.6 \pm 3.3$  to  $868.7 \pm 6.5$ ), respectively, all other factors held constant (Fig. 3).

### Discussion

Among all patients with eye diseases, the proportion of patients with glaucoma in the world is about 12-14%. This proportion is, however, as large as 11-20% in the eastern countries like India, Yemen, China, Singapore and Syria [11-17]. Over the recent decades, in Uzbekistan and the city of Tashkent, as in many other countries, there has been a steady growth in the annual incidence of glaucoma in the adults older than 40 years.

Our analysis demonstrated that, among all patients with eye diseases, the proportion of patients with glaucoma in Uzbekistan and the city of Tashkent is within the same range as in other Asian countries. Thus, in Uzbekistan and the city of Tashkent, among all patients with eye diseases, the mean proportion of patients with glaucoma for the decade was 13.2% and 5.6%, respectively, whereas the annual incidence of newly diagnosed cases of glaucoma in adults increased 1.8 times and 5.5 times, respectively ( $p \leq 0.05$ ).

In addition, there was an increase in the annual incidence of first visits of previously diagnosed cases of glaucoma in adults. Thus, from 2010 through 2019, the annual incidence of first visits of previously diagnosed cases of glaucoma in adults increased 1.3 times for the country in total, and 2.3 times, for the city of Tashkent. The higher incidence of glaucoma in Tashkent compared to other regions of the country can be explained by not only better provision of eye care service, and, consequently, better detection of glaucoma process, but also by the age structure of the population, with the age group of 60 years and above representing more than 15.7% of the population for the city, compared to 10% for the total country [18]. And it is the senior age groups that constitute a major portion of patients with glaucoma [1, 2, 3, 4, 11].

It is estimated that, from 2010 through 2029, the annual incidence of newly diagnosed cases of glaucoma in adults and the annual incidence of first visits of previously diagnosed cases of glaucoma in adults in the country will increase 3.7 times and 2.5 times, respectively ( $p \leq 0.05$ ), whereas those in the city of Tashkent will increase 12.6 times and 4.9 times, respectively ( $p \leq 0.05$ ).

It is likely that an increase in the incidence of glaucoma will be associated not only with an improvement in the quality and increase in the amount of eye care given, but also with an increase in the proportion of older people in the population of the republic. Thus, the proportion of people older than age 60 in the population of Uzbekistan is somewhat more than 10% currently, and will increase to 30-35% by 2030, with a current increase in life expectancy and low level of total mortality [18].

Given a high level of glaucoma-associated disability and increased risk of premature mortality due to glaucoma, the above increase in the incidence of glaucoma in the republic makes the management of the disease an

important medical and social challenge for Uzbekistan, necessitating further studies, improvement in treatment quality, development of advanced methods of prevention and early detection and incorporation of these methods into clinical practice.

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### *Conflict of Interest Statement:*

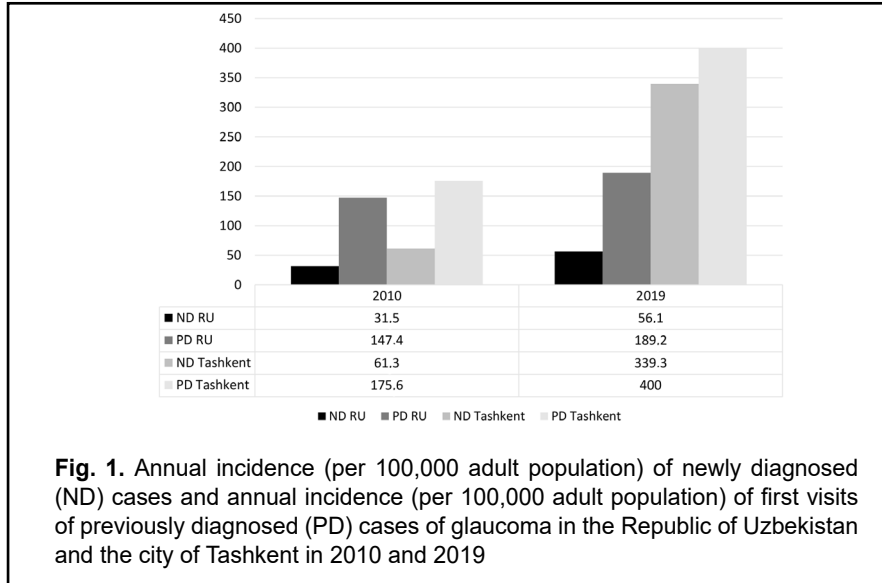
No conflict of interest to declare.

**Table 1.** Proportions of patients with glaucoma among all visits of previously diagnosed cases and among all newly diagnosed cases of diseases of the eye and ocular adnexa

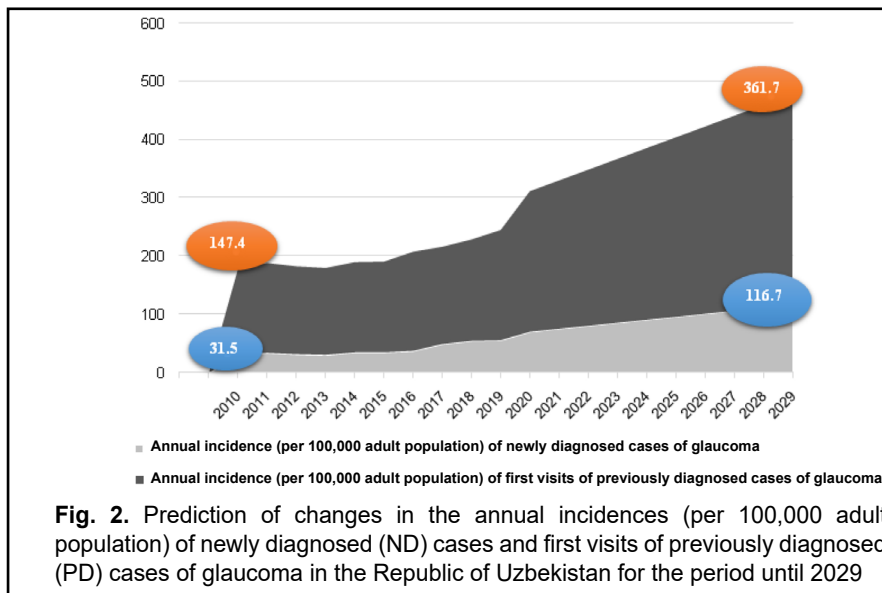
Incidence per 100,000 adult population	Republic of Uzbekistan		City of Tashkent	
	2010	2019	2010	2019
Annual incidence of first visits of previously diagnosed cases of diseases of the eye and ocular adnexa	2434.6	2856.0	4321.0	5538.3
Annual incidence of first visits of previously diagnosed cases of glaucoma in adults	292.2	414.6	175.6	400.0
The proportion of patients with glaucoma among all visits of previously diagnosed cases of diseases of the eye and ocular adnexa	12±0.7%	14.5±0.7%	4.1±0.3%	7.2±0.4%
Annual incidence of newly diagnosed cases of diseases of the eye and ocular adnexa	1600.5	2159.2	1961.1	3243.7
Annual incidence of newly diagnosed cases of glaucoma	119.7	102.2	61.3	339.3
The proportion of patients with glaucoma among all newly diagnosed cases of diseases of the eye and ocular adnexa	7.5±0.7%	4.7±0.5%	3.1±0.4%	10.5±0.5%

**Table 2.** Prediction of the incidence of glaucoma (per 100,000 adult population) in the republic of Uzbekistan and the city of Tashkent for 2010 to 2029

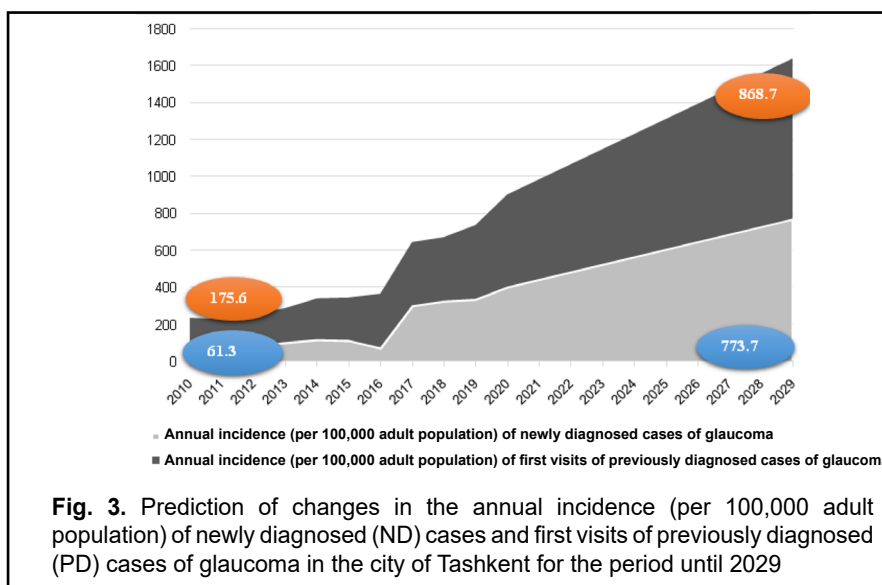
Incidence of glaucoma	City of Tashkent			Republic of Uzbekistan		
	2010	2029	Increase	2010	2029	Increase
Annual incidence of first visits of previously diagnosed cases of glaucoma	175.6±3.3	868.7±6.5	4.9 times	147.4±0.9	361.7±1.3	2.5 times
Annual incidence of newly diagnosed cases of glaucoma	61.3±1.9	773.7±6.2	12.6 times	31.5±0.4	116.7±0.7	3.7 times



**Fig. 1.** Annual incidence (per 100,000 adult population) of newly diagnosed (ND) cases and annual incidence (per 100,000 adult population) of first visits of previously diagnosed (PD) cases of glaucoma in the Republic of Uzbekistan and the city of Tashkent in 2010 and 2019



**Fig. 2.** Prediction of changes in the annual incidences (per 100,000 adult population) of newly diagnosed (ND) cases and first visits of previously diagnosed (PD) cases of glaucoma in the Republic of Uzbekistan for the period until 2029



**Fig. 3.** Prediction of changes in the annual incidence (per 100,000 adult population) of newly diagnosed (ND) cases and first visits of previously diagnosed (PD) cases of glaucoma in the city of Tashkent for the period until 2029