

Socioeconomics of long-term glaucoma therapy in India

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Purpose: To determine the socioeconomic impact of long-term glaucoma therapy. **Materials and Methods:** One hundred and fifty consecutive glaucoma patients on medical therapy, following up at our glaucoma service for at least 6 months were recruited. A questionnaire regarding monthly income, cost of glaucoma medications prescribed, availability of medications, travel time, time spent in review clinics, compliance, education status, medical insurance and systemic or local side-effects was administered. **Results:** The patients seen at the tertiary government hospital had an average monthly income of Rs. 10,912/- (range: Rs. 500/- to Rs. 50,000/-) with approximately 56% of the patients having an income of less than Rs. 5000/month. The expenditure on anti-glaucoma medications ranged from 0.3% in high income group to 123% of their monthly gross income in low income group ($P < 0.0001$). The total expenditure including travel, stay, and loss of wages of patients and accompanying persons ranged from 1.6% in high income group to 137% of the monthly income in low income group ($P < 0.0001$). Mean time required for a glaucoma clinic visit was 15.66 h, (range: 6–96 h/month). About 2.7% experienced systemic side-effects and 21.3% had complaints of ocular adverse effects. About 90% of the patients were compliant. 92% were not covered by any insurance plan/government reimbursement for their treatment. **Conclusions:** Medical therapy for glaucoma is an economic burden to many patients and should be individualized, according to the socioeconomic status, availability of drugs and the required distance to travel to reach the specialist clinics.

Key words: Chronic glaucoma patients, economic burden, socioeconomic profile

Glaucoma is a chronic disease for which lifelong control of intraocular pressure (IOP) is mandatory. The primary treatment for glaucoma is medical, as surgeries have a risk of failure and complications.^[1,2] Medicines are thought to be safer, however, patients often need >1 medication to reach the “target” IOP, which may increase the possibility of side effects, as well as long-term costs.^[3,4] In developed countries, the cost of glaucoma therapy is largely borne by government schemes or medical insurance companies while there are very few studies on the cost of glaucoma therapy in developing countries.^[5–8] This study was undertaken to evaluate the socioeconomic impact of patients on long-term medical therapy for glaucoma, which included aspects on direct and indirect financial implications, time spent by a patient and caregiver to attend regular reviews in a glaucoma clinic, awareness about the disease and their ability to opt for surgical or laser therapy due to cost implications.

Materials and Methods

This was a cross-sectional study conducted at the follow-up glaucoma services of our tertiary care hospital. The tenets of the Declaration of Helsinki were followed throughout. The study was conducted from July 2013 to December 2013. One hundred and fifty consecutive adult patients with chronic glaucoma on treatment for at least 6 months, and were regularly following

up at the glaucoma clinic were recruited over this period. The patients had been diagnosed as glaucoma, following slit-lamp biomicroscopy, fundus examination using +90 D lens, applanation tonometry, gonioscopy, diurnal phasing and perimetry (Humphrey® Field Analyzer/HFA™II-iSeries) by at least a glaucoma expert. Patients who were noncompliant or were unable to answer all questions were excluded. A questionnaire, Appendix 1, was administered by a single observer, to the patient or guardian. Information regarding family income per month, educational status, expenditure on drugs per month, time spent to attend clinic, regularity of drug use, systemic and local side effects encountered, availability of drugs in their local market and health insurance cover or reimbursement of medical costs, choice of surgery or medical management was collected. The United States Dollar (USD) equivalent of 1 Indian rupee was 0.016 at the time of study.

Data were analyzed using IBM SPSS STATISTICS, Version 20.0 (IBM Corporation, Armonk, NY, USA). Besides descriptive statistics, the comparison of expenditure was done by applying Kruskal–Wallis test followed by multiple comparisons by adjusting the probabilities. Mann–Whitney test was applied for nonparametric data with $P < 0.05$ considered as statistically significant.

Results

Of 150 patients recruited, 91 were male and 59 were females, with an average age of 47.2 ± 2.35 (range: 21–85) years in males and 56.3 ± 1.30 (range: 19–87) years in females. The frequency distribution of the type of glaucoma is shown in [Fig. 1] where we had the maximum number of cases diagnosed with primary angle closure glaucoma. Of the 150 patients, 61.3% (92) belonged to Delhi or National Capital Region (NCR), whereas the remaining 38.6% (58) patients were from distant rural areas.

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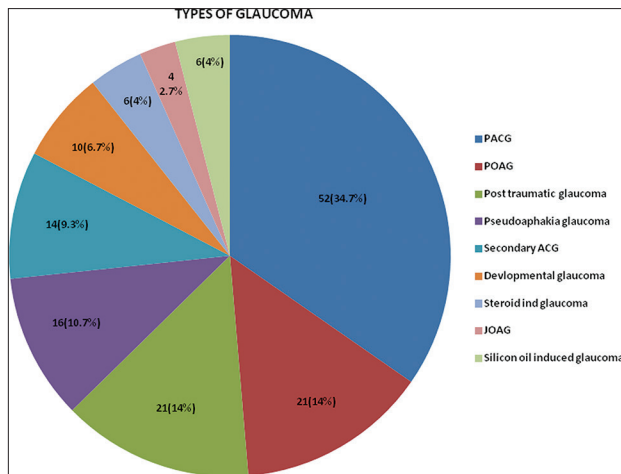


Figure 1: Pie chart showing distribution of patients with regard to different types of glaucoma

Fifty-six percent (84) of patients had a monthly income of <Rs. 5000, 16% (24) patients earned between Rs. 5000 and 10,000; 24.6% (37) patients earned between Rs. 10,000 and 30,000 and 3.3% (5) patients had a monthly income of >Rs. 30,000/month. 92% (138) patients bought medications at their own expense, whereas only 8% (12) patients got reimbursement through health insurance.

Of the 150 patients, 30.7% (46) were using only one medication, of which 18.6% (28) patients were using a beta blocker, 8.6% (13) were using a prostaglandin analogue, 1.3% (2) patients were using alpha agonists and 0.6% (1) patient was on a topical carbonic anhydrase inhibitor alone. About 42.7% (64) patients were using two drugs while 21.3% (32) were on three medications and 5.3% (8) were using >four medications [Fig. 2]. Beta blockers were the most commonly used overall by 76% (114) patients followed in frequency by an alpha agonist, a prostaglandin analogue, a carbonic anhydrase inhibitor and pilocarpine by 54.6% (82), 48.6% (73), 14.6% (22), and 2.6% (4) patients respectively. 36.6% (55) patients were using a combination of alpha agonist and beta blocker, 2.6% (4) were using a combination of beta blocker with carbonic anhydrase inhibitor and 2% (3) were using a combination of prostaglandin analogue and beta blocker in a single bottle. Generic drugs were being used by only 28% (42) of our patients.

Patients using timolol maleate alone, spent Rs. 80–100 (USD 13.33–16.41) per month, prostaglandin analogs costed Rs. 400–450 (USD 65.60–73.79) per month, an alpha agonist Rs. 200–250 (USD 32.81–41.00) per month, pilocarpine Rs. 50 (USD 8.21)–Rs. 70 (USD 11.49) per month and those using carbonic anhydrase inhibitors spent Rs. 225/- to 250/- (USD 36.90–41) per month. As most patients were using multiple medications, the mean monthly expenditure on glaucoma medications was Rs. 400.06 (USD 65.60) per month, (95% confidence interval Rs. 356.70–455.41) with a range of Rs. 50–1873 (USD 8.21–307.09).

Fifty-eight percent (87) patients spent an average of 6–8 h per visit, coming from distance of 50 km on an average, to the glaucoma clinic, while 24.6% (37) patients spent 8–16 h, coming from distance of 100 km, and 10.7% (16) patients spent 24–48 h, coming from distance of 300 km. 6.7% (10) had to spend between 2 and 4 days coming from distance of 1000 km

on average, to attend the clinic. This time duration included travel time and time at the hospital. The average follow-up visit in our patients was once in 3 months (interval was from 1 to 6 months). We recommend 3 monthly IOP check and 6 monthly visual fields for patients with moderate to severe glaucoma.

The cost of travel, food, lodging of the patient and accompanying person, was an average of Rs. 157.00 per visit to the hospital for patients coming from the same city, and Rs. 1950.00 for patients coming from distant rural areas.

Patients in low income group (<Rs. 5000/month) coming from Delhi and NCR had a mean expenditure on medicines of Rs. 377.19, (range: Rs. 40–1876). This amounted to 13.41%, (range: 0.8–123.4%) of their monthly incomes [Fig. 3a]. Consolidated expenditure on glaucoma management, including medicines, loss of wages, travel and stay, was Rs. 558.30 (range: Rs. 206–2872.00), which accounted for 18.36% (range: 4.1–136.6%) of average monthly income. A patient from this low income group coming from distant rural areas spent a mean of Rs. 586.09 (range: Rs. 100–1250) on medications, that is, 17.43% (range: 2–50%) of his monthly income. His mean consolidated expenditure was Rs. 1546.09 (range: Rs. 633–Rs. 3083) that is, 41.96% (range: 19.3–88.6%) of monthly income ($P = 0.0001$) [Fig. 3b].

A patient belonging to lower middle income group coming from Delhi and NCR spent 6.49% (range: 2.53–21%) of his monthly income on medicines, and his consolidated expenditure was 9.14% (range: 4.9–28%) of his monthly income. For those from distant areas, the expenditure on medicines was 7.22% and the consolidated expenditure was 21.11% (range: 14.6–34.1%) of average monthly income ($P = 0.008$). A patient from the upper middle income group coming from Delhi and NCR had a mean expenditure of 1.35% of monthly income and consolidated expense of 4.66% (range: 3.7–7.6%). A patient from distant rural areas spent 2.53% of his monthly income on medications and 10.20% as a consolidated cost on glaucoma therapy ($P = 0.016$).

Patients from higher income group (>Rs. 30,000/month) coming from Delhi and NCR spent 0.72% of their monthly income on medicines, and 5.2% on overall expenses. Those coming from distant rural areas spent 1.5% of their monthly income on medicines, and 6.8% overall on glaucoma therapy ($P = 0.7$).

The mean cost of glaucoma medications in patients below 40 years of age was Rs. 427.73 \pm 58.32 (range: Rs. 42–1873) as compared to similar costs in patients between 40 and 60 years of age, who spent Rs. 329.52 \pm 35.42 (range: Rs. 42.00–1250.00). The mean cost of medications in patients above 60 years of age was Rs. 465.05 \pm 37.79 (range: Rs. 80.00–1200.00). There was a significant difference in costs for patients above 60 years old and those below 40 years from age group of 40 to 60 years ($P = 0.016$).

Only 2.7% (4/114) patients experienced systemic side-effects in the form of exacerbation of asthma or respiratory depression due to timolol. Prostaglandin analogs had local side effects such as irritation and congestion in 17.8% (13) of patients using them. Alpha agonists, beta blockers, carbonic anhydrase inhibitors had local side-effects such as allergy, dry eye, watering, irritation, burning sensation and discomfort in 12.2% (10),

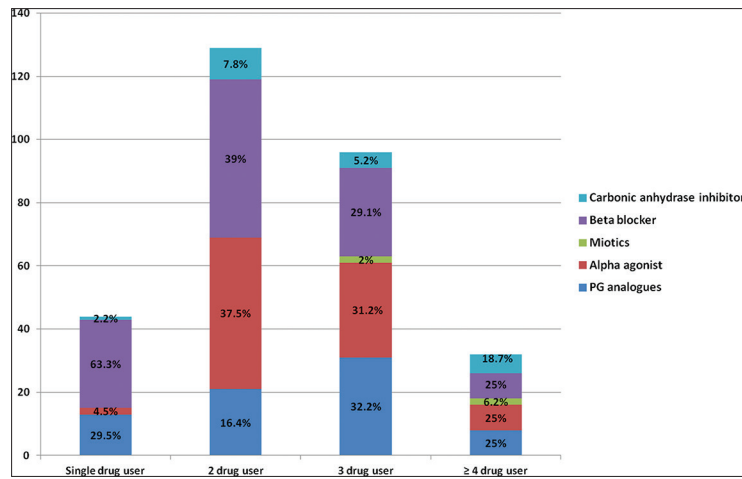


Figure 2: Component bar diagram showing percentage of different drugs used by single and multiple drug users patients

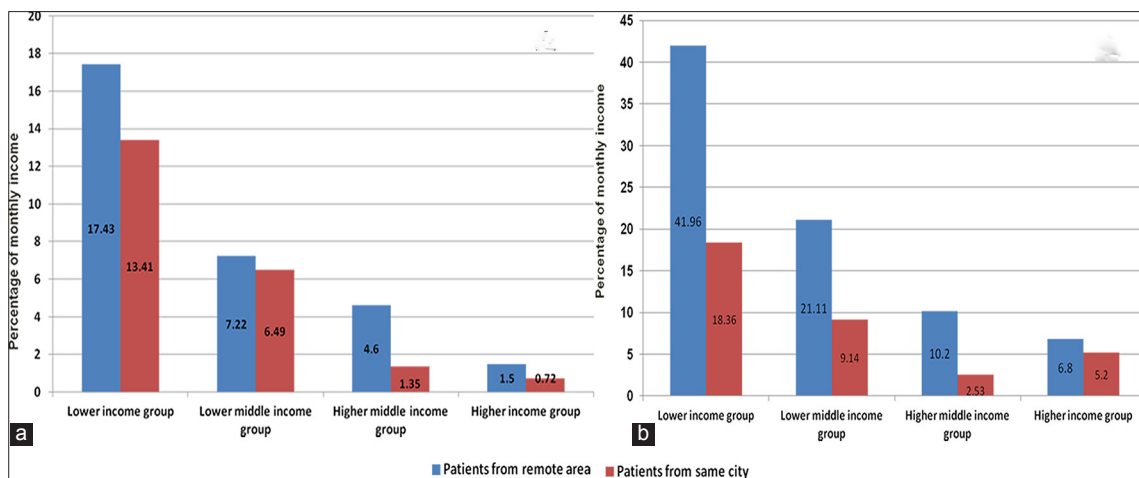


Figure 3: (a) Adjacent bar diagram showing mean drug cost in percentage of monthly income in patients both from remote area and of same city in different income groups. (b) Mean total expenses in percentage of monthly income in patients both from remote area and of same city in different income groups.

7.9% and 4.5% (1) of patients using them. Of the 4 patients who were using pilocarpine, none reported any local or systemic side effects.

Ninety-two percent (138) patients said they used their medicines regularly. 9.3% (14) of these had a postgraduate degree and said they understood the necessity of medications and the consequences of noncompliance. Of these, 17.3% (26) had received education between higher secondary school to graduation and were aware of the benefits of regular use of drugs to some extent and enquired for more information. About 50.7% (76) patients were educated up to 10th class and 22.7% (34) were illiterate, used medicines drug solely because they had been asked to do so and showed little interest in finding out more about their disease. The more educated patients having postgraduation degree were more compliant with their medication (100%) in comparison to the less educated group that was 88.2% ($P = 0.598$). The highly educated patients had better understanding of the disease.

Seventy-five percent (113) patients instilled their drops themselves, while 24.7% (29) had them administered by their family members. 5.3% (8) patients put their medications either themselves or by family members whenever available.

Given the option of laser or surgery instead of lifelong medications, 10% (15) patients agreed for laser therapy as an alternative treatment, while only 4% (6) wanted surgery. The majority of the patients 86% (129) could not make a decision and wanted the treating doctor to decide.

All glaucoma medications were not easily available in smaller markets and towns, but some were available in the district headquarter markets. Most patients bought and took their medicines from Delhi.

Discussion

This cross-sectional study on the socioeconomic impact of long-term medical therapy for glaucoma revealed that most of the patients presenting to the government funded center were extremely poor. Buying anti-glaucoma drugs on a regular basis was a burden for them since it raised their monthly expenditure exorbitantly beyond their monthly income. More than 50% patients presenting to us earned below Rs. 5000/month. Only 8% of patients had their medical costs reimbursed from health insurance or government schemes. The average cost of glaucoma drugs alone ranged from 13% to 123% of the

monthly income of the lower income group patients. This implies that either a loan was taken or assets sold, to finance therapy highlighting the need for a cost-effective treatment such as surgery in such patients, especially if they belong to distant rural areas.

A third of the visiting patients came from distant rural areas of various Indian states, a fact which increased indirect medical costs of the patients. If travel, stay and loss of wages are included, the average consolidated cost rises to 42% of the monthly income of patients from the lower income group, especially if they lived in rural areas wherein the nondrug cost is much more than the direct therapy cost ($P < 0.05$). Most of the patients worked in the unorganized sector and earned daily wages so that 6–8 h spent in the hospital meant loss of daily wages for the patient and their attendants. In our study, older age group (>60 years) and younger age group (<40 years) had been found to have higher cost of therapy ($P < 0.05$) than middle age group (40–60 years). This is probably because more medication is needed to achieve target IOP in older individuals and in younger than 40 years there were more refractive glaucomas like posttraumatic, operated vitreoretinal surgery with silicon oil induced glaucoma, postuveitic glaucoma and developmental glaucoma were found which also needed maximal medical therapy. Similarly, older age and greater severity of glaucoma have been found to be associated with higher costs of therapy.^[9] Similarly, a study from France by Rouland *et al.* showed that direct medical costs amounted to 45% of the total cost whereas direct nonmedical costs were 20%, and indirect costs were 35%, which were considerable.^[10] Another study from Europe found the average, estimated annual direct health care cost of glaucoma-related blindness to be between €429 and €523 per patient while annual total costs, including rehabilitation costs and costs to families, were estimated to be between €11,758 and €19,111.^[11] Similarly, in Nigeria, the average cost of glaucoma medications was USD 40/month, with indirect costs of tests, transportation and escorts adding another USD 105.4/month.^[5] Another study from USA found an average cost of glaucoma treatment per patient for outpatient and inpatient was \$276 and 2270 respectively.^[12] Development of the basic glaucoma-related services, diagnosis, therapy or at least a good review at neighboring district hospitals, would significantly decrease the expenses incurred by patients away from large cities. Training ophthalmologists to do a good fundus examination, tonometry, gonioscopy and even perimetry, should be undertaken periodically. Introduction of incentives by the government for ophthalmologists to practice in remote areas could be helpful. The introduction of telemedicine facilities at such hospitals would allow consultation with Glaucoma specialists when required. Hence, there is an urgent need for cheap health insurance schemes or microloan facilities for lower income group patients which would help patients seek medical help early, and continue the prescribed medical treatment lifelong.

A single medication was being used by 30.7% of patients in this study, of which beta blockers were used in two-thirds and prostaglandin analogues in about a third. The average expenditure on beta blockers was 4 times less, than prostaglandin analogues in a month. Though prostaglandin analogues are more effective in their IOP-lowering effect than other medications, however, their cost along with local ocular side effects is an issue.^[13] Timolol may be started as an initial

treatment in poorer patients, when not contraindicated, as it is extremely cost-effective and prostaglandin analogues may be reserved as an alternative or as add-on therapy for patients not achieving “target” IOP with timolol. However, prostaglandin cost is reported to be offset by fewer clinic visits for switches, and by avoiding surgery or costs associated with managing low vision.^[14] Pilocarpine which is a cheap, effective and comfortable alternative, should be utilized especially in cases of angle closure glaucoma and should be made available in developing countries. The availability of quality controlled generic drugs may make a significant impact to the cost of medical therapy. As most patients were on more than one drug, drug combinations may be considered, both from an economic and quality of life aspect, after evaluating the efficacy of each component.

Only 2.7% of our patients on timolol reported systemic side effects in the form of exacerbation of asthma.^[3] Sood *et al.* from India had described the incidence of systemic adverse effect from timolol to be 11.2% few decades earlier.^[6] This decline incidence of side effects could be because of punctual occlusion being performed by the patients and reflects awareness among doctors of such side effects, and effective history taking prior to starting this drug. Waldock *et al.* described decrease in pulmonary function test on spirometry in 15% of patients using timolol after excluding chronic obstructive pulmonary disease patients.^[3] Local ocular side-effects were encountered by 21.3% of patients. Local ocular adverse effects were most commonly appreciated with the use of prostaglandin analogues (17%), followed by alpha agonists (12%).^[15,16] Four patients using pilocarpine had no side effects.^[17] Any side-effect requires more frequent visits to the hospital resulting in an increase in indirect medical costs due to glaucoma.

Besides, all glaucoma investigations, such as the perimetry, imaging and diurnal phasing were not charged for in our institution, but in private hospitals, the cost of perimetry is on average Rs. 900 and that of tonometry which is included in consultation charges is on average Rs. 400 for a patient in Delhi. Hence, the total cost would rise significantly if the cost of these essential investigations at least twice a year is included. Thus, there is a need for proper follow-up guidelines, which should be drafted for these patients to avoid unnecessary outpatient visits at short intervals.

The impact of the proper doctor-patient interaction and patient counseling during the specialty clinic could be comprehended by the presence of more than 90% of the patients who were compliant because of repeated counseling by treating doctors. 86% of the follow-up patients, relied totally on their treating physician's advice regarding their course of treatment. This further underscores the importance of proper patient education. Hence, it is imperative, that developing countries with limited resources manage glaucoma patients after modifying the best practices, in a cost-effective manner.^[7] Only a fourth of our patients understood to some extent, the need for compliance, adherence and the risk of progression to blindness if the drugs were not used. The more educated patients having postgraduation degree were more compliant with their medication (100%) in comparison to the less educated group that was 88.2% ($P = 0.598$). The highly educated patients had better understanding of the disease. This highlights the necessity for repeated glaucoma education

programs, preferably during such glaucoma specialty clinics, so that patients are aware of risk factors for the disease and its progression, the importance of regular, timely medication use and review, as also screening of their family members. The doctor-patient interaction in most speciality clinics is short and hence that instead of advising every patient individually, it would save time and energy for both doctor and patients, to have a counselor or video tape discussing these topics in the local language of the patients.^[18,19]

Implementing glaucoma screening programs for all patients over 40 years presenting to the hospital would help detect glaucoma early, which would decrease costs in the long-term. Early, primary surgery could be considered for the low socioeconomic group, after health education on glaucoma. Anand *et al.* in a study from India found a reasonable acceptance, of early surgery in 65% primary open-angle glaucoma patients, and this increased on educating patients about their disease.^[8] A study from USA by Varma *et al.* showed that early identification and treatment of patients with glaucoma or ocular hypertension at risk of vision loss is likely to reduce an individual's loss of health-related quality of life as well as minimize the personal and societal economic burdens.^[20] Vaahtoranta-Lehtonen *et al.* reported that an organized screening program in Finland, was a cost-effective strategy, especially in older age groups, and was acceptable to decision makers and patients at any level.^[21]

Conclusion

The socioeconomic impact of medical therapy in glaucoma is considerable, and treatment should be individualized to suit the educational and socioeconomic aspect of each patient. We often tend to neglect the economic burden of travelling and loss of livelihood due to the frequent follow-ups. Implementation of certain steps such as an introduction of quality controlled generic drugs, and use of cheaper alternatives such as timolol and pilocarpine in suitable candidates may address the cost issue for some patients. Appropriate patient counseling and holding glaucoma education programs may help in ensuring good patient compliance. Periodic training of ophthalmologists at district hospitals in the management and follow-up of these patients, and using teleophthalmology facilities in peripheral areas would minimize travel issue for such patients.

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