Title
Time Trade-off Utility Values in Noninfectious Uveitis

Authors
Niemeyer, Katherine M
Gonzales, John A
Doan, Thuy
et al.

Publication Date
2019-12-01

DOI
10.1016/j.ajo.2019.06.005

Peer reviewed

HHS Public Access

Author manuscript

Am J Ophthalmol. Author manuscript; available in PMC 2020 December 01.

Published in final edited form as:

Am J Ophthalmol. 2019 December ; 208: 47–55. doi:10.1016/j.ajo.2019.06.005.

Time Trade-Off Utility Values in Noninfectious Uveitis

Katherine M. Niemeyer[1], **John A. Gonzales**[1,2], **Thuy Doan**[1,2], **Erica N. Browne**[1], **Maya M. Rao**[1], **Nisha R. Acharya**[1,2,3]

[1]F.I. Proctor Foundation, University of California, San Francisco

[2]Department of Ophthalmology, University of California, San Francisco

[3]Department of Epidemiology and Biostatistics, University of California, San Francisco

Abstract

Purpose: To investigate time trade-off (TTO) utility values in patients with noninfectious uveitis and determine whether patient demographics and clinical characteristics are associated with utility scores.

Design: Time trade-off utility analysis.

Methods: Setting: A tertiary care uveitis center in San Francisco, CA.

Patient Population: 104 consecutive adults with noninfectious uveitis, enrolled between November 2016 and February 2017.

Main Outcome and Measures: TTO utility values, as collected by an interviewer-guided survey. Information regarding general health, ocular symptoms, and religion was also collected and medical record review was conducted to record anatomic location of uveitis, disease activity, visual acuity, and treatments. Multivariable regression analysis with backwards selection was used to identify variables associated with TTO values.

Results: Median TTO score was 0.975 (IQR: 0.8–1.0), corresponding to trading a median 1.28 years of remaining life for healthy eyes (IQR: 0–6.29). Regression analysis revealed that worse eye visual acuity, >6 months of oral corticosteroid use, and current antidepressant use were associated with lower TTO scores (P=0.008; P=0.006; P=0.008, respectively), controlling for age and sex. In particular, patients who had been taking oral corticosteroids for over 6 months, regardless of dose, were 10.5 times more likely to trade 20% or more years of remaining life (TTO≤0.8) than patients not taking oral corticosteroids (95% CI: 2.3, 48.1; P=0.002).

Conclusions: Patients with noninfectious uveitis had measurable, though modest, reductions in quality of life, as assessed by TTO, and these decreases were significantly associated with visual acuity in the worse eye and long-term oral corticosteroid use.

Corresponding Author: Dr. Nisha R. Acharya, F.I. Proctor Foundation, Room S309, 513 Parnassus Avenue, University of California San Francisco, San Francisco, CA 94143-0412. Tel: (415) 476-8131; Fax: (415) 476-0527, nisha.acharya@ucsf.edu.

INTRODUCTION

Uveitis can cause significant visual impairment and is responsible for an estimated 10% of all cases of blindness in the United States.[1,2] Patients with noninfectious uveitis can have chronic inflammation and require ongoing immunosuppressive therapy, which may be associated with negative systemic side effects. Because uveitis can affect patients of all ages and cause significant ocular morbidity, it is associated with substantial medical and work loss costs.[3,4] Altogether, noninfectious uveitis has been shown to cause significant deficits in quality of life.[5–9] While several studies have used quality of life questionnaires, such as the National Eye Institute Visual Function Questionnaire (NEI-VFQ), Medical Outcomes Study 36-item Short Form Survey (SF-36), and EuroQol survey (EQ-5D), to assess quality of life with uveitis, there have been no studies that have used time trade-off utility values in patients with noninfectious uveitis.

Utility is a measure of quality of life that reflects the ability of a patient to function in activities of everyday living. Time trade-off (TTO) is a measure of utility that assesses how patients with a particular condition value their lives by asking how much time of remaining life they would trade for a described better health state. A score is then calculated on a scale from 0 (equivalent to death) to 1 (equivalent to the described better health state). Utility measures have advantages over other quality of life instruments by taking into account all aspects of a disease's impact on life in a single score that is comparable between disease states.[10] TTO can also be used in the calculation of quality-adjusted life-years and in cost effectiveness analyses, providing a way to quantify burden of disease.[11]

TTO analysis has been used to analyze the impact of several visual conditions, including macular degeneration, diabetic retinopathy, and glaucoma, on quality of life.[12–15] In these studies, better visual acuity is correlated with higher quality of life as measured by TTO, while ocular symptoms, such as persistent vitreous floaters, have been associated with decreased utility scores.[14,16–18] Patients with noninfectious uveitis not only experience visual symptoms, such as reduced acuity and floaters, but may also endure ocular and systemic side effects of immunosuppressive treatment. TTO analysis offers the opportunity to obtain a global view of how patients with noninfectious uveitis value their life.

The purpose of this study was to evaluate the quality of life in patients with noninfectious uveitis using TTO utility values and to determine how patient and disease characteristics and treatment correlate with these scores. As TTO has never been used in this population, test-retest reliability was also assessed.

METHODS

Study Design

A cross-sectional survey and medical record review was performed at the Francis I. Proctor Foundation, a tertiary care referral center at the University of California, San Francisco. The study received expedited approval through the Institutional Review Board at the University of California, San Francisco. All patients provided written informed consent. 131 consecutive patients seen between November 31, 2016 and February 21, 2017 were invited

to participate in this study until the target number of patients was achieved. Patients were considered eligible if they were at least 18 years of age, able to read and converse in English, and diagnosed with noninfectious uveitis by a uveitis specialist.

Quality of Life Survey

Participants were interviewed by a study coordinator (KN) and completed a quality of life survey using the internet survey system Google Forms (Google Inc., Mountain View, CA). The survey consisted of basic demographics questions, linear rating scales, and the TTO activity (described below). Factors such as religious affiliation and religious beliefs were also assessed, as these may influence TTO utility values.[19]

Time Trade-Off Activity

TTO utility values were obtained by structured interview-assisted questions during the quality of life survey. The protocol was adapted from the EuroQol protocol for TTO valuation and guided by previous studies regarding this technique.[20,21] The study coordinator described a state of permanently "healthy eyes" without uveitis, uveitis-related complications, or medications used for uveitis, but with no other changes to the patient's health. This was followed by a series of questions to determine how much time of remaining life, if any, patients were willing to trade for this described health state. Using visual aids, patients were asked to choose between x years with healthy eyes and 10 years in their current state of eye health. Using a 10 year horizon reduces the bias associated with temporal discounting and avoids the lower TTO values that are seen when using additional life expectancy. The value x ping-ponged from high to low values until an indifference point was reached. The ping-ponging method was chosen so that responses did not suffer from anchoring bias, which can be seen when titrating from a starting value. The smallest tradable unit was 0.5 years. Utility values were then calculated by dividing the x at which patients were indifferent by 10.

To calculate the total amount of time a patient was willing to trade, remaining life expectancy was estimated using mortality and population data from the California Department of Public Health and the U.S. Census Bureau, 2010–2012, stratified by sex and race.[22] This was then multiplied by the percentage of time a patient was willing to trade (1-TTO) to estimate how many years of remaining life a patient would trade for healthy eyes.

Medical Record Review

Medical records were reviewed for each patient to gather information on the anatomical location of uveitis, chronicity, and associated systemic diseases. Clinical characteristics collected from the visit included: visual acuity, anterior chamber cell, anterior vitreous cell, vitreous haze, retinal/choroidal lesions, and macular edema. Current and past immunosuppressive treatments were recorded, as were all comorbidities and prescribed medications. Medical record review was conducted using Research Electronic Database Capture (REDCap, Nashville, TN).

Activity, location of inflammation, and chronicity of ocular disease were described and recorded as outlined by the Standardization of Uveitis Nomenclature (SUN) criteria.[23]

Better eye (BEVA) and worse eye visual acuity (WEVA) were collected using the best recorded acuity at the date of interview. For analysis, visual acuity was converted from a Snellen measurement into a logarithm of the minimum angle of resolution (logMAR) value.

Retesting

Patients were eligible for retesting if no changes were made to their medication regimen at the visit when the interview was conducted. Retests were emailed to patients within a week of their interview and contained the same TTO activity that was completed during the primary survey.

Statistical Analysis

This study was powered to detect differences in TTO between patients with anterior uveitis and posterior segment inflammation (intermediate, posterior, and panuveitis), due to differences in treatment and outcomes between anterior uveitis and posterior segment inflammation.[24] A sample size of 104 patients, stratified to include 52 patients with anterior uveitis and 52 patients with posterior segment inflammation, was chosen to detect a 10% difference in TTO value between these groups with a two-sided α=0.05 and power=80%.

Nonparametric testing (Wilcoxon ranksum, Kruskal-Wallis) was used to summarize results, as the distribution of quality of life scores was non-normal. Multivariable linear regression modeling with backwards stepwise selection was used to assess the association of TTO scores with other variables collected, adjusting for age and sex. Because linear models did not meet normality assumptions, permutation testing was performed for these models. Logistic regression modeling was used for dichotomous classifications of TTO scores, using backwards stepwise selection, adjusting for age and sex. Test-retest reliability was assessed with intraclass correlation coefficients (ICC). Data were analyzed using Stata 14 (StataCorp LP, College Station, TX).

RESULTS

One hundred and four patients participated in the study, 52 patients with anterior uveitis and 52 patients with posterior segment inflammation. Two patients were excluded from analysis post-hoc, due to a lack of understanding of the TTO activity, leaving 102 patients included in the analysis: 50 patients (49%) with anterior uveitis, 4 patients (4%) with anterior and intermediate uveitis, 7 patients (7%) with intermediate uveitis, 10 patients (10%) with posterior uveitis, and 31 patients (30%) with panuveitis.

Demographic and Clinical Characteristics

Patient demographics and clinical characteristics can be found in Tables 1 and 2. Median age was 38 (IQR: 28–53) for the full cohort and 55 patients (54%) were female. Age, sex, race, and education did not differ between patients with anterior uveitis or posterior inflammation. More patients with posterior segment inflammation had bilateral disease (P=0.008) and chronic disease course (P<0.001) than patients with anterior uveitis. The majority of patients (58%) had either current or recent (within 2 months) inflammation at the time of interview. A higher percentage of patients with anterior uveitis were using topical corticosteroids

(*P*=0.03) and a lower percentage were using oral corticosteroids (*P*=0.04) or immunomodulatory therapy (*P*=0.05). Median visual acuity was 0.1 logMAR (Snellen equivalent 20/25; IQR: 0–0.176 logMAR) in the better eye and 0.176 (20/30; IQR: 0.1–1.0) in the worse eye.

Quality of Life

The distribution of TTO scores was non-normal (Shapiro-Wilk *P*<0.00001), with a mean score of 0.881 (SD=0.178) and median score of 0.975 (IQR: 0.8–1.0). Estimating life expectancy by race and sex, patients were willing to trade a median 1.28 years of remaining life (IQR: 0–6.29) for healthy eyes. The median TTO score for patients with anterior uveitis was 0.975 (IQR: 0.825–0.975) and the median TTO score for patients with posterior segment inflammation was 0.975 (IQR: 0.8–1.0; *P*=0.88).

Clinical characteristics associated with TTO scores

The backwards stepwise linear regression model, adjusted for age and sex, included the following variables: worse eye visual acuity (WEVA), months on oral corticosteroids, and current use of antidepressants (Table 3). TTO scores decreased with low visual acuity in the worse eye, being on oral corticosteroids for >6 months regardless of dose, and antidepressant use. Clinical characteristics that did not meet significance requirements for inclusion in the multivariable model included: better eye visual acuity, inflammatory activity, ocular symptoms, oral corticosteroid dose, current use of immunomodulatory therapy, length of time since diagnosis, or any past treatments.

Patients who were legally blind in at least one eye (WEVA of ≥1.0 logMAR, Snellen equivalent 20/200 or worse) had a median TTO score of 0.8 (IQR: 0.96–1.0) and were willing to trade a median of 4.30 years of remaining life (IQR: 0–11.17). Patients who were not legally blind had significantly higher scores, median 0.975 (IQR: 0.9–1.0; *P*=0.008), and traded significantly less time (median 1.07 years, IQR: 0–3.80), *P*=0.01. Worse eye visual acuity (WEVA) was also associated with how often a patient worries about his or her eyesight (*P*=0.01), while better eye visual acuity (BEVA) was not (*P*=0.15). Patients who were legally blind in at least one eye were 3.56-fold more likely to say that they worry about their eyesight most or all of the time, adjusting for age and sex (95% CI: 1.38, 9.16; *P*=0.008).

Median TTO score was 0.738 (IQR: 0.6–0.925) for patients taking oral corticosteroids >6 months, 0.95 (IQR: 0.85–1.0) for patients taking oral corticosteroids ≤6 months, and 0.975 (IQR: 0.825–1.0) for patients not taking oral corticosteroids (*P*=0.01). This corresponds to trading 7.94 (IQR: 3.35–11.66), 2.14 (IQR: 0–6.29), and 1.09 (IQR: 0–3.99) years of remaining life, respectively (*P*=0.02). Of the 26 (25%) patients on oral corticosteroids, the median dose was 18.8 mg/day (IQR: 5–50): 42.5 mg/day (IQR: 20–60) for patients on corticosteroids ≤6 months and 5 mg/day (IQR: 4–7.5) for patients on corticosteroids >6 months. Although a higher proportion of patients on oral corticosteroids >6 months had experienced a negative side effect associated with immunosuppressive medication compared to the rest of the cohort, this did not reach statistical significance (92% vs 67%; *P*=0.10).

There were 4 patients (4%) who were taking antidepressants at the time of interview. These patients had significantly lower TTO scores, median 0.488 (IQR: 0.35–0.663), than the rest of the cohort, median 0.975 (0.825–1.0; P=0.002). Using life expectancy data, this translated to trading a median of 10.92 years of remaining life (IQR: 10.19–17.39) for healthy eyes, compared to 1.26 years (IQR: 0–5.43) traded by the rest of the cohort (P=0.004).

Predictors of low time trade-off scores

Twenty-seven patients (26%) were in the bottom quartile of TTO scores, with utility values ≤0.8, meaning they were willing to trade ≥20% of remaining years of life for healthy eyes. Using a backwards stepwise multivariable logistic regression model, controlling for age and sex, the following variables were significant predictors of being in the bottom quartile: WEVA (OR=3.61; 95% CI: 1.60, 8.16; P=0.002) and being on oral corticosteroids for > 6 months (OR=10.51; 95% CI: 2.30, 48.13; P=0.002). Patients with a TTO score ≤0.8 had significantly lower WEVA, median 1.0 logMAR (Snellen equivalent 20/200; IQR: 0.1–1.8 logMAR) than patients with higher scores, median 0.176 (20/30; IQR: 0.05–0.6; P=0.004). The months on oral corticosteroids and current dose of oral corticosteroids can be seen by TTO score in Figure 1. Eight patients (31%) in the bottom quartile were on oral corticosteroids for >6 months, compared to 4 patients (5%) who were not in the bottom quartile (P=0.005). All patients that were on antidepressants had TTO scores ≤0.8.

Predictors of trading behavior

Seventy-four patients (73%) were willing to trade time of remaining life for healthy eyes, while 28 patients (27%) did not trade any time (TTO=1.0). Using a backwards stepwise multivariable logistic regression model, adjusting for age and sex, the following variables were significant predictors for trading time: college education (OR=5.12; 95% CI: 1.54, 17.05; P=0.008) and Catholic religion (OR=0.27, 95% CI: 0.08, 0.89; P=0.03). Ten patients (36%) who did not trade any time had no college education, compared to 6 patients (8%) who traded time (P=0.001). Nine patients (32%) who did not trade any time identified as Catholic, compared to 7 patients (9%) who traded time (P=0.01). Belief in God or a Supreme Being, belief in the afterlife, belief in reincarnation, and religiosity on a 0–10 scale were not predictive of trading behavior.

Test-retest reliability

Thirty-one patients were eligible to receive the retest and 21 patients (68%) responded within one week from the interview: 13 patients (62%) with anterior uveitis and 8 patients (38%) with posterior segment inflammation. The patients that completed the retest did not differ from the full cohort in age (P=0.96), gender (P=1.00), anatomic location (P=0.34), or TTO score (P=0.87). No patients reported a change in vision or overall health since their initial interview. Median TTO score for the retested group was 0.975 (IQR: 0.925–0.975) during the initial interview and 0.975 (IQR: 0.925–0.975) in the follow-up survey (P=1.00). The ICC was 0.95 for all patients retested (95% CI: 0.89, 0.98; P<0.001): 0.96 for patients with anterior uveitis (95% CI: 0.88, 0.99; P<0.001), and 0.95 for patients with posterior segment inflammation (95% CI: 0.79, 0.99; P<0.001).

DISCUSSION

The large majority of patients with noninfectious uveitis were willing to trade time of remaining life for healthy eyes. Specifically, patients were willing to trade a median 2.5% of remaining life, corresponding to a TTO score of 0.975. Using estimated life expectancy by race and sex, patients were willing to trade just over 1 year to live without the symptoms, damage, complications, and treatments they experience with noninfectious uveitis. TTO scores did not significantly differ by anatomical location as predicted. This indicates that rather than classification of disease, it is the treatment and clinical outcomes that more significantly influence quality of life.

Lower TTO scores, meaning trading more time, were associated with lower visual acuity in the worse-seeing eye. While TTO studies regarding retinal diseases such as age-related macular edema and diabetic retinopathy have demonstrated significant associations between utility and BEVA,[12,13,25–27] studies regarding glaucoma and vitreous floaters have more often found utility scores to be significantly associated with WEVA.[15,17,28,29] This study falls into the latter category, finding that WEVA was significantly related to how much time of remaining life a patient would trade for healthy eyes, while BEVA was not. WEVA, and not BEVA, was also associated with how much a patient worries about his or her eyesight. In a large, population-based survey, the intensity and frequency of negative thoughts were found to be related to TTO scores.[30] In particular, persistent negative thoughts were associated with trading significantly more time of remaining life. Decreased vision in just one eye, therefore, may cause a patient psychological distress that is reflected in their willingness to trade more time for healthy eyes.

Lower TTO scores were also associated with >6 months of oral corticosteroid use, irrespective of dose. Previous studies of patients with noninfectious uveitis have shown that corticosteroid use is associated with lower quality of life, although the effect of duration has not been shown.[7,31,32] Other studies of autoimmune disorders, however, suggest that chronic use of corticosteroids can decrease quality of life, independent of disease severity.[33] Using corticosteroids for extended periods of time increases the risk of adverse events, including weight gain, diabetes mellitus, osteoporotic fractures, cataracts, and glaucoma, and these corticosteroid-related toxicities are associated with trading more time of remaining life.[34–37] Nearly all patients who had been on oral corticosteroids for >6 months in this study experienced at least one side effect of immunosuppressive treatment. This may have contributed to the significantly higher amount of time of remaining life these patients were willing to trade for healthy eyes, compared to the rest of the cohort.

Another factor that was associated with significantly decreased TTO scores was the use of antidepressant medications. At the time of interview, there were 4 patients on antidepressants, though it is unclear from available data whether a psychiatric diagnosis preceded the diagnosis of uveitis. These patients were willing to trade almost 9 times the years of remaining life that patients who were not on antidepressants were. Being on antidepressant medications indicates the presence of a psychological disorder, most commonly depression.[38] One study found that patients with depression rated a described health state worse than patients without depression, and that these lower utility scores were

associated with low levels of self-compassion and more dysfunctional attitudes.[39] The dysfunctional thinking associated with depression, in addition to persistent negative thoughts as mentioned previously, may increase patient willingness to give up more time for better health.[30,40] Because the prevalence of depression is higher in patients with noninfectious uveitis than the general population, depressive symptoms and dysfunctional attitudes should be monitored in these patients, as they can have a profound, negative effect on quality of life.[31,41–43]

In regards to trading behavior in the TTO activity, education level was a significant predictor of whether or not patients would trade time for healthy eyes. Patients with any college education were about 5 times more likely to trade time than patients with no college education. Previous studies of the general public have similarly shown that patients with lower education are more likely to not trade time (TTO=1.0).[44–46] Dolan et al. 1996 hypothesized that this may be due to status quo bias, meaning patients with lower education may be more likely to be resistant to changing their health status and may weigh perceived losses greater than perceived gains.[44] Patients with lower numerical literacy have since been shown to be more likely to want to keep the status quo when making health care decisions.[47] Patients with lower education, therefore, may be less willing to change their health status, making them more likely to not trade any time in the TTO activity.

This study also found that religion had a significant association with the decision to trade time for healthy eyes. Catholic patients were 73% less likely to trade any time of remaining life than patients of other religious affiliations. Because the TTO activity requires patients to forgo years of remaining life, religion and religious beliefs can influence responses. One study of TTO in a solely Catholic population found that patients with high measures of religiosity and a strong belief in life after death are significantly more likely to not trade any time (TTO=1.0).[19] Outside of Christianity, however, the association of religious beliefs and TTO has not been well studied. Our results indicate that religious affiliation, specifically Catholicism, was indicative of trading behavior, while individual beliefs, such as the belief in God, an afterlife, or reincarnation, were not significantly associated with whether or not a patient would trade time.

Because TTO analysis provides a single score that encompasses all aspects of a disease, the utility value associated with noninfectious uveitis in this study can be compared to the utility values of other ocular disease states. In doing so, however, it is important to note that, although many studies cite a lack of normality associated with TTO scores, most studies report mean TTO scores, rather than using nonparametric measures.[12,16,18,48–50] TTO utility values of retinal disease, such as age-related macular degeneration and diabetic retinopathy, have been cited to be as low as mean 0.48 in older patients with BEVA of 20/40 Snellen or worse, and as high as median 0.96, with most scores falling between 0.7 and 0.8.[13,51–54] Glaucoma, on the other hand, is typically associated with higher scores, ranging from 0.71 in patients who are legally blind to 0.96 in a combined group of glaucoma patients and glaucoma suspects, with most scores falling between 0.75 and 0.9.[15,48–50] Persistent vitreous floaters are associated with an average TTO score of 0.89 and uncorrected refractive error 0.96.[17,18,55]

The median TTO score of 0.975 and mean of 0.881 associated with noninfectious uveitis in this study aligns most closely with vitreous floaters, uncorrected refractive error, and the upper end of utility values found with glaucoma. One reason for the high scores in this study may be the high visual acuity of our patients. Literature regarding utility values in ocular disease has consistently shown an association with visual acuity, as described above. With a median BEVA of 20/25 and median WEVA of 20/30, high vision may account for the comparatively smaller amount of time traded by the cohort in this study. The patient population studied was also younger than studies of other ocular disease, as noninfectious uveitis can affect patients of all ages. Although no association of TTO scores and age was seen in this study, advanced age has been shown to decrease TTO scores, meaning older patients may be more willing to trade time.[45,56]

Finally, our study assessed the test-retest reliability of TTO analysis in patients with noninfectious uveitis. This utility measure was found to be highly reliable, with an ICC approaching 1. Other studies of TTO in ophthalmologic disease have also found high ICC values of this instrument, making it a reliable and useful tool to study quality of life in patients with ocular disease.[17,53–55]

Our study was the first to use TTO utility values in patients with noninfectious uveitis. Strengths include its prospective and structured, interview-assisted design. However, our study was limited in several ways. The relatively small sample size may have limited our power to detect differences in TTO scores between patient groups. Because it was not feasible to enroll patients with a single diagnosis, the patients enrolled in this study had a variety of uveitis etiologies. Different uveitic diagnoses and associated systemic conditions may influence patient-reported quality of life. As all patients were enrolled from a single tertiary clinic, results may be limited in their generalizability. For example, this population was very highly educated, with the percent of patients over 25 with an advanced degree approximately 3 times the national average.[57]

Our study may have also been limited in its study design. Although widely used, TTO methodology is not standardized and there are many methods of obtaining TTO utility values.[21] While it is not clear which method of TTO administration is best, we tried to minimize bias in our population by choosing a 10-year life span and ping-ponging response options in our TTO activity. Also, because clinical characteristics were obtained through chart review, their accuracy was contingent upon the availability of this information in chart notes. This study was additionally limited by the use of multiple comparisons, which increases the chance of finding an association. Our results, therefore, should be seen as hypothesis-generating.

CONCLUSION

Patients with noninfectious uveitis have measurable, though modest, reductions in quality of life as assessed by TTO utility values. Lower TTO scores, corresponding to trading more time of remaining life for healthy eyes, were associated with worse eye visual acuity and long-term oral corticosteroid use. These results underscore the negative impact that long-term oral corticosteroid use, even at low doses, can have on quality of life.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGMENTS

a. Funding/Support: Dr. Acharya is supported by National Eye Institute, Bethesda, MD [U10EY021125]. The UCSF Department of Ophthalmology is supported by National Eye Institute, Bethesda, MD [EY06190], That Man May See Foundation, San Francisco, CA, and an unrestricted grant from the Research to Prevent Blindness Foundation, New York, NY.

b. Financial Disclosures: The sponsors or funding organizations had no role in the design or conduct of this research. Dr. Nisha R. Acharya reports receiving research support from Abbvie, Inc. unrelated to this study. No other authors have any financial or personal disclosures related to this manuscript.

c. Other Acknowledgments: None

REFERENCES

1. Suttorp-Schulten MS, Rothova A. The possible impact of uveitis in blindness: a literature survey. Br J Ophthalmol. 1996;80(9):844–848. [PubMed: 8962842]
2. Nussenblatt RB. The natural history of uveitis. Int Ophthalmol. 1990;14(5–6):303–308. [PubMed: 2249907]
3. Thorne JE, Skup M, Tundia N, et al. Direct and indirect resource use, healthcare costs and work force absence in patients with non-infectious intermediate, posterior or panuveitis. Acta Ophthalmol. 2016;94(5):e331–339. [PubMed: 26932535]
4. Dick AD, Tundia N, Sorg R, et al. Risk of Ocular Complications in Patients with Noninfectious Intermediate Uveitis, Posterior Uveitis, or Panuveitis. Ophthalmology. 2016;123(3):655–662. [PubMed: 26712559]
5. Schiffman RM, Jacobsen G, Whitcup SM. Visual functioning and general health status in patients with uveitis. Arch Ophthalmol. 2001;119(6):841–849. [PubMed: 11405835]
6. Naik RK, Rentz AM, Foster CS, et al. Normative comparison of patient-reported outcomes in patients with noninfectious uveitis. JAMA Ophthalmol. 2013;131(2):219–225. [PubMed: 23411886]
7. Miserocchi E, Modorati G, Mosconi P, Colucci A, Bandello F. Quality of life in patients with uveitis on chronic systemic immunosuppressive treatment. Ocul Immunol Inflamm. 2010;18(4):297–304. [PubMed: 20482406]
8. Hui MM, Wakefield D, Patel I, Cvejic E, P JM, J HC. Visual Functioning and Health-related Quality-of-Life are Compromised in Patients with Uveitis. Ocul Immunol Inflamm. 2016:1–6.
9. Hoeksema L, Los LI. Vision-Related Quality of Life in Patients with Inactive HLA-B27–Associated-Spectrum Anterior Uveitis. PLoS One. 2016;11(1):e0146956. [PubMed: 26808922]
10. Torrance GW. Utility approach to measuring health-related quality of life. J Chronic Dis. 1987;40(6):593–603. [PubMed: 3298297]
11. Torrance GW. Measurement of health state utilities for economic appraisal. J Health Econ. 1986;5(1):1–30. [PubMed: 10311607]
12. Brown MM, Brown GC, Sharma S, Landy J, Bakal J. Quality of life with visual acuity loss from diabetic retinopathy and age-related macular degeneration. Arch Ophthalmol. 2002;120(4):481–484. [PubMed: 11934322]
13. Shah VA, Gupta SK, Shah KV, Vinjamaram S, Chalam KV. TTO utility scores measure quality of life in patients with visual morbidity due to diabetic retinopathy or ARMD. Ophthalmic Epidemiol. 2004;11(1):43–51. [PubMed: 14977496]
14. Sharma S, Brown GC, Brown MM, et al. Converting visual acuity to utilities. Can J Ophthalmol. 2000;35(5):267–272. [PubMed: 10959467]
15. Jampel HD. Glaucoma patients' assessment of their visual function and quality of life. Trans Am Ophthalmol Soc. 2001;99:301–317. [PubMed: 11797316]

16. Brown GC, Brown MM, Sharma S, Beauchamp G, Hollands H. The reproducibility of ophthalmic utility values. Trans Am Ophthalmol Soc. 2001;99:199–203; discussion 203–194. [PubMed: 11797307]
17. Zou H, Liu H, Xu X, Zhang X. The impact of persistent visually disabling vitreous floaters on health status utility values. Qual Life Res. 2013;22(6):1507–1514. [PubMed: 23054488]
18. Wagle AM, Lim WY, Yap TP, Neelam K, Au Eong KG. Utility values associated with vitreous floaters. Am J Ophthalmol. 2011;152(1):60–65.e61. [PubMed: 21570045]
19. Jakubczyk M, Golicki D, Niewada M. The impact of a belief in life after death on health-state preferences: True difference or artifact? Qual Life Res. 2016;29(12):2997–3008.
20. Oppe M, Rand-Hendriksen K, Shah K, Ramos-Goni JM, Luo N. EuroQol Protocols for Time Trade-Off Valuation of Health Outcomes. Pharmacoeconomics. 2016;34(10):993–1004. [PubMed: 27084198]
21. Attema AE, Edelaar-Peeters Y, Versteegh MM, Stolk EA. Time trade-off: one methodology, different methods. Eur J Health Econ. 2013;14 Suppl 1:S53–64. [PubMed: 23900665]
22. Lewis K, Burd-Sharps S. A Portrait of California 2014–2015. Brooklyn: Social Science Research Council, 2014:1–172.
23. Jabs DA, Nussenblatt RB, Rosenbaum JT. Standardization of uveitis nomenclature for reporting clinical data. Results of the First International Workshop. Am J Ophthalmol. 2005;140(3):509–516. [PubMed: 16196117]
24. Rothova A, Suttorp-van Schulten MS, Frits Treffers W, Kijlstra A. Causes and frequency of blindness in patients with intraocular inflammatory disease. Br J Ophthalmol. 1996;80(4):332–336. [PubMed: 8703885]
25. Brown GC, Sharma S, Brown MM, Kistler J. Utility values and age-related macular degeneration. Arch Ophthalmol. 2000;118(1):47–51. [PubMed: 10636413]
26. Yanagi Y, Ueta T, Obata R, Iriyama A, Fukuda T, Hashimoto H. Utility values in Japanese patients with exudative age-related macular degeneration. Jpn J Ophthalmol. 2011;55(1):35–38. [PubMed: 21331690]
27. Heintz E, Wirehn AB, Peebo BB, Rosenqvist U, Levin LA. QALY weights for diabetic retinopathy--a comparison of health state valuations with HUI-3, EQ-5D, EQ-VAS, and TTO. Value Health. 2012;15(3):475–484. [PubMed: 22583458]
28. Sun X, Zhang S, Wang N, et al. Utility assessment among patients of primary angle closure/glaucoma in China: a preliminary study. Br J Ophthalmol. 2009;93(7):871–874. [PubMed: 19208679]
29. Gothwal VK, Bagga DK, Rao HL, et al. Is utility-based quality of life in adults affected by glaucoma? Invest Ophthalmol Vis Sci. 2014;55(3):1361–1369. [PubMed: 24519425]
30. Dolan P. Thinking about it: thoughts about health and valuing QALYs. Health Econ. 2011;20(12):1407–1416. [PubMed: 20967923]
31. Qian Y, Glaser T, Esterberg E, Acharya NR. Depression and visual functioning in patients with ocular inflammatory disease. Am J Ophthalmol. 2012;153(2):370–378.e372. [PubMed: 21924399]
32. Arriola-Villalobos P, Abasolo L, Garcia-Feijoo J, et al. Vision-related Quality of Life in Patients with Non-infectious Uveitis: A Cross-sectional Study. Ocul Immunol Inflamm. 2018;26(5):717–725. [PubMed: 28323495]
33. Judson MA, Chaudhry H, Louis A, Lee K, Yucel R. The effect of corticosteroids on quality of life in a sarcoidosis clinic: the results of a propensity analysis. Respir Med. 2015;109(4):526–531. [PubMed: 25698652]
34. Curtis JR, Westfall AO, Allison J, et al. Population-based assessment of adverse events associated with long-term glucocorticoid use. Arthritis Rheum. 2006;55(3):420–426. [PubMed: 16739208]
35. Garbe E, LeLorier J, Boivin JF, Suissa S. Risk of ocular hypertension or open-angle glaucoma in elderly patients on oral glucocorticoids. Lancet. 1997;350(9083):979–982. [PubMed: 9329512]
36. Steinbuch M, Youket TE, Cohen S. Oral glucocorticoid use is associated with an increased risk of fracture. Osteoporos Int. 2004;15(4):323–328. [PubMed: 14762652]
37. Merlino LA, Bagchi I, Taylor TN, et al. Preference for fractures and other glucocorticoid-associated adverse effects among rheumatoid arthritis patients. Med Decis Making. 2001;21(2):122–132. [PubMed: 11310945]

38. Wong J, Motulsky A, Eguale T, Buckeridge DL, Abrahamowicz M, Tamblyn R. Treatment Indications for Antidepressants Prescribed in Primary Care in Quebec, Canada, 2006–2015. Jama. 2016;315(20):2230–2232. [PubMed: 27218634]
39. Papageorgiou K, Vermeulen KM, Schroevers MJ, et al. Do individuals with and without depression value depression differently? And if so, why? Qual Life Res. 2015;24(11):2565–2575. [PubMed: 26038219]
40. Watkins ER. Constructive and unconstructive repetitive thought. Psychol Bull. 2008;134(2):163–206. [PubMed: 18298268]
41. Maca SM, Schiesser AW, Sobala A, et al. Distress, depression and coping in HLA-B27-associated anterior uveitis with focus on gender differences. Br J Ophthalmol. 2011;95(5):699–704. [PubMed: 20971789]
42. Onal S, Oray M, Yasa C, et al. Screening for Depression and Anxiety in Patients with Active Uveitis. Ocul Immunol Inflamm. 2018;26(7):1078–1093. [PubMed: 28548554]
43. Sittivarakul WM, Wongkot PM. Anxiety and Depression among Patients with Uveitis and Ocular Inflammatory Disease at a Tertiary Center in Southern Thailand: Vision-Related Quality-of-Life, Sociodemographics, and Clinical Characteristics Associated. Ocul Immunol Inflamm. 10.1080/09273948.2018.1484495.2018.06.03.
44. Dolan P, Gudex C, Kind P, Williams A. The time trade-off method: results from a general population study. Health Econ. 1996;5(2):141–154. [PubMed: 8733106]
45. Sherbourne CD, Keeler E, Unutzer J, Lenert L, Wells KB. Relationship between age and patients' current health state preferences. Gerontologist. 1999;39(3):271–278. [PubMed: 10396885]
46. van Nooten FE, Koolman X, Busschbach JJ, Brouwer WB. Thirty down, only ten to go?! Awareness and influence of a 10-year time frame in TTO. Qual Life Res. 2014;23(2):377–384. [PubMed: 23943291]
47. Fraenkel L, Cunningham M, Peters E. Subjective numeracy and preference to stay with the status quo. Med Decis Making. 2015;35(1):6–11. [PubMed: 24759686]
48. Bozzani FM, Alavi Y, Jofre-Bonet M, Kuper H. A comparison of the sensitivity of EQ-5D, SF-6D and TTO utility values to changes in vision and perceived visual function in patients with primary open-angle glaucoma. BMC Ophthalmol. 2012;12:43. [PubMed: 22909264]
49. Paletta Guedes RA, Paletta Guedes VM, Freitas SM, Chaoubah A. Utility values for glaucoma in Brazil and their correlation with visual function. Clin Ophthalmol. 2014;8:529–535. [PubMed: 24648717]
50. Alavi Y, Jofre-Bonet M, Bunce C, et al. Developing an algorithm to convert routine measures of vision into utility values for glaucoma. Ophthalmic Epidemiol. 2011;18(5):233–243. [PubMed: 21961513]
51. Butt T, Dunbar HM, Morris S, Orr S, Rubin GS. Patient and public preferences for health states associated with AMD. Optom Vis Sci. 2013;90(8):855–860. [PubMed: 23811607]
52. Brown MM, Brown GC, Sharma S, Shah G. Utility values and diabetic retinopathy. Am J Ophthalmol. 1999;128(3):324–330. [PubMed: 10511027]
53. Hollands H, Lam M, Pater J, et al. Reliability of the time trade-off technique of utility assessment in patients with retinal disease. Can J Ophthalmol. 2001;36(4):202–209. [PubMed: 11428529]
54. Polack S, Alavi Y, Rachapalle Reddi S, Kulothungan V, Kuper H. Utility values associated with diabetic retinopathy in Chennai, India. Ophthalmic Epidemiol. 2015;22(1):20–27. [PubMed: 24669801]
55. Tahhan N, Papas E, Fricke TR, Frick KD, Holden BA. Utility and uncorrected refractive error. Ophthalmology. 2013;120(9):1736–1744. [PubMed: 23664469]
56. Dolan P, Roberts J. To what extent can we explain time trade-off values from other information about respondents? Soc Sci Med. 2002;54(6):919–929. [PubMed: 11996025]
57. Ryan CL, Bauman K. Educational Attainment in the United States: 2015. United States Census Bureau. 2016;P20–578.

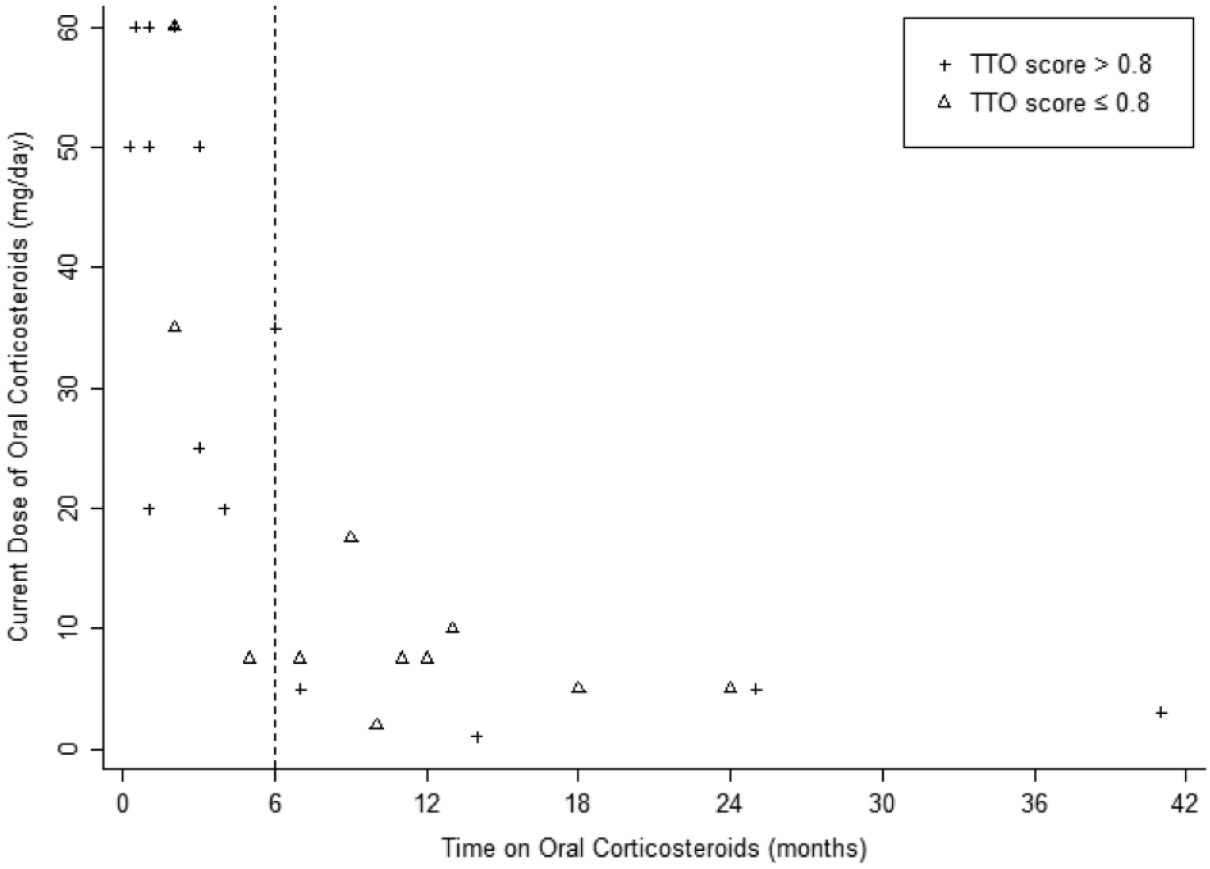

Figure 1.
Scatterplot of months on oral corticosteroid and oral corticosteroid dose, labeled by Time Trade Off (TTO) score.

Table 1:

Patient demographic information

	N	(%)
Age		
Median (IQR)	38	(28–54)
Gender		
Female	55	(54%)
Male	47	(46%)
Race		
Asian	14	(14%)
Black	14	(14%)
Caucasian	50	(49%)
Hispanic	9	(9%)
Middle eastern	1	(1%)
Pacific Islander	2	(2%)
Other/Mixed	11	(11%)
Prefer not to say	1	(1%)
Highest Level of Education		
Middle school	2	(2%)
High school	14	(14%)
Some college	13	(13%)
College (2 years)	6	(6%)
College (4 years)	34	(33%)
Graduate school	33	(32%)
Religious Affiliation		
Agnosticism	6	(6%)
Atheism	8	(8%)
Buddhism	5	(5%)
Catholicism	16	(16%)
Christianity (non-Catholic)	27	(26%)
Islam	3	(3%)
Judaism	6	(6%)
Mixed	4	(4%)
No religious affiliation	23	(23%)
Prefer not to answer	4	(4%)

Abbreviations used: IQR, interquartile region

Table 2:

Clinical characteristics by anatomic group

	Anterior Uveitis		Posterior Segment Inflammation		*P* value
	N	**(%)**	***N***	**(%)**	
Total	50	(49%)	52	(51%)	
Etiology					
Idiopathic	25	(50%)	23	(44%)	<0.001
Behcet's Disease	2	(4%)	0	(0%)	
Birdshot chorioretinopathy	0	(0%)	7	(13%)	
HLA-B27 associated	11	(22%)	0	(0%)	
Juvenile idiopathic arthritis	2	(4%)	1	(2%)	
Multifocal choroiditis	0	(0%)	4	(8%)	
Multiple sclerosis	2	(4%)	2	(4%)	
Psoriatic arthritis	3	(6%)	1	(2%)	
Sarcoidosis	2	(4%)	5	(10%)	
Serpiginous choroiditis	0	(0%)	2	(4%)	
Sympathetic ophthalmia	0	(0%)	1	(2%)	
Vogt-Koyanagi-Harada Disease	0	(0%)	4	(8%)	
Other	3	(6%)	2	(4%)	
Years since diagnosis					
Median (IQR)	7.3	(2.8–14.1)	5.8	(1.5–11.4)	0.22
Laterality					
Unilateral	16	(32%)	6	(12%)	0.04
Bilateral	34	(68%)	46	(88%)	
Chronicity					
Acute	5	(10%)	1	(2%)	<0.001
Recurrent	15	(30%)	1	(2%)	
Chronic	30	(60%)	50	(96%)	
Activity					
Current inflammation	30	(60%)	19	(37%)	0.02
Within 2 months	6	(12%)	4	(8%)	
No recent inflammation	14	(28%)	29	(56%)	
Better Eye Visual Acuity					
logMAR (IQR)	0.1	(0–0.176)	0.1	(0–0.238)	0.50
Snellen equivalent	20/25	(20/20 to 20/30)	20/25	(20/20 to 20/32)	
Worse Eye Visual Acuity					
logMAR (IQR)	0.176	(0–0.6)	0.176	(0.1–1.0)	0.46
Snellen equivalent	20/30	(20/20 to 20/80)	20/30	(20/25 to 20/200)	
Topical Corticosteroid Use					
Yes	32	(64%)	22	(42%)	0.03
No	18	(36%)	30	(58%)	
Oral Corticosteroid Use					

	Anterior Uveitis		Posterior Segment Inflammation		*P* value
	N	**(%)**	***N***	**(%)**	
Yes	8	(16%)	18	(35%)	0.04
No	42	(84%)	34	(65%)	
Months on Oral Corticosteroids					
None	42	(84%)	34	(68%)	0.06
≤6 months	3	(6%)	11	(22%)	
>6 months	5	(10%)	7	(14%)	
Immunomodulatory Therapy Use					
Yes	17	(34%)	28	(54%)	0.05
No	33	(66%)	24	(46%)	
Antidepressant Medication					
Yes	1	(2%)	3	(6%)	0.62
No	49	(98%)	49	(94%)	

Abbreviations used: IQR, interquartile range; logMAR, logarithm of the minimal angle of resolution

Table 3:

Backwards stepwise multivariable linear regression model, predicting time trade-off score

	Linear Model			Permutation
Variable	**Coefficient**	**(95% CI)**	***P* value**	***P* value**
Age	−0.001	(−0.003, 0.001)	0.45	0.46
Sex (Male)	−0.01	(−0.07, 0.05)	0.64	0.77
Worse eye visual acuity (logMAR)	−0.08	(−0.13, −0.03)	0.002	0.008
Months on oral corticosteroids[a]				
≤6 months	−0.01	(−0.09, 0.08)	0.86	0.89
>6 months	−0.16	(−0.25, −0.07)	0.001	0.006
Currently taking an antidepressant	−0.29	(−0.45, −0.13)	<0.001	0.008
Intercept	0.99	(0.90, 1.09)	<0.001	0.02

Abbreviations used: CI, confidence interval; logMAR, logarithm of the minimal angle of resolution

[a]Compared to no current oral corticosteroid use