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Research Article

Severe Healthcare Disparities Arise in Patients with Diabetic Retinopathy

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Abstract

Diabetic retinopathy, an ocular complication of diabetes mellitus, is the leading cause of blindness in the United States. Effective glycemic control and routine eye screen screening can improve the patients outcomes of those with diabetes. However, due to differences in glycemic control and consistency of screening, diabetic retinopathy disproportionately affects racial and ethnic minority populations. To analyze the extent of these differences, we performed a retrospective patient chart analysis study on 511 patients with diabetes at New England Retina Associates, a vitreo-retinal ophthalmology practice based in Connecticut. We found that of the ethnic groups recorded, on average, Black/African American patients and Hispanic patients presented at the youngest age and had the highest HbA1c. They also had the highest rates of being uninsured or using Medicaid and presenting with a severe form of diabetic retinopathy. Similar healthcare disparities arise when patients are analyzed by insurance type, with patients on no insurance or utilizing Medicaid presenting the worst. As the rate of diabetes in the United States continued to increase, it becomes increasingly important for primary care providers to understand these disparities and incorporate them into their treatments and referrals. We should strive for efforts to improve ocular care for racial minority and socioeconomically disadvantaged patients to reduce healthcare disparities in the treatment of diabetic retinopathy.

Keywords: *Diabetic Retinopathy; Diabetes Mellitus; Disparity; Ethnicity; Socioeconomic Status*

Abbreviations

DR: Diabetic Retinopathy; NERA: New England Retina Associates; NPDR: Non-proliferative Diabetic Retinopathy; PDR: Proliferative Diabetic Retinopathy; DME: Diabetic Macular Edema; VA: Visual Acuity; DNK: Did Not Know

Introduction

Diabetes and diabetic retinopathy is a growing problem in the United States and globally. In the United States, diabetes is most prevalent in Blacks, followed by Asians, Hispanics, and lastly White population [1]. This disparity can be attributed to biological factors worsened by environmental factors like differences in education, socioeconomic status, and behavioral factors [2]. Between 2001 and 2020, overall prevalence of diabetes in American adults increased from 10.3% to 13.2% [1].

An estimated 4.1 million American adults have diabetic retinopathy (DR), representing 1.2% of the population. DR is categorized into: non-proliferative (NPDR) and proliferative diabetic retinopathy (PDR). NPDR is further classified into mild, moderate, and severe NPDR. In any stage of DR, patients are at risk for diabetic macular edema (DME), the primary cause of vision loss in DR. The incidence DME increases with increased severity of DR.

Objective of the Study

The objective of this study is to analyze the disparities in the level of severity of DR on initial presentation based on ethnicity and socioeconomic status in patients from New England Retina Associates (NERA), a private practice in Connecticut. This chart review retrospective study of diabetic patients at NERA was approved by Western IRB. The data analyzed was only from the patient's first visit, and included demographic information, diagnoses, systemic medications, insurance, and clinical values.

Methods/Study Design

We evaluated the last 511 patients referred to NERA with diabetes mellitus. Patient ethnicity was determined based on the patient's self-identification as White, Black American, Hispanic, Asian, or Other. Patients who did not list an ethnicity were also recorded. Insurance information was recorded, and is classified into one of 4 groups: Medicare, Medicaid, Commercial, or None.

The primary outcome was the severity of diabetic retinopathy for each eye upon initial presentation, as diagnosed as either None, Mild, Moderate, Severe Nonproliferative or Proliferative. We also define both Severe Nonproliferative and Proliferative to be extreme forms of DR. Secondary outcomes HbA1c level upon presentation, visual acuity upon presentation, macular thickness and DME on presentation, total number of medications and number of diabetic medications. It was also recorded if the patient didn't know or couldn't remember any of the above measurements.

Results and Discussion

Baseline characteristics

511 patients were identified as having diabetes mellitus. Table 1 presents the study's ethnic breakdown, along with values for age, the gender breakdown for each ethnicity, and the number of each type of insurance users for each ethnicity.

Table 1 presents the characteristics of the study population sorted by ethnicity. Of the four ethnicities recorded, Black/African American patients had the lowest average age upon presentation (59.3), followed by Hispanic (59.6), Asian (62.8), and finally White (66.0), indicating a younger diagnosis and development of DR for those patients of color compared to their White counterparts. Table 1 also shows that the Hispanic population has the highest rate of uninsurance (12.9%) when compared to the other ethnic groups (2.2%, 4.9%, 0%), indicating a potential inability to afford required medications. Hispanic patients also had the highest rate of being insured through Medicaid (22.6%), followed by Black/African American (14.8%), Asian (9.1%), and White (5.8%), also indicating differences in socioeconomic capabilities.

	Whole Population n = 511 (100%)	**White n = 224 (43.8%)**	**Black/African American n = 81 (15.9%)**	**Asian n = 22 (4.3%)**	**Hispanic n = 93 (18.2%)**	**Other n = 12 (2.3%)**	**Did Not List n = 79 (15.4%)**
Avg. Age	63.5	66.0	59.3	62.8	59.6	65.0	65.27
Sex							
Male	235	108	34	12	45	2	34
Female	276	116	47	10	48	10	45
Insurance							
Medicare	222 (43.4%)	109 (48.7%)	31 (38.3%)	11 (50.0%)	27 (29.0%)	4 (33.3%)	40 (50.63%)
Medicaid	62 (12.13%)	13 (5.8%)	12 (14.8%)	2 (9.1%)	21 (22.6%)	1 (8.3%)	13 (16.46%)
Commercial	199 (38.9%)	97 (43.3%)	34 (42.0%)	9 (40.9%)	33 (35.5%)	6 (50.0%)	20 (25.32%)
None	28 (5.5%)	5 (2.2%)	4 (4.9%)	0 (0%)	12 (12.9%)	1 (8.3%)	6 (7.60%)

Table 1: *Baseline characteristic of the study population.*

Systemic characteristics by ethnicity

	Whole Population n = 511 (100)	White n = 224 (43.8)	Black/African American n = 81 (15.9)	Asian n = 22 (4.3)	Hispanic n = 93 (18.2)	Other n = 12 (2.3)	Did Not List n = 79 (15.4)
Avg. HbA1c	7.68	7.39	8.00	6.59	8.11	7.78	8.11
# DNK	177 (34.64%)	61 (27.23%)	27 (33.75%)	11 (50%)	42 (45.16%)	1 (8.33%)	33 (41.77%)
# of Meds	6.05	6.29	6.07	4.27	6.00	8.08	5.57
# of DM Meds	1.83	1.81	1.69	1.76	2.07	2.42	1.71

Table 2: *Systemic information of the study population, sorted by ethnicity.*

Table 2 shows the patients in the study sorted by ethnic group. Number of patients that did not know (DNK) their HbA1c is indicated in the table. Meds List was obtained in 99.02% of patients. Patients whose measurements couldn't be recorded were excluded from the analysis of those measurements.

It can be seen that Black/African American patients and Hispanic patients had the worst average HbA1c values (8.00 and 8.11). It should also be noted that Hispanic patients were the only ethnic group to have on average more than 2 diabetes meds, which also indicates more severe cases of diabetes.

Ocular characteristics by ethnicity

	Whole Population n = 511 (100%)	White n = 224 (43.8%)	Black/African American n = 81 (15.9%)	Asian n = 22 (4.3%)	Hispanic n = 93 (18.2%)	Other n = 12 (2.3%)	Did Not List n = 79 (15.4%)
Avg. VA (logMar)	0.35	0.31	0.45	0.36	0.37	0.44	0.35
Avg. Macular Thickness (μm)	301.9	305.9	306.7	279.5	288.2	285.8	311.2
DR Severity							
None	236 (23.2%)	122 (27.2%)	24 (14.8%)	12 (27.3%)	48 (25.8%)	6 (25.0%)	24 (16.3%)
Mild	236 (23.1%)	114 (25.4%)	21 (13.0%)	16 (36.4%)	34 (18.3%)	5 (20.8%)	46 (28.8%)
Moderate	277 (27.1%)	138 (30.8%)	41 (25.3%)	11 (25.0%)	46 (24.7%)	8 (33.3%)	33 (20.6%)
Severe NP	95 (9.3%)	25 (5.6%)	22 (13.6%)	2 (4.5%)	14 (7.5%)	4 (16.7%)	28 (17.5%)
Proliferative	178 (17.4%)	49 (10.9%)	54 (33.3%)	3 (6.8%)	44 (23.7%)	1 (4.2%)	27 (16.9%)
Presence of DME	269 (26.32%)	139 (31.03%)	46 (28.40%)	6 (13.64%)	36 (19.35%)	7 (29.17%)	35 (21.88%)

Table 3: *Ocular information of the study population, sorted by ethnicity.*

Table 3 shows the patients in the study sorted by ethnic group. Visual acuity (VA) was recorded in 98.73% of eyes, macular thickness was recorded in 93.15% of eyes, Meds List was obtained in 99.02% of patients, DR Severity level was recorded in 100% of patients, and

insurance plan was recorded in 100% of patients. Patients whose measurements couldn't be recorded were excluded from the analysis of those measurements.

Table 3 confirms that Black/African American and Hispanic eyes presented with extreme forms of DR (46.9% and 31.2%, respectively) much more than White (16.5%) and Asian (11.3%) eyes. Black/African American patients also had the lowest rate of presenting with no DR (14.8%) compared to the other ethnic groups (27.2%, 27.3%, 25.8%). These findings indicate that there are important differences in the development of diabetic retinopathy between ethnicities, with Black/African American and Hispanic eyes suffering the most. Table 3 also shows that Black/African American patients had greater macular thicknesses on average (306.7 μm), followed by White patients (305.9 μm), Hispanic patients (288.2 μm), and Asian (279.5 μm) patients.

Table 3 shows that Black/African American patients also saw significantly worse visual acuity than other ethnic groups, as indicated by their highest average value on the logMar scale (0.45). They are followed by Hispanic patients (0.37), Asian patients (0.36), and White patients (0.31). These findings indicate that Black/African American seem to be in worse health upon initial presentation when compared to other ethnic groups.

Table 3 exhibits a high contribution of Black patients to the total number of eyes affected with DME (28.4%). They are followed by White patients (31.03%), Hispanic patients (19.35%), and Asian patients (13.64%). These findings display a higher presentation of DME in Black patients compared to other ethnic groups, caused by a greater severity of DR seen in these ethnic groups.

Clinical characteristics by insurance

	Whole Population n = 511 (100%)	**Medicare n = 222 (43.4%)**	**Medicaid n = 62 (12.13%)**	**Commercial n = 199 (38.9%)**	**None n = 28 (5.5%)**
Avg. HA1C	7.68	7.30	7.64	7.97	8.48
# DNK	177 (34.64%)	82 (36.94%)	28 (45.16%)	56 (28.14%)	11 (39.29%)
Avg. VA (logMar)	0.35	0.41	0.35	0.29	0.42
Avg. Macular Thickness (μm)	301.9	307.93	287.71	302.53	282.45
DR Severity					
None	236 (23.2%)	121 (27.25%)	23 (18.55%)	83 (20.85%)	9 (16.07%)
Mild	236 (23.1%)	126 (28.38%)	23 (18.55%)	84 (21.11%)	3 (5.26%)
Moderate	277 (27.1%)	108 (24.32%)	31 (25.00%)	116 (29.15%)	22 (39.29%)
Severe NP	95 (9.3%)	40 (9.01%)	18 (14.52%)	35 (8.79%)	2 (3.57%)
Proliferative	178 (17.4%)	49 (11.04%)	29 (23.39%)	80 (20.10%)	20 (35.71%)
# of Meds	6.05	7.11	5.61	5.18	4.82
# of DM Meds	1.83	1.78	1.77	1.96	1.57
Presence of DME (# of eyes)	269 (26.32%)	142 (31.98%)	28 (22.58%)	115 (28.89%)	13 (23.21%)

Table 4: *Clinical information of the study population, sorted by insurance type.*

Table 4 shows the patients in the study sorted by insurance type. It shows that patients with no insurance have the highest rates of presenting with an extreme form of DR (39.28%), followed by Medicaid patients (37.91%), patients with a Commercial insurance plan

(28.89%) and Medicare patients (20.05%). Medicare and Commercial patients also had the highest rates of presenting with no DR compared to Medicaid patients and patients with no DR. These findings indicate that the patients in the financially worst position are also the ones presenting with the worst DR. It should also be noted that while recorded patients on a Commercial plan have a higher average HbA1c than recorded patients on Medicaid, there is a higher rate of Medicaid patients who are unaware of their HbA1c than Commercial patients. Patients without an insurance plan tend to have the highest HbA1c and higher-than-average rates of not knowing their HbA1c.

It is also seen that patients on a Commercial plan had the best visual acuity upon presentation, as indicated by their lowest value on the logMar scale (0.29). They are then followed by Medicaid patients (0.35), and Medicare patients and patients with no insurance having the worst visual acuity (0.41 and 0.42, respectively). This indicates that those populations in financial need present in worse ocular health overall.

Additionally, Medicare patients saw the highest presence of eyes affected by DME (31.98%), followed by patients on a Commercial plan (28.29%), patients without insurance (23.21%), and Medicaid patients (22.58%). This data shows a higher level of suffrage for patients experiencing financial shortage.

All the above findings show that Black/African American and Hispanic patients develop more severe diseases and are generally in worse condition than White and Asian patients. Black/African American and Hispanic patients also tend to come from poorer communities, as indicated by their high rates of Medicaid plans and being uninsured, which inhibits their ability to receive proper treatments. Even regardless of race, uninsured patients and patients on Medicaid present with worse cases of DR when compared to patients with Commercial insurance. These communities are often poorly educated, making it harder for them to understand their disease and the severity of it.

Conclusion

Diabetic retinopathy is a growing public health issue in the United State and globally. Our research indicates that poorer patients and patients of color, specifically Black and Hispanic patients, are more likely to develop severe levels of diabetic retinopathy, as well as develop them at a younger age. As a result, they also tend to have greater retinal damage and worse vision. This is likely due in part to poor control of their diabetes, represented by a greater HbA1c value. These patients are some of the most vulnerable members of our population due to cost, lack of access or knowledge of disease state. Healthcare providers should work to make their services more accessible to these populations and put effort into educating them about the severity of diabetes and its related conditions. A comprehensive approach to educating diabetic patients on diabetes and diabetes related conditions can facilitate an early and timely referral to specialists to prevent blindness and other complications in this population. The treatment of diabetic retinopathy and diabetic macular edema have improved significantly in the past 10 - 20 years with the development of anti-vascular endothelial growth factor drugs and retinal surgery. Collaborative exchange of knowledge between all healthcare providers taking care of diabetic patients can help to ensure timely referral of these patients before severe or irreversible damage of the retina has occurred.

Bibliography

1. https://www.cdc.gov/diabetes/data/statistics-report/diagnosed-undiagnosed-diabetes.html

2. Bancks MP., *et al*. "Association of Modifiable Risk Factors in Young Adulthood With Racial Disparity in Incident Type 2 Diabetes During Middle Adulthood". *Journal of the American Medical Association* (2017).

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