

Glaucoma Medication Compliance Issues in a Jamaican Hospital Eye Clinic

L Mowatt^{1, 2}, J Nelson-Imoru², G Gordon-Strachan¹

ABSTRACT

Objective: To investigate the level of compliance with glaucoma medications in a clinic setting and the factors associated with failed compliance.

Method: This was a prospective study done at the Glaucoma Clinic, University Hospital of the West Indies, between April and June 2005. Consecutive patients in the clinic were administered a questionnaire by the doctor. Statistical analysis was done using cross-tabulations, Chi-square (χ^2) tests and odds ratio using SPSS version 11.0.

Results: One hundred glaucoma patients were recruited: 63% were female; 57% of the total group was in the 61–80-year age group. Forty-seven per cent had been attending the glaucoma clinic for over 10 years. Eighty-five per cent knew their diagnosis, although only 22% understood their diagnosis. Patients who did not have a full understanding of glaucoma were more likely to be non-compliant (odds ratio 0.771 (95% CI 0.298, 1.995, $p = 0.591$)).

Females were more likely to be compliant than males (odds ratio was 1.64 (95% CI 0.72, 3.75, $p = 0.24$)). Patients who were clinic attendees for less than five years duration were less compliant than those attending the glaucoma clinic for 6–10 years. The reasons for reduced compliance were financial in 44%, forgetfulness in 20% and eye-drops being unimportant in 12% of cases. The educational level of patients was not related to compliance.

Conclusion: The level of full compliance was 50% and partial compliance 43%. There was a 7% level of non-compliance. Higher levels of compliance were seen in females, patients who understood their diagnosis and those who had no co-morbid disease.

Keywords: Afro-Caribbean, compliance, glaucoma, Jamaican, non-adherence

Problemas del Cumplimiento de la Medicación en una Hospital Oftalmológico de Jamaica

L Mowatt^{1, 2}, J Nelson-Imoru², G Gordon-Strachan¹

RESUMEN

Objetivo: Investigar el nivel de cumplimiento de la medicación del glaucoma en el contexto de una clínica y los factores asociados con la falta del cumplimiento.

Método: Se trata de un estudio prospectivo en la Clínica del Glaucoma del Hospital Universitario de West Indies, entre abril y junio de 2005. A un número de pacientes consecutivos en la clínica, les fue aplicado un cuestionario por parte de un facultativo. El análisis estadístico se realizó usando tabulaciones cruzadas y pruebas de chi-cuadrado (χ^2) así como el cociente de probabilidades (odds ratio) usando la versión 11.0 del SPSS.

Resultados: Se reclutaron cien pacientes con glaucoma, de los cuales el 63% eran hembras. El 57% de la totalidad de los pacientes se hallaba en el grupo etario de 61 a 80 años. El 47% había estado asistiendo a la clínica del glaucoma por más de 10 años. El 85% conocía su diagnóstico, aunque sólo el 22% entendía su diagnóstico. Los pacientes que no tenían plena comprensión del glaucoma eran con mayor probabilidad aquellos que no cumplían con la medicación (odds ratio 0.771 (95% CI 0.298, 1.995, $p = 0.591$)).

From: ¹Department of Surgery, Radiology, Anaesthesia and Intensive Care, The University of the West Indies, Kingston 7, Jamaica and ²University Hospital of the West Indies, Kingston 7, Jamaica.

Correspondence: Dr L Mowatt, University Hospital of the West Indies, Kingston 7, Jamaica. E-mail: lizettemowatt@yahoo.com

Las hembras mostraron una mayor probabilidad que los varones en cuanto a cumplir con la medicación (odds ratio 1.64 (95% CI 0.72, 3.75, $p = 0.24$)). Los pacientes que habían asistido a la clínica por menos de cinco años, mostraban menos cumplimiento que los que habían asistido a la clínica del glaucoma por un período de 6 a 10 años. Las razones para la disminución del cumplimiento fueron problemas financieros en 44%, olvido en 20% y el considerar los colirios como no importantes en 12% de casos. El nivel educacional de los pacientes no guardaba relación con el cumplimiento.

Conclusión: *El nivel de cumplimiento pleno fue de 50% y el de cumplimiento parcial 43%. Hubo un nivel de no cumplimiento de 7%. Se vieron niveles más altos de cumplimiento en las hembras, los pacientes que entendían el diagnóstico, y aquéllos que no tenían ninguna enfermedad co-mórbida.*

Palabras claves: Afro-caribeño, cumplimiento, glaucoma, no adhesión, jamaicano

West Indian Med J 2011; 60 (5): 542

INTRODUCTION

Glaucoma is an irreversible blinding disease which is estimated to affect over 60.5 million people in the year 2010 (1). It is the second most common cause of blindness worldwide and the most common cause of blindness in African-Americans (1, 2). Racial differences have been found in Afro-Caribbeans who have significantly higher intraocular pressures (IOPs), thinner corneas and greater optic disc and cup areas compared to Caucasians (3). Jamaica is the largest English-speaking island in the Caribbean, with a population of about 2.8 million people of which 91.2% are of African descent (4). Although there are no published prevalence data from Jamaica, the prevalence of glaucoma is 3.9–8.8% in Afro-Caribbean people from Barbados and St Lucia (5–7). African-Americans are more likely to develop earlier and more progressive glaucoma than Caucasians (5).

Lowering IOP is the main target of treatment, which will prevent progression of glaucoma and visual loss (8). Compliance with effective treatment ensures that the IOP is lowered which can prevent visual impairment. Patients with chronic diseases that are asymptomatic such as chronic open angle glaucoma have been shown to be more prone to poor patient adherence (9). Medical non-compliance may be due to several reasons including financial, physical and time constraints, frequency of medication, lack of understanding of the disease, co-morbid conditions and presence of cognitive, visual and/or hearing impairment (10–14). Tsai *et al* found that situational and environmental factors were obstacles to compliance in 49% of cases, medication regimens 32% and patients' factors in 16% of cases in his study on glaucoma (10). Situational factors such as forgetfulness and 'being away from drops' have been cited as major factors for non-compliance in other studies (11, 15). African-Americans have been noted to be poorer adherers to glaucoma medication, taking less than 25% of their medication, (13). The purpose of this study is to assess the level of compliance and risk factors for non-compliance in this Jamaican sample population.

SUBJECTS AND METHODS

This was a prospective study conducted at the glaucoma clinic of the University Hospital of the West Indies (UHWI), Jamaica, between April and June 2005. The inclusion criteria included all glaucoma patients attending the glaucoma clinic and who were able to give consent. Voluntary written consent was obtained from all patients. Patients were excluded if they were unable to communicate verbally.

Data were collected in the form of a questionnaire which was asked by the attending doctor at the end of the patient's glaucoma clinic visit (Appendix). Data were obtained on the patient's age, gender, level of education, occupation, knowledge of their diagnosis and understanding of glaucoma, visual acuity, medication regime, and compliance level, reasons for non-compliance, the presence of co-morbid disease and the number of years attending the clinic. Full compliance was defined as adhering to the patient's regimen and not missing any medication from their last clinic visit. Partial compliance was defined as missing one or more eye-drops per week. Non-compliance was defined as not taking any prescribed glaucoma medication at all. The study was done in accordance with the tenets of the Helsinki Declaration. Voluntary consent was obtained and patient confidentiality was maintained throughout the study. The research protocol was approved by the Ethics committee, Faculty of Medical Sciences at The University of the West Indies. Cross-tabulation, Chi-square (χ^2) tests and odds ratio were done. Statistical analysis was by the SPSS software version 11.0.

RESULTS

Gender and age groups

One hundred consecutive patients were recruited from the glaucoma clinic at the UHWI between April and June 2005. Sixty-three per cent were females; 42% of females were non-compliant compared to 54% of males. Females were more likely to be compliant than males, 69.4% *versus* 30.6% ($p = 0.31$) respectively. The odds ratio of females and males with respect to compliance was 1.64 (95% CI 0.72, 3.75, $p =$

0.24). Fifty-seven per cent of the total group were in the 61–80-year old age group. Fourteen per cent were in the > 80-year old age group and 4% were < 20 years old. The patients were analysed according to their age groups of < 21, 21–40, 41–60, 61–80 and > 81 years. All of the patients < 21 years old were male of which 75% were compliant (Fig. 1). In the 21–40-year old age group, 33.3% were compliant,

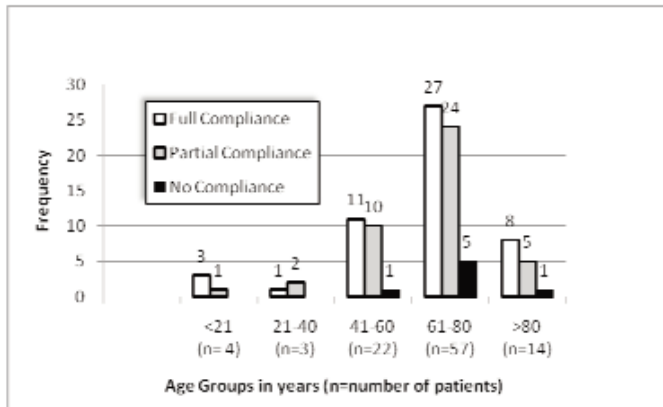


Fig. 1: Compliance within age groups.

compared to 50% in the 41–60-year old age group. In the 61–80-year old age group, 47.3% were compliant. Although the 21–40-year old age group had the least compliance level, the number of patients in that group was small. Seventy-one per cent of the patients were older than 60 years of age. The odds ratio of patients who were ≤ 60 years *versus* those > 60 years was 0.907 (95% CI 0.38, 2.15, $p = 0.83$); therefore, patients ≤ 60 years would be more compliant.

Number of years attending the eye clinic

Fifty-three per cent of patients had been attending the glaucoma clinic at the UHWI for < 10 years (Fig. 2). Four-

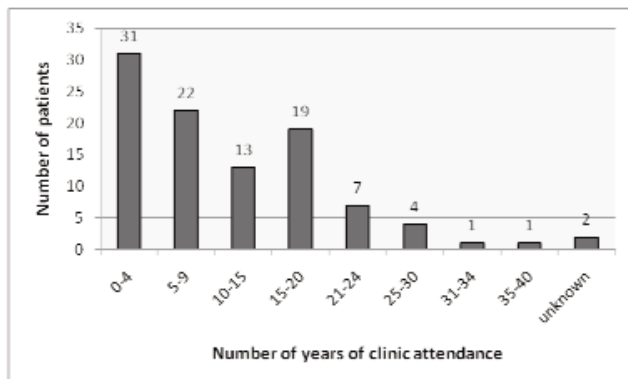


Fig. 2: Number of years attending the glaucoma clinic.

teen per cent had been attending the clinic for > 20 years. Patients who had been attending the clinic for ≤ 10 years, were subdivided into those in their first and second 5-year period to determine if there was a difference in compliance

according to the length of period of attendance. Patients who were clinic attendees ≤ 5 years were less compliant than those attending clinic in their second 5 years (6–10 years of attending the glaucoma clinic). The odds ratio was 0.90 (95% CI 0.299, 2.712, $p = 0.85$), however, this was not statistically significant.

The compliance data of the patients in their first 10 years of clinic attendance were compared to those in their second decade of attending the glaucoma clinic. Patients who have been attending the clinic for more than 10 years were more likely to be non-compliant (odds ratio 0.655, 95% CI 0.288, 1.49, $p = 0.31$). Patients were more likely to be less compliant during the first 5 years of clinic attendance and also after >10 years of clinic attendance.

Effect of educational level, knowledge and understanding of diagnosis on compliance

Seven per cent of the patients had tertiary education and 62% had at least secondary (high school) education. Thirteen per cent were domestic helpers, 8% were retired, 6% were in the health profession (4 nurses and 2 ward assistants), 5% were self-employed, 4% were students and 3% were unemployed. Only 33% of patients who had tertiary (university) education were fully compliant compared with 50% and 53% of patients with primary and secondary (high school) education respectively (Fig. 3). In 8 cases, it could not be determined

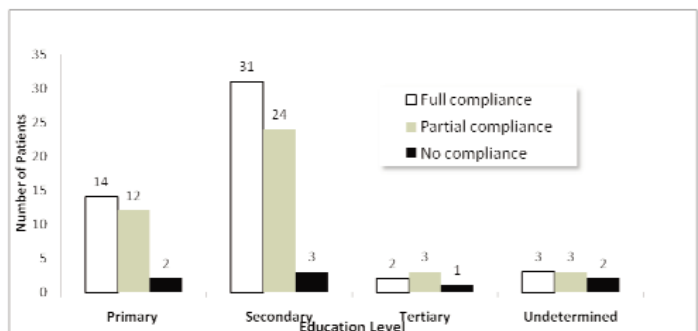


Fig. 3: Compliance with respect to the educational level of clinic patients.

what level of education the patients had attained. The compliance odds ratio was 1.0 (95% CI 0.439, 2.572, $p = 0.893$) whether one had only primary or at least secondary education. There was no statistical difference between the level of education and medication compliance ($p = 0.855$).

Eighty-five per cent of the patients knew that their diagnosis was glaucoma. However, only 22% of the total group had a complete understanding of what glaucoma was with regard to an increase of intraocular pressure and the need for eye-drops to reduce the pressure thereby reducing the risk of visual loss. Thirty-three per cent had an incomplete idea of what glaucoma was and 45% had no idea what glaucoma meant. Patients who did not have a full understanding of glaucoma were more likely to be non-compliant (odds ratio 0.771 (95% CI 0.298, 1.995, $p = 0.591$). Patients

who understood their disease were 1.13 times more likely to be compliant (relative risk) *versus* those who did not understand their disease.

Treatment modalities and compliance

Fifty per cent of patients said that they were fully compliant with their medications, 43% said that they were partially compliant and 7% reported no compliance. Seventy-three per cent were on topical treatment only, 27% used a combination of topical and oral medications and 1% took oral medications alone. Forty-two per cent required only one eye-drop, 34% required two eye-drops and 24% required three or more eye-drops (Fig. 4). Twenty-two per cent of patients

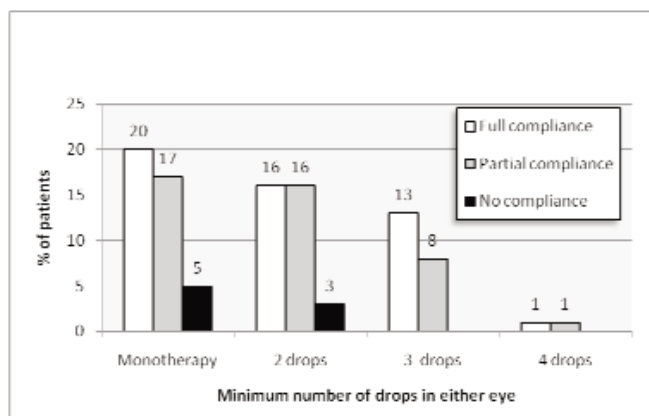


Fig. 4: Compliance with respect to number of drops (monotherapy *versus* polytherapy).

who were compliant were on oral medications compared to 26% who were non-compliant. There were 46.5% of patients who were on monotherapy; 45.7% of patients on dual therapy compared with 61.9% of patients on three eye-drops were fully compliant. The number of patients taking more than three drops was small. Although compliance was highest amongst those taking three topical medications, it was not statistically significant.

Effect of co-morbidity and visual acuity on compliance

There were 84.4% of patients that were compliant (full and partial) who did not have systemic co-morbid disease. However, of the patients with co-morbid disease (hypertension and diabetes) only 42% were fully or partially compliant. The effect of reduced vision on compliance was analysed; only 38.5% of patients with significantly reduced vision in at least one eye of 20/200 (log MAR 1.0) were fully compliant. Ten per cent had no compliance at all with their eye-drops (Table 1). The odds ratio of compliance with patients with log MAR 1.0 or less was 1.06 (95% CI 0.452, 2.497, $p = 0.89$). The odds ratios of compliance between patients with log MAR visual acuity of 0.5 *versus* those with a visual acuity worse than 0.5 was 1.0. Having good vision *versus* reduced vision did not have an effect on compliance.

Table 1: Compliance in patients with reduced visual acuity $\leq 20/200$ in one eye

Compliance	Frequency	Percentage (%)
Full	15	38.5%
Partial	20	51.3%
None	4	10.3%

Risk factors for lack of compliance

The main causes of lack of compliance were financial in 44% and forgetfulness in 20% of cases. Twelve per cent of non-compliant patients did not think that the drops were important (Table 2); 8% of non-compliant patients could not

Table 2: Reasons for non-compliance

Reasons	Number (n)	% of patients
Forgot to use drops	10	20%
Drops not important	6	12%
No reason	4	8%
Lost prescription	3	6%
Side effects	3	6%
Wrong instillation of drops	1	2%
No help with drops	1	2%

give a reason. In this group of patients, there was no statistical significance in gender, age, education, knowledge and understanding of disease and use of multiple medications on the cause for compliance (Table 3).

Table 3: Statistical significance of risk factors for compliance

Risk factors	Statistical significance
Gender	0.31
Age	0.77
Educational level	0.86
Knowledge of their diagnosis	0.16
Understanding of glaucoma	0.33
Multiple medications to eye	0.34

DISCUSSION

Non-compliance in glaucoma medication usage ranges from 5%–80% depending on the method used in the assessment of compliance (16–22). Different assessment methods include structured interviews, patient self-reports, medication possession ratio (MPR), electronic and microprocessor monitoring (10–13, 23). The method may affect the final result as patient interviews had 8.3–80% of non-compliers (16–18). Patient compliance, when assessed by the questionnaire method, ranged from 5–59% (19, 20). For prescription collection data analysis, there was 24.7% non-compliance (21). However, patients might have collected their prescription but that did not necessarily mean that they took medications as prescribed.

The Glaucoma Adherence and Persistency Study (GAP Study) used the mean MPR [*ie* days of prescription supply dispensed divided by the number of days between the first and last prescription] (12). This objective method showed that only 10% of patients actually continuously refilled their medication in a year (12). The MPR can be underestimated in patients on monotherapy (MPR 0.56, *versus* 0.7 for patients on bilateral treatment) or patients who get samples. However, the electronic medication monitoring reports a much lower compliance to medication than patients' self-report and physician's estimate (13). The definitions of compliance were not standardized amongst the studies.

Estimated compliance by patients is much higher than that of physicians and also that logged by eye-drop monitor. In the study by Kass *et al*, interviewed patients stated 99% compliance, the physicians' estimated 79% compliance and the eye-drop monitor revealed 76% compliance (24). In the study by Okeke *et al*, the patients were more compliant just after the office visit and just before the return visit, with 55% of patients taking 75% of their required eye-drops (25). In that study, patients were on a single once a day eye-drop which was supplied free of cost.

A 'white coat syndrome' has been described where patients were more compliant five days before the office visit, declining in compliance over 30 days after the visit (11, 12). This may explain cases in which the patient's intra-ocular pressures may be normal at the office visit, yet they continued losing visual field over time. It is important for the ophthalmologist to be aware of patients who may not be fully compliant with their medications. The GAP Study showed that 1:5 patients had clinically significant non-adherence which the physician could not detect, as patients self-reporting of compliance may be as high as 95% (12).

In this Jamaican study, the 'white coat' effect was reversed in some cases, as patients whose eye-drops had finished a few days to a week before their clinic appointment did not refill their prescription. This was done for varying reasons including that they 'thought' that the prescription might be changed, to the fact that they were hoping to get samples. Jamaican patients also had a tendency not to use their eye-drops on the day of clinic, either because 'the doctor was going to use drops in the eyes' or because they had to leave early to get to the eye clinic and forgot to use them.

Compliance of patients with their medication can depend on their understanding of the disease, how important, they think it is to their health, their symptoms, visible health benefits and the consequences of non-compliance (26, 27). Patients may be less likely to stick to chronic regimes that do not offer definitive symptomatic improvement as adherence to prostaglandin eye-drops were lower than to cardiovascular, oral anti-diabetic or oral treatment for osteoporosis (26). The adjusted odds ratio of compliance with oral anti-diabetics *versus* topical prostaglandin analogues was 17.6: 2 (26). This may be related to the effect of the disease on

lifestyle, resulting in its level of importance to the patient. In the index study, there was no statistical difference in compliance levels between patients with good vision *versus* patients with low vision.

Eighty-six per cent of the patients knew their diagnosis which was in keeping with studies by Kosko *et al* and Stryker *et al* which were predominantly in a Black population (27, 28). However, only 22% of patients in the present study understood their diagnosis. The patients who understood their diagnosis were 1.13 times more likely to be compliant than those who did not, as noted in other studies (27, 28). Studies have shown that patients were less compliant if < 50 or ≥ 80 years, African American, higher depression levels and lower income (13, 29). However, other studies showed similar compliance between Caucasians and African-Americans (27, 30–32).

In the present study, higher levels of compliance occurred in females, patients ≤ 60 years old and patients in their first 5 years of attending the eye clinic but these were not statistically significant. Older patients may have a lower compliance due to lack of family support, reduced vision or problems with manual dexterity, coordination, comprehension or memory; however, this was not assessed in this study. Patients who were widowed ($p = 0.041$) or lived alone ($p = 0.042$) were more likely to be compliant (31). This may be related to the importance that the patient placed on maintaining vision and independence. Only 38.5% of patients who had reduced vision in one eye ($\leq 20/200$ or log MAR 1.0) were compliant. There was no difference between the compliance of patients with \leq log MAR 0.5 *versus* those with worse vision $>$ log MAR 0.5. However, a review of the literature showed a possible association of compliance with vision, where the compliance was better if the vision was better (22).

Anti-glaucoma agent requiring > 2 administrations per day was a significant predictor of reduced compliance (23, 25, 33). Kass *et al*, in his group of patients treated with pilocarpine, found that 15.2% of patients omitted at least 50% of the drops and 6% of the patients omitted at least 75% of the drops (24). Norell and Granström noted that 41% of the patients omitted at least 10% of prescribed pilocarpine in their patient self-reporting study (33). Gurwitz *et al* also showed that patients on multiple agents had an adjusted odds ratio of 0.55 with respect to compliance *versus* monotherapy (32). Monotherapy *versus* polytherapy did not play a significant role in the level of non-compliance in the present study.

In the index study, the most common reason for reduced compliance was financial in 44% of cases, with forgetfulness as a cause in 20% and eye-drops being unimportant in 12% of cases. Financial problems were listed by 24.7% of patients as their cause for non-compliance. In another study, lower compliance level was more likely in patients with lower incomes and educational level [Blacks and females] (34). However, only 14.7% of that study popu-

lation was Black. Studies may be biased if eye-drops were supplied by the study group, hence finances would not have been a factor (25).

Patients with secondary level education showed the highest level of compliance (full and partial). In the present study, only 33% of patients with a university education were compliant, but the number in this group was too small to further analyse. However, in the total study group, there was no statistical difference between the level of education and compliance as seen in other studies (31).

Forgetfulness and inconvenience were the reasons for non-compliance in 42% of MacKean's and Elkington's study population (30). That study showed that younger patients were more likely to know their diagnosis, be better educated and of a higher social class than those that did not know their diagnosis. Gender, severity of visual field loss, length of time of diagnosis and knowledge of the disease mechanism did not have any effect on compliance (30). Situational factors such as lack of support, major life events, being away from home and changes in routine can also cause reduced compliance in 49% of cases (10). Side effects affected compliance in 6% of patients in the present study. In the GAP Study, patients who spontaneously reported the adverse effects of stinging and burning were more adherent to their medications than those who did not report it (35). Therefore, this and hyperaemia can be used as markers for adherence to the drug.

Although gender, educational level, time attending the clinic, knowledge and understanding of the disease were not associated with statistically significant factors for compliance, financial constraint has been an issue for non-compliance in the present study. In Jamaica, although most of the glaucoma eye-drops are subsidized by the National Health Fund, there is still a problem with compliance.

The GAP Study showed that patients had a poor adherence to the medication if they had a passive 'doctor dependent' role in learning about glaucoma and if they were not concerned about visual loss. Also, patients who were less adherent to their regimens were less satisfied with their doctor-patient encounter.

It is important to detect and address non-compliance amongst glaucoma patients. The importance of the eye-drops can be improved by patient education; however, this alone may not be sufficient and may require communication skills and understanding of patient beliefs, attitudes and behaviour. A patient centred communication with verbal encouragement, empathy, reinforcement, written instructions and involving the patient have been shown to improve compliance (34–36).

REFERENCES

1. Quigley HA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020. *Br J Ophthalmol* 2006; **90**: 262–7.
2. Eye Diseases Prevalence Research Group. Prevalence of Open-angle Glaucoma among Adults in the United States. *Archives of Ophthalmology* 2004; **122**: 532–8.
3. Fanni AA, Papamatheakis DG, Harasymowycz PJ. Racial variability of glaucoma risk factors between African Caribbeans and Caucasians in a Canadian urban screening population. *Can J Ophthalmol* 2009; **44**: 576–81.
4. Central Intelligence Agency: The World Fact book: Jamaica [Internet]. Accessed September 19, 2011. Available from: URL: <https://www.cia.gov/library/publications/the-world-factbook/geos/jm.html>
5. Wormald RP, Basauri E, Wright LA, Evans JR. The African Caribbean Eye Survey: risk factors for glaucoma in a sample of African Caribbean people living in London. *Eye (Lond)* 1994; **8**: 315–20.
6. Leske MC, Wu SY, Honkanen R, Nemesure B, Schachat A, Hyman L et al. Barbados Eye Studies Group. Nine-year incidence of open-angle glaucoma in the Barbados Eye Studies. *Ophthalmology* 2007; **114**: 1058–64.
7. Mason RP, Kosoko O, Wilson MR, Martone JF, Cowan Jr CL, Gear JC et al. National survey of the prevalence and risk factors of glaucoma in St Lucia, West Indies. Part I. Prevalence findings. *Ophthalmology* 1989; **96**: 1363–8.
8. Leske MC, Heijl A, Hyman L, Bengtsson B, Komaroff E. Factors for progression and glaucoma treatment: the Early Manifest Glaucoma Trial. *Curr Opin Ophthalmol* 2004; **15**: 102–6.
9. DiMatteo MR, Giordani PJ, Lepper HS, Croghan TW. Patient adherence and medical treatment outcomes. *Med Care* 2002; **40**: 794–11.
10. Tsai JC, McClure CA, Ramos SE, Schlundt DG, Pichert JW. Compliance barriers in glaucoma: a systematic classification. *J Glaucoma* 2003; **12**: 393–8.
11. Schwartz GF. Compliance and persistency in glaucoma follow-up treatment. *Curr Opin Ophthalmol* 2005; **16**: 114–21.
12. Friedman DS, Quigley HA, Gelb L, Tan J, Margolis J, Shah SN et al. Using pharmacy claims data to study adherence to glaucoma medications: methodology and findings of the Glaucoma Adherence and Persistency Study (GAPS). *Invest Ophthalmol Vis Sci* 2007; **48**: 5052–7.
13. Friedman DS, Okeke CO, Jampel HD, Ying GS, Plyler RJ, Jiang Y et al. Risk factors for poor adherence to eye-drops in electronically monitored patients with glaucoma. *Ophthalmology* 2009; **116**: 1097–105.
14. Winfield AJ, Jessiman D, Williams A, Esakowitz LA. A study of the causes of non-compliance by patients prescribed eye-drops. *Br J Ophthalmol* 1990; **74**: 477–80.
15. Kholdebarin R, Campbell RJ, Jin YP, Buys YM. Multicenter study of compliance and drop administration in glaucoma. *Can J Ophthalmol* 2008; **43**: 454–61.
16. Amon M, Menapace R, Wedrich A, Rada U. Aspekte der Betreuung von Glaukompatienten und deren Auswirkung auf die Compliance. *Spektrum Augenheilkd* 1990; **4**: 5–8.
17. Bloch S, Rosenthal AR, Friedman L, Caldarolla P. Patient compliance in glaucoma. *Br J Ophthalmol* 1977; **61**: 531–4.
18. Konstas AGP, Maskaleris G, Gratsonidis S, Sardelli C. Compliance and viewpoint of glaucoma patients in Greece. *Eye* 2000; **14**: 752–6.
19. Deokule S, Sadiq S, Shah S. Chronic open angle glaucoma: patient awareness of the nature of the disease, topical medication, compliance and the prevalence of systemic symptoms. *Ophthalmic Physiol Opt* 2004; **24**: 9–15.
20. Chang Jr JS, Lee DA, Petursson G, Spaeth G, Zimmerman TJ, Hoskins HD et al. The effect of a glaucoma medication reminder cap on patient compliance and intraocular pressure. *J Ocul Pharmacol* 1991; **7**: 117–24.
21. Gurwitz JH, Yeomans SM, Glynn RJ, Lewis BE, Levin R, Avorn J. Patient noncompliance in the managed care setting. The case of medical therapy for glaucoma. *Med Care* 1998; **36**: 357–69.
22. Olthoff CMG, Jan SAG, Schouten JSAG, van de Borne BW, Webers C. Noncompliance with ocular hypotensive treatment in patients with glaucoma or ocular hypertension: An evidence-based review. *Ophthalmology* 2005; **112**: 953–61.
23. Hermann M, Diestelhorst M. Microprocessor controlled compliance monitor for eye drop medication. *Br J Ophthalmol* 2006; **90**: 830–2.

24. Kass MA, Meltzer DW, Gordon M, Cooper D, Goldberg J. Compliance with topical pilocarpine treatment. *Am J Ophthalmology* 1986; **101**: 515–23.
25. Okeke CO, Quigley HA, Jampel HD, Ying GS, Plyler RJ, Jiang Y et al. Adherence with topical glaucoma medication monitored electronically. The Travatan dosing aid study. *Ophthalmology* 2009; **116**: 191–9.
26. Yeaw J, Benner JS, Walt JG, Sian S, Smith DB. Comparing adherence and persistence across 6 chronic medication classes. *J Manag Care Pharm* 2009; **15**: 728–40.
27. Stryker JE, Beck AD, Primo SA, Echt KV, Bundy L, Pretorius GC et al. An exploratory study of factors influencing glaucoma treatment adherence. *J Glaucoma* 2010; **19**: 66–72.
28. Kosoko O, Quigley H, Vitale S, Enger C, Kerrigan L, Tielsch JM. Risk factors for non-compliance with glaucoma follow-up visits in a resident's eye clinic. *Ophthalmology* 1998; **105**: 2105–11.
29. DiMatteo MR, Lepper HS, Croghan TW. Depression is a risk factor for noncompliance with medical treatment: meta-analysis of the effects of anxiety and depression on patient adherence. *Arch Intern Med* 2000; **160**: 2101–07.
30. MacKean JM, Elkington AR. Compliance with the treatment of patients with chronic open angle glaucoma. *B J Ophthalmol* 1983; **67**: 46–9.
31. Djafari F, Lesk MR, Harasymowycz PJ, Desjardins D, Lachaine J. Determinants of adherence to glaucoma medical therapy in a long term patient population. *J Glaucoma* 2009; **18**: 238–43.
32. Gurwitz JH, Glynn RJ, Monane M, Everitt DE, Gilden D, Smith N et al. Treatment for glaucoma: Adherence by the elderly American. *J of Public Health* 1993; **83**: 711–6.
33. Norell SE, Granström PA. Self-medication with pilocarpine among outpatients in a glaucoma clinic. *Br J Ophthalmol* 1980; **64**: 137–41.
34. Budenz DL. A Clinician's guide to the assessment and management of non-adherence in glaucoma. *Ophthalmology* 2009; **116**: S43–S47.
35. Friedman DS, Hahn SR, Gelb L, Tan J, Shah SN, Kim EE et al. Doctor-patient communication, health related beliefs and adherence in glaucoma results from the Glaucoma Adherence and Persistency Study. *Ophthalmology* 2008; **115**: 1320–7.
36. Friedman DS, Hahn SR, Quigley H, Kotak S, Kim E, Onofrey M et al. Doctor-Patient communication in glaucoma care. Analysis of videotaped encounter in a community based office practice. *Ophthalmology* 2009; **116**: 2277–85.

APPENDIX

Questionnaire used for the study

GLAUCOMA AUDIT April – May 2005

Age <input type="checkbox"/> <20yrs <input type="checkbox"/> 20–40 yrs <input type="checkbox"/> 41–60 yrs <input type="checkbox"/> 61–80yrs <input type="checkbox"/> >80yrs	<input type="checkbox"/> Male <input type="checkbox"/> Female	Educational Level <i>Age they left school</i> <input type="checkbox"/> Primary <input type="checkbox"/> Secondary <input type="checkbox"/> Tertiary <input type="checkbox"/> Other
---	--	---

Occupation: _____ **No of years attending clinic:** _____

What is your diagnosis? **Glaucoma** ☐ **Don't know** ☐

Do you understand what is Glaucoma? **Yes** ☐ **Vague idea** ☐ **No** ☐
(ask pt to describe in his own words what it is, doctor will determine patient's understanding)

MEDICATION: (tick where applicable)

COMPLIANCE

Anti glaucoma Drug	RE	LE
Betablockers	<input type="checkbox"/>	<input type="checkbox"/>
Pilocarpine	<input type="checkbox"/>	<input type="checkbox"/>
Dorzolamide	<input type="checkbox"/>	<input type="checkbox"/>
Brimonidine tartrate	<input type="checkbox"/>	<input type="checkbox"/>
Brinzolamide	<input type="checkbox"/>	<input type="checkbox"/>
Timolol/dorzolamide	<input type="checkbox"/>	<input type="checkbox"/>
Latanoprost	<input type="checkbox"/>	<input type="checkbox"/>
Travaprost	<input type="checkbox"/>	<input type="checkbox"/>
Acetazolamide	<input type="checkbox"/>	<input type="checkbox"/>

- ☐ **Fully (all meds, always)**
☐ **Partial (some meds occ)**
☐ **Not on any meds**

If Non compliant Reasons given:

- ☐ **No Money**
☐ **Drops not important**
☐ **Lost prescription.**
☐ **More important meds to buy**
☐ **Doctor never told him to get more**
☐ **Other (explain).....**

Visual Acuity (best corrected)

RE..... **LE**.....

Other Illness: ☐ **DM**
☐ **HTN**
☐ **Other chronic illness**

Please return to Dr Nelson –Imoru after completion. Thank you!