

Organizational issues of glaucoma diagnosis in Kazakhstan

Neilya Aldasheva

Kazakh Eye Research Institute

Lyailya Tashtitova

Kazakh Eye Research Institute

Mukhit Kulmaganbetov (✉ KulmaganbetovM@cardiff.ac.uk)

Cardiff University <https://orcid.org/0000-0003-2112-4208>

Research article

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Abstract

Purpose Analysis of the organizational issues of the diagnosis of glaucoma in Kazakhstan and State programs for health care system: "Salamatty Kazakhstan" and "Densaulyk". **Methods** The state of screening for glaucoma was included increased intraocular pressure (IOP) measurement and pachymetry, which was used for the corneal thickness examination. Although the IOP can be increased or be in the normal ranges, thin central cornea thickness generally was ignored by ophthalmologists. In this regard, the indications for examination for glaucoma with systemic hypotension during screening were expanded, and pachymetry was one of the essential diagnostic tool in the clinical guideline for the diagnosis and treatment of glaucoma as a mandatory research method. **Results** Sufficiency and effectiveness of the screening program was confirmed by the trend in the number of identified patients with glaucoma depending on age. Correlation between suspected glaucoma and age groups was exposed. The number of registered glaucoma patients was 43,337 patients in 2010. In contrast, after the screening program the figures raised to 68,195 people in 2016. Moreover, there was the increase of newly identified glaucoma cases by 49%: from 70.8 per 100 thousand populations in 2010 to 124 per 100 thousand populations in 2016. **Conclusions** State programs for health care system development in Republic of Kazakhstan "Salamatty Kazakhstan" (2011-2015) and "Densaulyk" (2016 – 2019) were the initial steps for the prevention of the irreversible blindness and disability due to glaucoma. Screening programs allow to timely and adequate diagnosis of the disease over 40 years of age.

Background

Glaucoma is a group of diseases caused by multiple factors and manifested by deterioration of the visual field and progressive optic neuropathy [1,2]. The main and common pathogenetic symptom is the degeneration of the optic nerve with usual accompany of the increased intraocular pressure (IOP) [3-5]. Also, the apoptosis of retinal ganglion cells (RGCs) leads to loss of dendrites of RGCs and retinal nerve fiber layer (RNFL) thinning [2,6].

Glaucoma is one of the major cause of blindness [7], especially in developing countries [8]. It is the most frequent cause of irreversible loss of vision in Kazakhstan [14]. According to the data of Islamova S.Ye. [14] the incidence of glaucoma in the Republic of Kazakhstan over the past 10 years has increased by 25%. For the same decade the number of disability due to glaucoma elevated by 3.7 times and rose from fifth to second place.

Since 2014, of 37.8% blind people in Kazakhstan suffer from glaucoma among the causes of visual disability. Every fifth disabled person (21.6%) is a person of working age. Moreover, almost one third of patients with glaucoma are recognized as disabled in the first group due to complete or almost complete loss of vision [15]. Considering these changes in the number of people with blindness and age demography, glaucoma is the urgent social and economic issue [9]. However, so far there are no systematic comparative studies of the epidemiology and screening methods of glaucoma in Kazakhstan.

Measurement of IOP has been the general method of screening for glaucoma. Sensitivity and specificity of this technique, however, is low and there is a demand for more extensive methods of detection [10]. The main

achievement in the organization of the fight against glaucoma in the Republic of Kazakhstan is the State Screening, which was started in 2011 and aimed at the early detection of the disease [15].

Methods

The mission of the Kazakhstan State screening program was the identification of cases of increased IOP among persons over 40 years of age, followed by examination of them for glaucoma in the context of specialized glaucoma offices. These glaucoma offices were opened as part of the State programs "Salamatty Kazakhstan" [16] and "Densaulyk" for health care system development in Republic of Kazakhstan 2016 – 2019 [17]. The opening of cabinets allowed to raise the quality of the disease management to a higher level due to the availability of the retinal tomography and computer perimeters. The innovative development of diagnostic ophthalmic equipment has led to a change in the standards for the diagnosis and monitoring of glaucoma.

As mentioned earlier, the state of screening for glaucoma is based on identifying cases of increased intraocular pressure (IOP). At the same time, cases of glaucoma with low IOP and cases of underestimation of IOP indices with thin central cornea thickness fall out of the sight of ophthalmologists. In this regard, the indications for examination for glaucoma with systemic hypotension during screening were expanded, and pachymetry was included in the clinical protocols for the diagnosis and treatment of glaucoma as a mandatory research method. Perimetry is also used for the screening method of glaucoma [11-13]. However, due to unavailability of the equipment in all regions of Kazakhstan, the visual field test was excluded from general cohort.

Results

Despite the risks of hypodiagnosis of glaucoma during screening, the effectiveness and adequacy of the screening was confirmed by the trend in the number of identified patients with glaucoma depending on age (Figure 1 and Table 1). A direct correlation was revealed: an increase in the percentage of detectable glaucoma in older age groups, which corresponds to the literature data [1].

According to official statistics from Medinform LLP[1] [18], at the time of the screening start in 2010, the number of registered glaucoma patients was 43,337 people. In contrast, after the implementation of the program at the end of 2016, this number accounted to 68,195 patients. Hence, the number of registered patients during the screening increased by more than 50%.

The total number of newly diagnosed cases of glaucoma during the screening was increased by an average of 49%. This means that, starting from 2012, an average of 4,000 cases of glaucoma was detected every year (Figure 2). Thus, the effectiveness of screening in terms of detecting new cases of the disease is 49%, which is confirmed by the data of Medinform LLP on the primary incidence of glaucoma: 70.8 per 100 thousand populations in 2010 against 124 per 100 thousand populations in 2016.

Based on the above data, the estimated number of patients with officially registered cases of glaucoma patients should be over 113,000 people at the end of 2016. At the same time, according to Medinform LLP, this number is only 68,195. The database on the total amount of registered patients with a particular disease is

compiled on the basis of at least one annual visit to outpatient clinics. Therefore, it can be assumed that about 25% of patients with an established diagnosis of glaucoma do not undergo follow-up and clinical examinations for the disease. The most likely reasons are primarily the lack of a glaucomatous patient register, as well as an insufficient level of informing patients about the consequences of the disease.

Collected data from the screening program illustrates the variations of the glaucoma incidences in various regions of Kazakhstan with the increased epidemiology in the southern territories of the country (Figure 3).

The correlation dependences of the incidence of glaucoma indicator on the availability of personnel and diagnostic equipment are demonstrated in Figure 4. The analysis of the dependence of the incidence rates of glaucoma in various regions of the republic on the availability of ophthalmological personnel and diagnostic equipment revealed a low correlation.

[1] The company Medinform LLP was established in 1995 and the main activity of the company is the preparation and publication of analytical collections on the state of public health (<http://www.medinfo.kz/>).

Discussion

Thus, the massive measurement of IOP during the screening program and the provision of diagnostic equipment was not enough to prevent and detect early the glaucoma. Consequently, it is necessary to raise the level of public awareness and the level of knowledge of ophthalmologists. The solution of these tasks is possible within the framework of the implementation of the State program of health development "Densaulyk" adopted in the Republic of Kazakhstan for 2016-2019 [17].

One of the key objectives of the program is the integration of all health services around patient needs through the modernization and priority development of primary health care, as well as the development of public health services (PHS). One of the key objectives of the regional divisions of PHS will be to increase public responsibility for their health, including through timely screening and follow-up examination.

These days, primary health care is considered as a central link in the system of organizing medical care for the population (according to the Order of the Ministry of Healthcare and Social Development of December 26, 2012 No. 885 "On Approval of Protocols (Standards) for Clinical Examination of Patients with Chronic Diseases") [19]. In the process of clinical examination, a significant role is assigned to nurses and general practitioners (GPs). The process of delegation of authority in terms of follow-up observation of patients with glaucoma can be lengthy due to the use of high-tech diagnostic equipment in monitoring the disease, which incurs financial costs. Thus, in OECD countries, hospital funding amounts to 34%, and a huge share of the budget of the Ministry of Health is spent on primary health care - 61%. At the same time, in Kazakhstan, 62% of the funds go to the inpatient sector, only 34% is allocated for the work of the primary health care service.

Conclusions

Thus, the implementation of the State program "Salamatty Kazakhstan" [16] and "Densaulyk" [17] played a crucial role in reducing blindness and disability from glaucoma. One of the modern organizational forms of dealing with this socially significant ophthalmic pathology is screening examinations, which should be provided for early detection of glaucoma in the population over 40 years of age. It is also necessary to inform the public about effective methods of treatment, prevention of glaucoma and the opportunities provided by domestic medicine, including a list of services within the guaranteed volume of free medical care.

Abbreviations

GP - general practitioners

IOP - intraocular pressure

LLP - limited liability partnership

OECD - Organisation for Economic Co-operation and Development

PHS - public health service

RGC - retinal ganglion cell

RNFL - retinal nerve fiber layer

Declarations

Declarations

Ethics approval and consent to participate

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Ethics committee – Kazakh Eye Research Institute local ethics committee.

Consent for publication - Not Applicable.

Availability of data and materials

Please, see the attached files.

Competing Interests

The authors declare no competing interests.

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The State Program of Healthcare Development "Salamatty Kazakhstan" for 2011-2015 has been adopted by the Decree of the President of the Republic of Kazakhstan No.1113 dated November 29, 2010. The State Program "Densaulyk" for health care system development in Republic of Kazakhstan 2016 – 2019 has been adopted by the Decree of the President of the Republic of Kazakhstan dated February 1, 2010 № 922 "On the Strategic Development Plan of the Republic of Kazakhstan till 2020"; Message from the President of the Republic of Kazakhstan Nazarbayev NA the people of Kazakhstan of December 14, 2012 "Strategy" Kazakhstan-2050 ": a new policy established state"; Message from the President of the Republic of Kazakhstan Nazarbayev N.A. the people of Kazakhstan from November 11, 2014 "NurlyZhol - Path to the Future"; National Plan of the President of the Republic of Kazakhstan Nazarbayev N.A. Plan "100 concrete steps to implement the five institutional reforms"

Authors' Contribution

- Conceived and designed the experiments: NA, LT.
- Analysed the data: LT, MK.
- Interpretation of data: NA, MK.
- Wrote the paper: NA, LT, MK.

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Tables

Table 1. The screening results of the State screening program of glaucoma by age

**Report on the results of preventive medical examinations by screening men and women aged
40,42,44,46,48,50,52,54,56,58,60,62,64,68,70 years for the detection of glaucoma by age**

Date of screening program from 01/01/2016 to 12/31/2016

Age	Total examined	Identified patients from inspection (suspected glaucoma)		Of the identified taken on dispensary accounting	
		Absolute values	%	Absolute values	%
40	133849	175	0.13	154	88.00
42	133971	137	0.10	115	83.94
44	128978	174	0.13	156	89.66
46	121995	183	0.15	160	87.43
48	116064	213	0.18	196	92.02
50	128957	305	0.24	269	88.20
52	120094	330	0.27	301	91.21
54	127385	322	0.25	292	90.68
56	121987	419	0.34	383	91.41
58	111004	354	0.32	321	90.68
60	95296	369	0.39	341	92.41
62	78937	358	0.45	329	91.90
64	66652	375	0.56	354	94.40
66	59284	362	0.61	332	91.71
68	44195	320	0.72	304	95.00
70	32010	257	0.80	246	95.72
Total	1620658	4653	0.29	4253	91.40

Figures

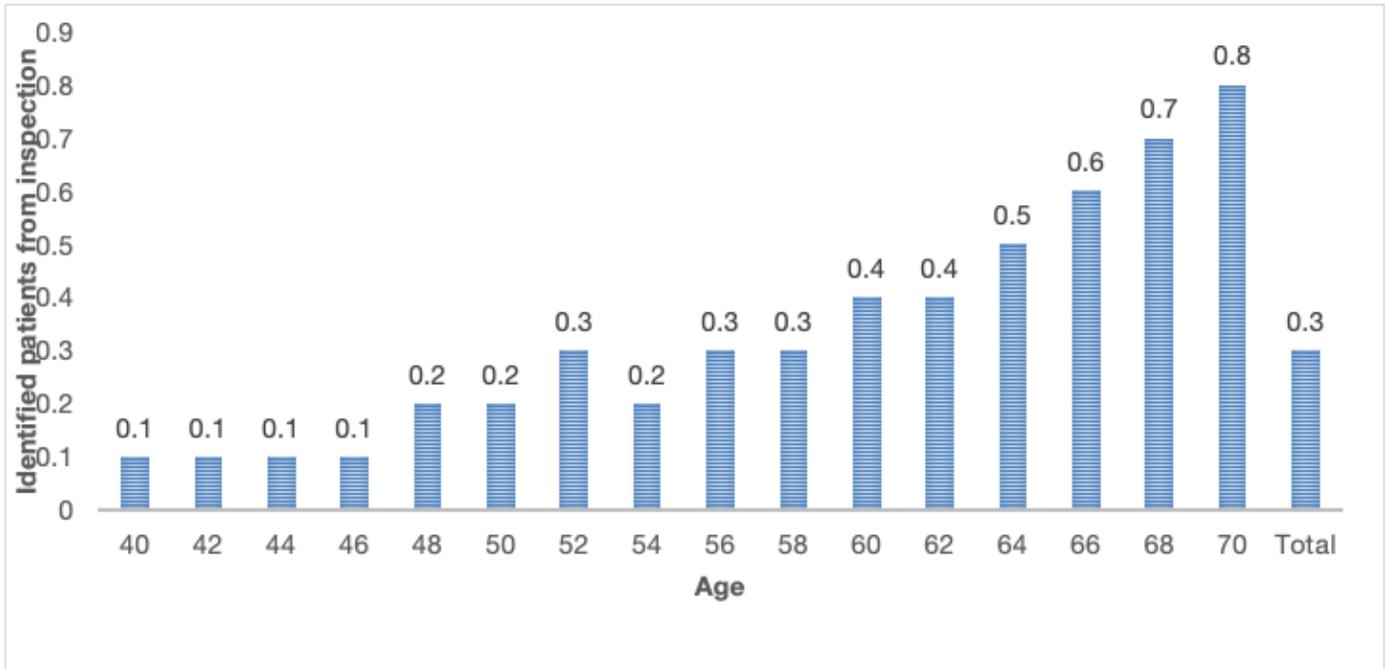


Figure 1

Indicators of the detection of glaucoma in different age groups (according to the results of screening in the framework of State Program of the Development of Healthcare)

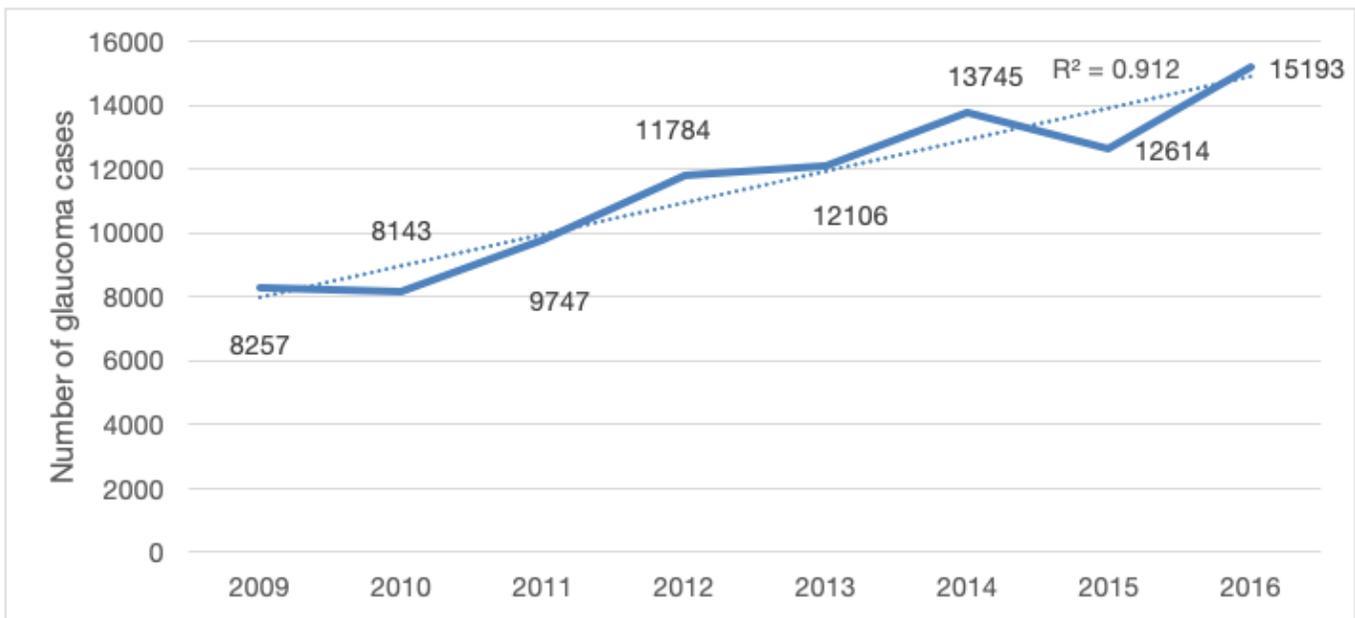


Figure 2

The total number of patients with newly diagnosed glaucoma (Medinform LLP) [18]

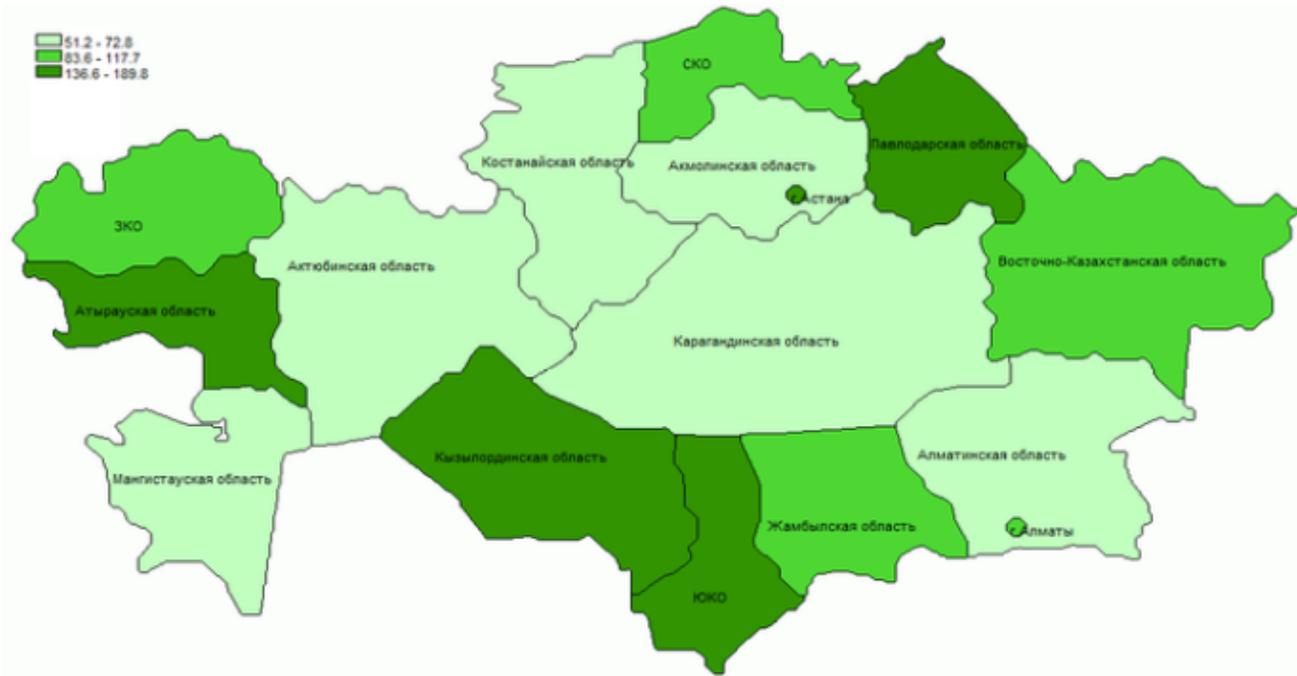


Figure 3

Own cartogram - indicators of the incidence of glaucoma in different regions of the Republic of Kazakhstan per 100 thousand populations

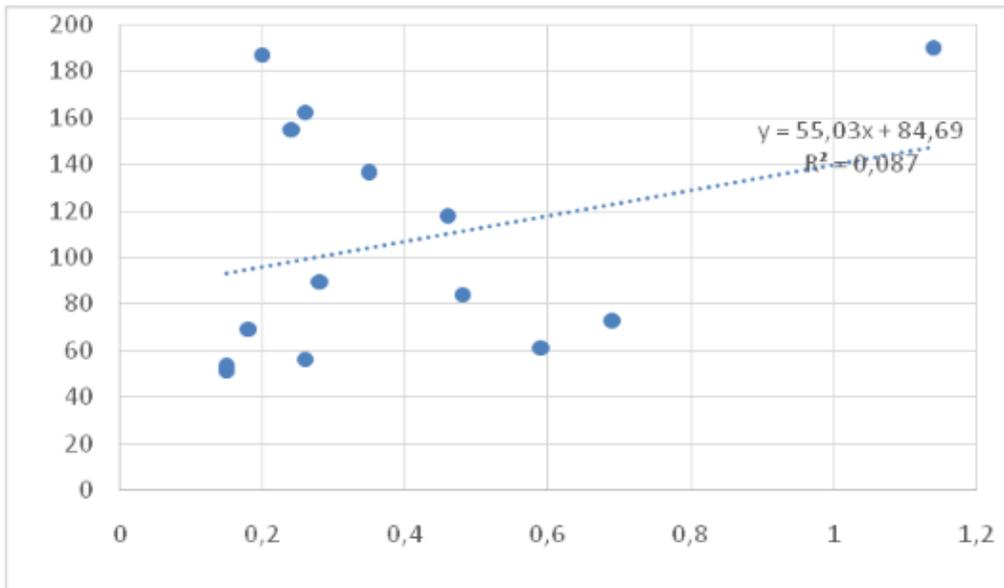
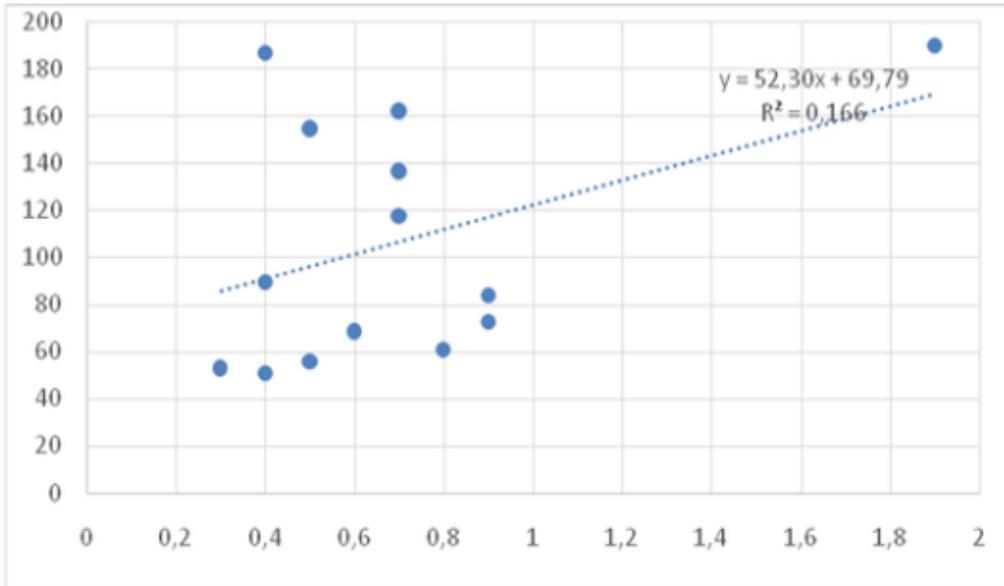


Figure 4

Dependences of the incidence of glaucoma on the availability of: top – ophthalmic personnel ($r=0,4$); bottom – diagnostic equipment in the region ($r=0,3$)

Supplementary Files

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