



Barriers to Care in the Treatment of Glaucoma: Socioeconomic Elements That Impact the Diagnosis, Treatment, and Outcomes in Glaucoma Patients

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Abstract

Purpose of Review This article reviews socioeconomic elements that impact the access to glaucoma care, early intervention in susceptible patients, and longevity of treatment and patient compliance in various demographic groups.

Recent Findings Socioeconomic factors such as insurance eligibility, education, income, marital status, and access to technology can deeply impact the diagnosis and long-term treatment of glaucoma patients. Depending on the severity, and/or urgency of care, many individuals who face these barriers forgo annual eye exams, leading to a higher incidence of untreated glaucoma.

Summary Early intervention and regular follow-up are essential for patient compliance in the management of glaucoma. Routine eye care leads to earlier detection and can improve management options and reduce the severity of disease burden.

Keywords Glaucoma · Socioeconomic · Race · Prevention · Demographic · Telemedicine

Introduction

Glaucoma is responsible for 15% of all cases of blindness worldwide and is the second leading cause of vision loss in the world [1]. As of 2020, 3 million Americans have been diagnosed with glaucoma, and 120,000 suffer from vision impairment due to disease progression [2]. Untreated glaucoma results in faster progression, causing permanent vision loss. Early detection, tailored treatment, and adherence to therapy are powerful tools in slowing disease progression

and preventing blindness. Socioeconomic barriers faced by patients inhibit early detection, access to treatment, and adherence to therapy which result in further vision loss. Glaucoma treatment cannot restore vision that has already been lost.

Risk Factors

The risk of glaucoma has been shown to increase predominantly with age, as well as in those with current pre-existing conditions such as diabetes, hypertension, and obstructive sleep apnea among others [3]. Race is another important risk factor, and it is important to note the disproportionate way glaucoma affects individuals from different racial backgrounds (Fig. 1). In primary open angle glaucoma, African American patients show a prevalence 6–8 times higher than in other minorities and white patients [5]. As for primary angle closure glaucoma, those of Inuit, East Asian, and white populations show a higher rate of diagnosis.

Sex may also appear as a risk factor regarding angle closure glaucoma (PACG), as women comprehensively outnumber men in PACG cases worldwide [6]. Though there is no clear gender dominance in open angle glaucoma cases, recent research has suggested that sex hormones in females

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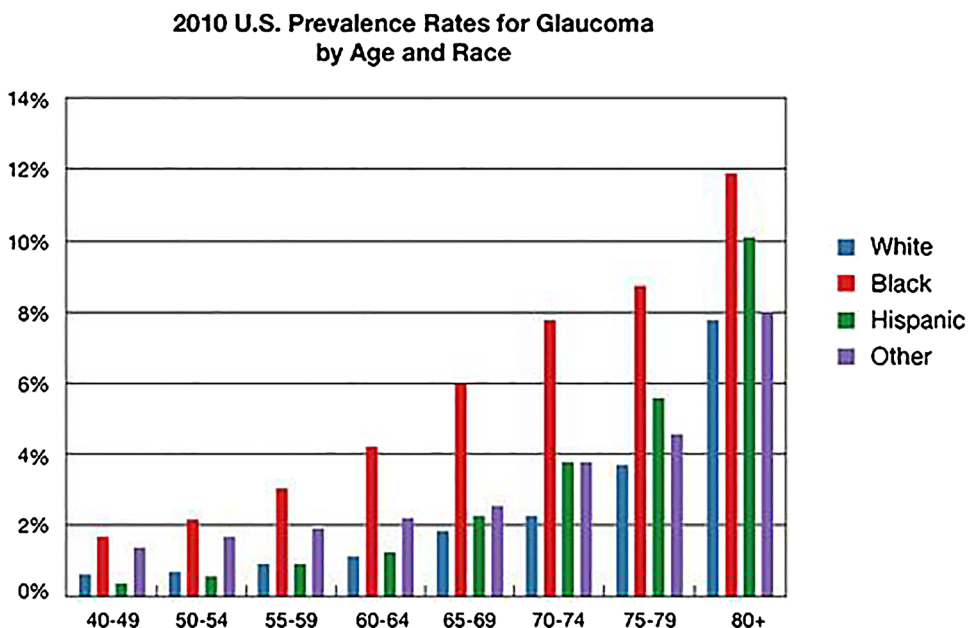
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Fig. 1 2010 US age-specific prevalence rates for glaucoma by age and race/ethnicity. The prevalence of glaucoma increases with advancing age. Black Americans aged 40 and older are at the highest risk of developing the disease compared with people of other races. By age 69, nearly 6% of black Americans have glaucoma; their risk rises to nearly 12% after age 80 [4]



may be protective of the optic nerve [6]. Lower levels of estrogen in men can increase risk for open angle glaucoma [6]. Thus, age, race, and sex are risk factors for different individuals for distinct forms of glaucoma.

Socioeconomic Status and Race

When patients have glaucoma risk factors such as race, family history, and/or preexisting conditions, they are often given referrals for more extensive ophthalmologic care [7]. These at-risk patients are given additional testing such as visual field testing, gonioscopy, cornea thickness measurements, and optic nerve scans. This is essential in the early diagnosis of glaucoma in high-risk patients. Those who adhere to physical exams, annual eye exams, and medications may improve their own glaucoma outcomes through medication adherence and follow-up.

Glaucoma patients often do not experience symptoms until an advanced stage of glaucoma is reached, at which point, considerable optic nerve damage can be detected. Patients that are not consistently evaluated by a primary care physician, or do not receive annual eye care, are far more likely to be diagnosed at a later stage of the disease—this is frequently observed in patients with lower socioeconomic status (SES) [8]. Socioeconomic status is essentially a measure of an individual's social status and economic class based on education, occupation, and income, and a higher SES is generally associated with better prevention of glaucoma progression [9]. A National Health Interview Survey utilized the ratio of income to poverty, which is a household income divided by the poverty threshold to associate poverty with

utilization of eye care. It showed that individuals with poverty income ratio less than 1.5 did not commonly receive regular eye care or dilation exams compared to those with a higher economic background [10]. A 2018 cross sectional study reported that 69% of primary open closure glaucoma were patients with a low SES. A diagnosis of end-stage glaucoma was associated with a lower SES, while patients with a higher SES were diagnosed and given medication in the early stage of the disease, allowing for prevention of disease progression [11]. Patients with increased socioeconomic deprivation presented with more advanced glaucoma. It is also significant that many at risk patients with familial history and genetic predisposition fall within the lower SES class, and not having regular eye examinations greatly impacts disease progression and quality of life.

Eye care utilization varies across different racial populations. While black and Hispanic populations are shown to have both greater prevalence and stage of glaucoma, these populations have less outpatient ophthalmologic visits and preventative testing [8]. The lower frequencies of glaucoma testing in these populations are a result of inadequate access to preventative eye care, due to lower socioeconomic status. While preventative measures are utilized to a greater extent in non-Hispanic white patients, there is a higher prevalence in glaucoma procedures in black and Hispanic patients [8]. Medication adherence, a preventative measure in disease progression, is lower in black populations when compared to white patients [12]. Thus, providers may suspect that black patients will not adhere to medications, resulting in a higher prevalence of surgical procedures in black patients [13].

In a 2022 study regarding eye care utilization and socioeconomic status, it was found that disparities in eye care

utilization between black and white populations persevere despite SES [8]. In groups with low and high SES, black patients continued to show a high rate of inpatient care, and a low rate of glaucoma testing and outpatient care. This demonstrates that SES alone does not describe disparities in eye care utilization among different racial population, instead, it is the result of several influencing factors such as systemic racism and insurance regulation [8].

Lifestyle

A variety of lifestyle statuses may contribute to the likelihood of receiving a glaucoma diagnosis in the early stages of degeneration, including but not limited to marital status, access to transportation, and access to consistent and reliable insurance.

Marital Status

Many unmarried or single patients across various studies reflected difficulty with application of drops or remembering to take medications. In addition, unmarried people also reported forgetting to get the annual eye exams necessary for screening. As married individuals tend to have a more regular access to assistance with treatments and procedure after care, they tend to have better follow-up overall. Additionally, 20% of patients with glaucoma depend on another person to instill their eyedrops [14]. Thus, being married or in a long-term relationship may impact a patient's adherence to preventative measures in glaucoma care as well as medications for glaucoma treatment.

Transportation

In analyzing a failure to follow up after a free glaucoma screening, 36% of patients reported lack of transportation as a difficulty in seeing a provider following a diagnosis [15]. Patients who are single, unmarried, or live alone might not have access to reliable transportation to and from appointments. This issue is most common in communities with a lower SES, where many at risk individuals do not have a car as a means of transportation [16]. In addition, surgical procedures that require presence of another person for safe transportation of the patient home, or for after-surgery care, may be avoided by patients who do not have established means of transportation.

Insurance

Insurance is a socioeconomic barrier that impacts the outcome of glaucoma patients in several ways. First, detection of glaucoma in later stages can be responsible for greater

associated costs for patients with a more severe form of the disease. In addition, the cost of diagnostic exams and various treatments may be unprecedented for many patients, and lack of insurance poses a substantial barrier. Upon diagnosis, patients work closely with ophthalmologists to form a treatment plan which includes medications, lasers, or surgery. Various insurances provide a large spectrum of coverage for these options, and not all treatments are covered equally. Also, nuances such as various copays may increase costs to patients. Furthermore, there are indirect costs such increased likelihood of hospital admittance for accidents and falls related to loss of vision caused by glaucoma [17].

The expense of these glaucoma-associated costs is stated as a barrier by groups of patients that are underinsured, uninsured, and insured without eye care. In the USA alone, every brand name glaucoma medication is more expensive in comparison to the same medications offered in Canada [18]. The average cost of brand name medication is \$1165.65, and generic medication \$281.95 [18]. The unregulated and consistently increasing costs of medications affect patients' access to glaucoma medications. This issue is further magnified by the way physicians prescribe medications for glaucoma. Depending on the severity of the optic neuropathy, physicians will prescribe medications based on drug efficacy, as most specialists are not aware of this cost barrier faced by patients [19]. Furthermore, the authorization process for medications and procedures can be challenging in those insured without eye care. The lack of coverage for specific glaucoma medications forms a disconnect between newly diagnosed patients and the office coordinating their care, which may delay or even prevent the start of their treatment. Insurance companies may deny the coverage of specific drugs prescribed by physicians, and patients use other drops with increased negative side effects as an alternative [20]. This highlights another barrier in treatment adherence in patients that are both insured and uninsured, as the cost of medication for glaucoma continues to increase. This is especially challenging because the success of glaucoma treatment is time sensitive, with preventative care being more efficient in preventing the loss of visual acuity.

In another study, almost half of patients with Medicaid did not undergo glaucoma testing after an initial diagnosis, compared to 21% of patients with commercial health insurance. It was recognized that patients with Medicaid struggled to find an eye care provider classified as "in network," effectively preventing them from scheduling diagnostic testing and beginning a treatment regimen [21]. Another concern is that many patients with Medicaid were those with lower income and lower literacy levels and were predominantly Hispanic and African American [15]. This is alarming, particularly when patients with this racial identity and SES are most at risk for open angle glaucoma and should be tested early.

The rise in cases has shown a need for screenings in areas with underserved and uninsured populations. A retrospective cohort study highlighted pilot programs in these inner-city communities to help close the disparity in patients. The average age of this population was 52.8 years, predominantly African American, and 65% female. It was also reported that lack of insured coverage for eye care means patients were less likely to have previous eye exams and experience more difficulty in obtaining eye care. Despite the free screenings and consultation, 42% of cases did not follow up. On telephone interviews with patients that did not follow up, lack of health insurance was the most cited barrier to consistent treatment [15].

Education and Adherence

Individuals who have pursued higher educational levels display increased understanding of glaucoma, and awareness of overall health, leading to a more consistent awareness of the necessity of eye care and healthcare adherence. Recent literature has demonstrated that individuals older than 65, female, white, and possessing a high school diploma utilize ophthalmic care more frequently than those who do not fall into these categories [15]. These patients are often diagnosed earlier, and thus have access to long-term treatment plans that are more effective at preventing the progression of glaucoma [15]. Patient education is the key to long-term glaucoma prevention and management of treatment. In screening participants, while 91% of these individuals have insurance, only 29% could accurately define glaucoma [15]. The lack of awareness regarding glaucoma and the importance of consistent eye care can drastically prolong the diagnosis of many patients, averting their access to preventative treatment. When educational workshops or pilot programs were provided to communities, there was an increase in glaucoma evaluation appointments. It is essential that patients are aware of what glaucoma is and can then work closely with physicians to monitor changes in eye pressure or vision that may indicate the need for further screening.

Education is another barrier to medication adherence, as experienced by many patients undergoing treatment for glaucoma. Leaflets or informational handouts are often utilized to give patients information regarding glaucoma, though many suffering from the condition find this technique inadequate. Miscommunication due to medical terminology and medication names was another commonly stated issue by patients regarding their education on the condition [22]. There is a language barrier experienced by patients that do not consider English to be their first language. In a study analysis regarding barriers to follow-up, it was found that 60 to 80% of Latino and Asian-Pacific Islanders required the assistance of a foreign language medical interpreter [23].

This poses a barrier for these patients, leading to miscommunication with their providers regarding diagnosis and treatment.

In the weeks following a glaucoma diagnosis, patients who used outside sources to understand the meaning of glaucoma showed a deeper understanding of the condition and its potential ramifications, and this understanding led to a better adherence to prescribed medication [20]. Self-educating may consist of articles, informative websites, pharmacy pamphlets, and pharmacists' advice. Overall, an emphasis on education regarding glaucoma is essential at diagnosis and follow-up appointments with physicians. Improved patient understanding is vital for both early diagnosis and patient adherence of treatment.

The process of obtaining medication, undergoing diagnostic testing, seeking a provider, and filling prescriptions can also be difficult for elderly patients and patients with poor literacy skills [14]. In patients with secondary education and therefore improved literacy skills, education did not pose a barrier to medication adherence. A study that utilized pharmacy data with 13,956 subjects reported that only 10% of patients with prescribed glaucoma drops were consistent with refilling and utilizing treatment over a period of 12 months [24]. Physicians were more likely to educate patients with a higher literacy level regarding glaucoma medications, and those with lower literacy skills were challenged with understanding and obtaining their medications [25]. The gaps in medication adherence have been associated with inferior clinical outcomes in patients.

Another dimension to this socioeconomic challenge was the lack of patient education regarding drop administration. In an evaluation of eyedrop instillation in patients with glaucoma, patients experienced with using drops performed poorly while instilling eyedrops without touching the bottle directly to the eye [26]. Physicians addressed the technique of drop administration in only 26% of visits [25]. By assessing eyedrop technique at follow-up appointments, providers can ensure the patients understand how to administer the drops which can lead to improved medication adherence.

Recent literature has found a racial disparity in the levels of education provided to patients by physicians. Providers were more likely to educate non-African American patients regarding glaucoma, despite African Americans being more susceptible to this disease [25]. African Americans were least adherent to medications when compared to populations with decreased risk of glaucoma. Racial disparities that cause blindness can be addressed by ensuring physicians educate all patients equally regarding glaucoma, their risk, and the importance of treatment adherence. Overall, patients of all backgrounds, stages of disease, and education levels must be thoroughly educated regarding glaucoma. Understanding the condition, the importance of medications in preventing disease

progression, and how to utilize drops can improve long-term clinical outcomes. Furthermore, in educating at risk populations prior to diagnosis, more patients are more likely to utilize eye care, preventing a later diagnosis. This includes a discussion regarding at-risk family members in established glaucoma patients.

Underutilization of Telemedicine

Due to the general asymptomatic nature of early to moderate glaucoma and the issues detailed above, more than 50% of individuals in different populations have gone undiagnosed for this disease [27]. Telemedicine can give patients direct access to specialized care, allowing them to have detection of the disease at an earlier stage and even help with prevention of disease progression. Modernized technology has become an outlet for improved management of glaucoma. Patients can monitor changes in vision, new symptoms, side effects, refills of medications, and other glaucoma-related changes and forward these changes to their provider using mobile apps, virtual charts, and other software. There are also at-home tests, such as the iCare HOME tonometer, that patients can perform that gives their providers updated information regarding visual function and intraocular pressure as markers of disease progression [28]. Physicians can be kept updated on patient experiences between appointments, simplifying what needs to be addressed during visits in both an online and in person format. Additionally, by monitoring changes and taking an initiative in their care, patients will be more engaged in the management of their disease.

Despite the benefits of telemedicine, socioeconomic factors have posed an impediment in at-risk populations, resulting in the underutilization of this outlet of care. Patients of increased age have less familiarity with modern technology and are less likely to utilize virtual medicine as opposed to in person appointments. Also, in urban communities that display increased rates of poverty, connection to cellular network necessary for telehealth is not always accessible. In this way, the underutilization of telemedicine for glaucoma is affected by finances, age, and race, forming gaps between different patient demographics.

The COVID-19 pandemic caused a decline in patient visits across all medical specialties, but ophthalmology practices showed the greatest decline [29]. The pandemic has impacted the health and economic status of at-risk communities, and socioeconomic barriers cause disparities in the use of telemedicine [30]. In a study from 2021, it was found that racial minorities and older patients were less likely to use live video visits for eye care during the initial wave of the pandemic.

Conclusion

Once glaucoma is diagnosed, the treating physician and the health system must consider socioeconomic barriers to care experienced by patients including companionship, transportation, insurance coverage, education level, demonstration of drop technique, and the use of telemedicine for optimal treatment outcomes. By targeting screenings for at-risk populations, early glaucoma can be detected and with addressing various barriers to care, better treatment outcomes can be achieved.

Declarations

Conflict of Interest The authors declare no competing interests.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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