Research Article
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# Visit duration of office-based ophthalmology visits in a nationally representative sample

## Abstract

**Purpose:** To assess the mean visit duration of office-based ophthalmology visits in the United States.

**Methods:** The National Ambulatory Medical Care Survey (NAMCS) was queried to identify visits conducted by ophthalmologists between years 2006-2016. Primary outcome measure was the time spent with the ophthalmologist (in minutes). Demographic and health information including patient age, sex, race/ethnicity, insurance type, and number of chronic conditions were assessed. Reason for visit, new patient status, number of medications prescribed, electronic medical record use, regional location, and metropolitan status of each visit were also collected. International Classification of Diseases Clinical Modification Ninth and Tenth Revision codes (ICD-9-CM and ICD-10-CM) were used to categorize each visit by subspecialty of primary diagnosis (i.e. cataract, cornea/refractive, glaucoma, oculoplastic, perioperative, and retina). Univariate and multivariate ordinary least square linear regression analyses were used to determine predictors of visit duration.

**Results:** Between 2006-2016, there was an annual average of 52 million ophthalmology office-based visits. Mean visit duration [standard error] was 20.7 [0.4] minutes, annually. An increase in visit duration was observed with a mean of 19.1 [1.5] minutes in 2006 and a mean of 22.5 [1.2] minutes in 2016. The five strongest predictors of visit duration were Medicaid insurance (ß [regression coefficient] 5.1; 95% CI [confidence interval] 1.39-8.74), new patient status (ß 2.7; 95% CI 1.55-3.79), new medications (ß 1.1; 95% CI 0.32-1.92), year of visit (ß 0.7; 95% CI 0.48-0.93), and non-metropolitan location (ß -2.8; 95% CI -4.45- (-1.20)) (all p<0.01).

**Conclusion:** Across 11 years, mean visit duration of office-based ophthalmology visits has increased. Predictors of visit duration reflect healthcare utilization patterns in low-resource populations, provider-patient encounters, a growing aging population, and a shortage of ophthalmologists in rural areas. As interventions are made to better model and improve the clinic experience of ophthalmic patients, these factors should be considered.

**Keywords:** visit length, visit duration, ophthalmology, clinic visits

Volume 14 Issue 1 - 2024

Joana E Andoh,[1] Brian M DeBroff[2]
[1]Wilmer Eye Institute, Department of Ophthalmology, Johns Hopkins University School of Medicine, USA
[2]Department of Ophthalmology and Visual Science, Yale School of Medicine, USA

**Correspondence:** Brian M DeBroff, Department of Ophthalmology and Visual Science, Yale School of Medicine, 40 Temple Street, New Haven, CT 06510, USA, Tel (203) 785-2020, Email brian.debrof@yale.edu

**Received:** February 09, 2024 | **Published:** February 20, 2024

## Introduction

As the prevalence of vision impairment increases,[1] delivering quality and efficient healthcare remains a priority for ophthalmologists. While not a direct marker of quality, the amount of time patients spend with their providers has been strongly associated with patient satisfaction.[2] Furthermore, studies related to waiting times,[3] prediction models of visit duration,[4] and impact of time-saving interventions, such as scribes,[5] have attempted to characterize the duration of outpatient ophthalmology visits. Despite these findings, no contemporary study has quantified the typical duration of ophthalmology outpatient visits. The purpose of this study was to assess the average duration of office-based ophthalmology visits.

## Materials and methods

The National Ambulatory Medical Care Survey (NAMCS) was queried to identify outpatient visits between years 2006 to 2016. Publicly available and nationally representative, the NAMCS is annually conducted by the National Center for Health Statistics (NCHS). Data is based on sample visits to nonfederal office-based physicians who primarily engage in patient care. Physicians complete surveys for individual patient encounters, which are processed using a 3-stage sampling design. Starting in 2012, NAMCS switched from paper to computerized survey instruments. Further details regarding survey methods are available elsewhere.[6] This study was exempt by the Institutional Review Board (IRB) of Yale School of Medicine and abided by the tenets of Helsinki.

The primary outcome variable was visit duration defined by the time spent with the ophthalmologist for a given visit (in minutes). This duration did not include patient wait time or time spent with another healthcare provider. Visits that had a duration of zero minutes were omitted from the study. Covariates included demographic and health information (patient age, sex, race/ethnicity, insurance type, and number of chronic conditions). Major reason for visit, new patient status, number of medications prescribed, electronic medical record use, regional location, and metropolitan status of each clinic visit were also collected. Primary diagnoses and International Classification of Diseases Clinical Modification Ninth and Tenth Revision codes (ICD-9 CM and ICD-10 CM) were used to categorize the primary diagnosis of each visit by subspecialty (ie cataract, cornea/refractive, glaucoma, oculoplastic, perioperative, and retina) (Supplemental Table 1).[7] Univariate ordinary least squares linear regression was used to identify predictors of visit duration. Variables significant in univariate analysis were ultimately selected for multivariate regression based on backward elimination until all variables left in the model were statistically significant. We considered a p-value <0.05 to be statistically significant. To present nationally representative data, estimations are presented as averages per year. All analyses were conducted using RStudio (version 1.3.1056; RStudio, Inc).[8]

**Supplementary Table 1** Subspecialty categorization of primary diagnostic codes

| ICD-9-CM codes | ICD-10-CM codes | Category |
|---|---|---|
| 360.XX-363.XX, 250.XX | H30.XXX-H36.XXX, H43.XXX-H44.XXX, E08.XXX-E13.XXX | Retina |
| 364.XX, 370.XX-372.XX, 54.43, 375.15 | HIO.XXX-HII.XXX, H04.12, H15.XXX-H22.XXX, B00.52 | Cornea |
| 365.XX | H40.XXX-H42.XXX, Q15.0 | Glaucoma |
| 366.XX | H25.XXX-H28.XXX | Cataract |
| 367.XX | H52.XXX | Refractive |
| 373.XX-376.XX except 375.15 | HOO.XXX-H05.XXX except H04.12 | Oculoplastics |
| 368.XX, 369.XX, 377.XX, 378.XX | H46.XXX-H47.XXX, H49.XXX-H51.XXX, H53.XXX-H54.XXX | Pediatric/Neuro Ophthalmology |
| V45,V58,V67,996.51 | H59.XXX, zag | Perioperative |

**Notes:** Categorizations adapted from Hellman et al.[7]

**Abbreviations:** ICD, International classification of diseases; CM, clinical modification

# Results

## Baseline characteristics of ophthalmology visits

Between 2006-2016, there was a total of 577 million office-based ophthalmology visits, accounting for 52 million visits annually. Annually, the mean visit duration [standard error] was 20.7 [0.4] minutes (Table 1). An increase in visit duration was observed with a mean [SE] duration of 19.1 [1.5] minutes in 2006 and a mean duration of 22.5 [1.2] minutes in 2016 ($p<0.001$; Figure 1). The percentage of patient visits in the NAMCS database categorized as ophthalmology decreased from 6.4% in 2006 to 5.2% in 2016 ($p<0.05$). The mean [SE] age of patients seen by ophthalmologists was 62.2 [0.5]. The mean [SE] number of chronic conditions was 1.1 [0.04]. Gender distributions were 58.5% female and 41.5% male. The most predominant race/ethnicity was white (75.5%), followed by Hispanic (10.0%), Black (9.4%), and other (5.1%). Patients represented in these visits mostly had private insurance (60.9%) as a form of payment, followed by Medicare (49.2%), and Medicaid (8.5%). An estimated 34.6% of visits pertained to a routine chronic problem. Other reasons for visits included a new problem (23.2%), pre-/post-surgery (17.1%), preventative care (16.5%), and a flare-up of a chronic problem (6.0%). Over half (52.5%) of ophthalmologists reported not using electronic medical records (EMRs). Under a third (29.6%) of ophthalmologists reported using only EMRs while 17.6% reported using a combination of paper and EMRs. An estimated 15.3% of visits were new patients. Visits related to injuries comprised 3.7%. The mean [SE] number of new medications prescribed during visits was 0.4 [0.03]. The mean [SE] number of medications continued during visits was 1.8 [0.1]. Based on primary diagnosis, the subspecialty distribution was 17.0% retina, 16.8% cataract, 14.9% glaucoma, 11.7% cornea and refractive, 7.5% oculoplastic, 4.6% perioperative, 4.3% pediatrics/neuro-ophthalmology, and 23.2% other. The geographic distribution of visits was as follows: 34.1% South, 24.0% Northeast, 23.0% West, 18.9% Midwest region. A large majority of visits (90.8%) took place in a metropolitan setting.

## Predictors of visit duration, univariate regression analysis

Univariate regression analysis identified 5 factors significantly associated with longer visit duration including non-white race, having Medicaid, being a new patient, new medications, and visits in more recent years (Table 2). Characteristics significantly associated with shorter visit durations were as follows: older age, having private insurance, visiting for a chronic routine problem, pre-/post-surgery and preventative care, using paper records, perioperative diagnosis, Midwest region, and non-metropolitan setting.

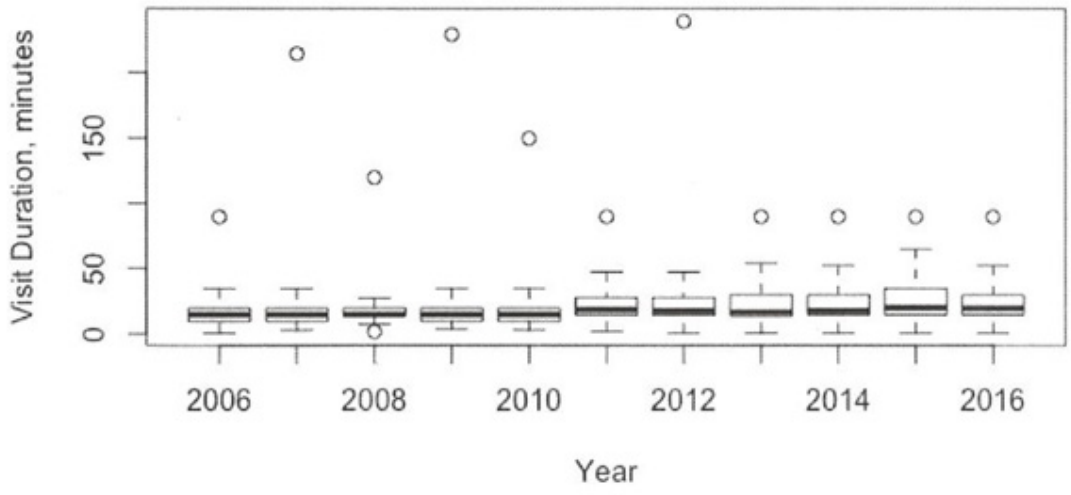


**Figure 1** Boxplot of estimated office-based ophthalmology visit duration by year.

**Citation:** Andoh JE, DeBroff BM. Visit duration of office-based ophthalmology visits in a nationally representative sample. *Adv Ophthalmol Vis Syst.* 2024;14(1):18–23. DOI: 10.15406/aovs.2024.14.00456

**Table 1** Baseline characteristics of ophthalmology visits, NAMCS 2006-2016

| Variable | Weighted N, in thousands (%) | |
|---|---|---|
| Annual average visits | 52004.4 | (100) |
| Mean age, y (SE) | 62.2 | (0.5) |
| Mean duration | 20.7 | (0.4) |
| Mean number of chronic conditions, n (SE) | 1.1 | (0.04) |
| **Gender** | | |
| Female | 30416.4 | (58.5) |
| Male | 21588 | (41.5) |
| **Race/ethnicity** | | |
| Non-Hispanic white | 39260.7 | (75.5) |
| Non-Hispanic black | 4899.1 | (9.4) |
| Hispanic | 5207.5 | (10) |
| Non-Hispanic other | 2637.1 | (5.1) |
| **Insurance** | | |
| Medicare | 25593.7 | (49.2) |
| Medicaid | 4403.3 | (8.5) |
| Private | 31646.2 | (60.9) |
| **Major Reason for Visit** | | |
| New problem (less than 3 mos. onset) | 12081.9 | (23.2) |
| Chronic problem, routine | 17970 | (34.6) |
| Chronic problem, flare-up | 3110.7 | (6) |
| Pre-/Post-surgery | 8874.8 | (17.1) |
| Preventive care | 8591.5 | (16.5) |
| **Practice Uses Electronic Medical Records** | | |
| Yes, all electronic | 15367.7 | (29.6) |
| Yes, part paper and part electronic | 9150.5 | (17.6) |
| No | 27326 | (52.5) |
| Don't know | 3.2 | (0) |
| **Other characteristics** | | |
| New patient | 7975.7 | (15.3) |
| Injury-related | 1941.2 | (3.7) |
| Mean number of new medications, n (SE) | 0.4 | (0.03) |
| Mean number of continued medications, n (SE) | 1.8 | (0.1) |
| **Subspecialty** | | |
| Cataract | 8719.7 | (16.8) |
| Retina | 12058.8 | (23.2) |
| Cornea and refractive | 8858 .9 | (17) |
| Glaucoma | 6116.3 | (11.8) |
| Oculoplastic | 7747.1 | (14.9) |
| Pediatrics/Neuro-Ophthalmology | 3876 .7 | (7.5) |
| Perioperative | 2247 .9 | (4.3) |
| Other | 2379 | (4 .6) |
| **Geographic region** | | |
| Northeast | 12466.7 | (24) |
| Midwest | 9834 | (18.9) |
| South | 17735.7 | (34 .1) |
| West | 11968 | (23) |
| **Metropolitan status** | | |
| Metropolitan | 47241.7 | (90.8) |
| Non-Metropolitan | 4762.8 | (9.2) |

**Abbreviation:** NA, not applicable

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**Table 2** Predictors of visit duration using univariate and multivariate regression

| Variable | Univariate | | | Multivariate | | |
|---|---|---|---|---|---|---|
| | **Beta** | **95% CI** | **p-value** | **Beta** | **95% CI** | **p-value** |
| Age | -0.03 | (-0.05-(-0.003)) | <0.05 | | | |
| Number of chronic conditions | 0.4 | (-0.1-1) | 0.1 | | | |
| **Gender** | | | | | | |
| Female | 1 | [Reference] | NA | | | |
| Male | 0.2 | (-0.3-0.7) | 0.4 | | | |
| **Race/ethnicity** | | | | | | |
| Non-hispanic white | 1 | [Reference] | NA | | | |
| Non-hispanic black | 1.8 | (0.5-3.1) | <0.01 | | | |
| Hispanic | 3.8 | (0.9-6.7) | <0.01 | | | |
| Non-hispanic other | 1.8 | (0.4-3.3) | <0.05 | | | |
| **Insurance** | | | | | | |
| Medicare | -0.4 | (-1.2-0.4) | 0.3 | | | |
| Medicaid | 5.7 | (1.7-9 .8) | <0.01 | 5.1 | (1.39-8.74) | <0.01 |
| Private | -1.4 | (-2.7-(-0.1)) | <0.05 | | | |
| **Major Reason for Visit** | | | | | | |
| New problem (less than 3 mos. onset) | 1 | [Reference] | NA | | | |
| Chronic problem, routine | -1.5 | (-2.4-(-0.6)) | <0.001 | | | |
| Chronic problem, flare-up | 2 | (-0.9-4.8) | 0.2 | | | |
| Pre-/Post-surgery | -3.5 | (-4.7 -(-2.3)) | <0.001 | | | |
| Preventive care | -1.6 | (-2.8-(-0.4)) | <0.01 | | | |
| **Practice Uses Electronic Medical Records** | | | | | | |
| Yes, all electronic | 1 | [Reference] | NA | | | |
| Yes, part paper and part electronic | 0.5 | (O.5-3 .1) | 0.7 | | | |
| No | -2.4 | (0.9-6.7) | <0.05 | | | |
| Don't know | -0.6 | (0.4-3.3) | 0.5 | | | |
| **Other characteristics** | | | | | | |
| New patient | 2.9 | (1.8-4.1) | <0.001 | 2.7 | (1.55-3.79) | <0.001 |
| Injury-related | 0.02 | (-1.3-1.3) | 1 | | | |
| Number of new medications | 1.5 | (0.6-2.4) | <0.01 | 1.1 | (0.32-1.92) | <0.01 |
| Number of continued medications | 0.02 | (-0.3-0.3) | 0.9 | | | |
| Year of visit | 0.8 | (0.5-1) | <0.001 | 0.7 | (0.48-0.93) | <0.001 |
| **Subspecialty** | | | | | | |
| Cataract | 1 | [Reference] | NA | | | |
| Retina | 2.3 | (-0.1-4.8) | 0.1 | | | |
| Cornea and refractive | -0.02 | (-1.3-1.3) | 1 | | | |
| Glaucoma | -0.9 | (-2-0.2) | 0.1 | | | |
| Oculoplastic | 0.4 | (-0.8-1.6) | 0.5 | | | |
| Pediatruics/Neuro-Opthomology | 2.1 | (-0.7-4.8) | 0.1 | | | |
| Perioperative | -4.1 | (-5.5--2.7) | 0 | | | |
| Other | -0.7 | (-2-0.5) | 0.2 | | | |
| **Geographic region** | | | | | | |
| Northeast | 1 | [Reference] | NA | | | |
| Midwest | -3.2 | (-5.9-(-0.9)) | <0.01 | | | |
| South | -1.7 | (-4.2-0.8) | 0.2 | | | |
| West | 1.5 | (-1.7-4.6) | 0.4 | | | |
| **Metropolitan status** | | | | | | |
| Metropolitan | 1 | [Reference] | NA | | | |
| Non-Metropolitan | -2.8 | (-4.8-(-0.8)) | <0.01 | -2.8 | (-4.45- (-1.20)) | < 0.001 |

**Abbreviation:** NA, not applicable

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### Predictors of visit duration, multivariate regression analysis

In multivariate regression analysis, having Medicaid was associated with an estimated 5.1-minute increase in visit duration (95% CI [Confidence Interval] 1.4-8.7). Being a new patient was associated with an estimated 2.7-minute increase in visit duration (95% CI 1.6-3.8). For every new medication prescribed, there was an estimated 1.1-minute increase in visit duration (95% CI 0.3-1.9). There was an estimated annual increase in visit duration by 0.7 minutes between years 2006-2016 (95% CI 0.5-0.9). Non-metropolitan sites had shorter visits by an estimated 2.8 minutes (95% CI -4.5- (-1.2)) (all $p<0.01$).

## Discussion

This study revealed that office-based ophthalmology visits had an annual mean duration of 20.7 [0.4] minutes. Between 2006-2016, there has been an increasing trend in visit duration. The five strongest predictors of visit duration were Medicaid insurance, new patient status, new medications, year of visit, and non-metropolitan location. To our knowledge, this is one of the first studies to derive visit duration from 11 years of nationally representative ophthalmology visits.

Our study identified that visits with Medicaid patients were 5.1 minutes longer. Previous studies of visit duration and insurance type have yielded varied results. Among primary care physicians, Bruen et al found no significant differences in the visit duration by insurance status.[9] Another study of office-based physicians revealed that Medicaid patients had 20% shorter visits compared to privately insured patients.[10] The same study observed that in states where reimbursement for Medicaid patients is higher, visits with Medicaid patients were longer (than states with lower reimbursement) and more comparable to visits with privately insured patients. Among visits with cancer patients, visit duration for Medicaid patients did not differ when compared to privately insured patients.[11] Medicaid patients are more likely to have lower income and be less educated, characteristics associated with decreased eye care utilization in the United States.[12,13] Therefore, when Medicaid patients do present, they may have more severe or complex needs, extending visit duration. In addition, Medicaid patients are more likely to require interpreter services which can increase the length of the visit.[14] It is of note that visits with Medicaid patients comprised only 8.5% of the study population. Difficulty obtaining appointments may be a contributing factor to this finding,[13] as a proportion of physicians do not serve Medicaid patients due to low reimbursement rates.[10,15,16] Thus, the small proportion of visits with Medicaid patients may introduce a sampling bias. Overall, we underscore the need to contextualize the longer visit duration observed among Medicaid patients. As this finding is likely complicated by eye care underutilization and limits in appointment availability.

The identification of new patients as a predictor of visit duration concurs with previous studies. Among new cancer patients, Guy et al observed an 8.1-minute increase in visit duration compared to returning patients.[11] In primary care settings, new patients also exhibited a longer average visit duration.[9] Our findings are explicable as new ophthalmic patients often undergo intake procedures, refraction, and pupil dilation, which may require longer interactions with the ophthalmologist. To the literature our findings demonstrate that this pattern observed with new patients holds true in ophthalmology. Additionally, newly prescribed medication also increased the visit duration by 1.1 minutes, an association previously described. Tarn et al observed that the process of discussing a medication's purpose, directions of use, and side effects to a patient took a mean duration of 49 seconds.[17] Interestingly, a study of post-visit patient understanding recommended that providing written information about frequency/dosing and verbal information about side effects may better facilitate patient awareness of side effects.[18] Our findings offer a unique opportunity to further explore the relationship between visit duration, discussions of newly prescribed medications, and patient perception in ophthalmology.

The duration of office-based ophthalmology visits increased by 3.4 minutes annually between 2006-2016. Increases in visit duration have been observed among primary care physicians,[19] largely attributed to the additional resources and time it takes to care for an aging population with more co-morbidities.[20] An unexpected predictor was non-metropolitan locations, which were associated with visits shorter by 2.8 minutes. Among primary care,[20] cancer,[11] and psychiatric outpatient visits,[21] no difference between metropolitan and non-metropolitan locations has been reported. Previously, a study of rural physicians observed high workloads, thought to be due to high patient to provider ratios.[22] Given these varied findings, the shorter visit duration of non-metropolitan visits may be complicated by more severe shortages of specialists, particularly ophthalmologists.[23]

There are several limitations to this study. We cannot generalize our findings to all practicing ophthalmologists. As NAMCS excludes select populations, including federally employed physicians. Data from NAMCS are voluntary responses of physicians. Thus, our findings may be subject to patterns in underreporting of select variables. Visit duration was not validated by independent observation, which may introduce bias and previously reported overestimation.[24,25] However, we believe examining the relative differences posed by our predictor variables may aid to offset this shortcoming. Additionally, the use of ophthalmic technicians, refraction, and pupil dilation were not specified in this database of patient encounters. Overall, we believe the limitations of the NAMCS database in characterizing ophthalmic encounters derives from its initial purpose to document encounters across all medical specialties. These limitations emphasize the need for future studies to take such missing factors into account.

## Conclusion

This study revealed that office-based ophthalmology visits had an annual mean [SE] duration of 20.7 [0.4] minutes and an increasing trend over an 11-year period. Medicaid insurance, new patient status, new medications, year of visit, and non-metropolitan location were the five strongest predictors of visit duration. These findings are likely reflective of healthcare utilization patterns in low-resource populations, provider-patient encounters, a growing aging population, and a shortage of ophthalmologists in rural areas. As interventions are made to better model and improve the clinic experience of ophthalmic patients, these factors should be taken into account.

## Data availability statement

The authors declare that all data supporting the findings of this study are available within the paper and its Supplementary Figures and Tables. Should any raw data files be needed in another format they are available from the corresponding author upon reasonable request.

## Ethics approval and consent to participate

This study involved data that is publicly available on the National Ambulatory Medical Care Survey which is conducted annually by the National Center for Health Statistics. This study was exempt by the institutional Review Board (IRB) of Yale University School of Medicine and abided by the tenets of Helsinki.

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## Funding

None.

## Author's contribution

Dr. Joana Andoh and Dr. Brian DeBroff both conceived and designed the study and analysis, collected the data, contributed to the analysis of the data and wrote the paper.

## Acknowledgments

None.

## Conflicts of interest

The authors report no conflicts of interest in this work.

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