Eye Care Utilization Among Older Insured Adults with Kidney Disease and Diabetes

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Older adults have increased risk factors for chronic kidney disease (CKD), diabetes, and blindness. Frequent routine screening may help with early detection, management, and prevention of eye disease and blindness. Using data from the National Health Interview Survey (NHIS), this study examined the use of eye health service among a national sample of older insured adults with self-reported diabetes and chronic kidney disease diagnoses. This study demonstrates an important correlation in the use of eye healthcare based on diabetes status, kidney disease status, and length of a diabetes diagnosis. Given the importance of early detection of potential eye disease, encouraging people and their families to seek early and frequent eye examinations is suggested.

INTRODUCTION

Chronic kidney disease (CKD), defined by reduced glomerular filtration rate (GFR < 60 ml/min/1.73m^2) or kidney damage (National Kidney Foundation, 2002), is recognized as a common condition. According to recent estimates, in 2019, approximately 15% (37 million) of adults in the United States have CKD (Centers for Disease Control and Prevention (CDC), 2019). CKD may occur at the same time as other health problems, including diabetes (Fox et al., 2004), heart disease (Meisinger, Döring, Löwel, & KORA Study Group, 2006), high blood pressure (Horowitz, Miskulin, & Zager, 2015), and other illnesses (Fox et al., 2004; Iwagami, Caplin, Smeeth, Tomlinson, & Nitsch, 2018). In addition, due to the presence of many of these different risk factors, CKD is elevated in older adults (Prakash & O'Hare, 2009).

CKD, DIABETES, AND VISION LOSS

In 2018, 50.9 million Americans were 65 years of age or older, and this population is projected to almost double to 98 million in 2060 (Administration for Community Living, 2019). The aging of the overall U.S. population is a significant driver of some chronic multi-morbidities, including CKD and diabetes. According to current estimates, CKD affects 38% of people aged 65 years or older, but only 13% of people aged 45–64 years, and 7% 18–44 years (CDC, 2019). According to estimates from 2018 (the latest year for which such data are available), diabetes affects 26.8% of people aged 65 years or older, but only about 17.5% among people 45–64 years of age (CDC, 2020).

There is a significant correlation between CKD and diabetes. The prevalence of CKD in U.S. adults with diagnosed diabetes was 25% between 2011 and 2014 (CDC, n.d.). This may be because the prevalence of CKD tends to be significantly and progressively higher with increasing levels of serum insulin and therefore, one of the main risk factors for CKD is diabetes. Previous work in the general population of the U.S. has found that, participants with diabetes had an estimated prevalence of 25% any stage CKD (eGFR < 60 ml/min per 1.73 m^2; albumin-to-creatinine ratio ≥ 30 mg/g; or both) versus 5.3% CKD in nondiabetic subjects, respectively (Zelnick et al., 2017). Researchers have also found that the presence of CKD in people with diabetes foreshadows significantly worse prognoses and poorer health outcomes (Fox et al., 2012; Pecoits-Filho et al., 2016).

In addition to the complex relationship between CKD and diabetes, other important complications of diabetes exist. Diabetes itself is also closely associated with other comorbid conditions, particularly blindness, vision loss, and diabetic retinopathy. Diabetic retinopathy is a common complication of both type 1 and type 2 diabetes and occurs when high blood sugar levels cause damage to blood vessels in the retina (Solomon et al., 2017). According to the National Eye Institute, a division of the National Institutes of Health (NIH), diabetic retinopathy is the most common cause of vision loss among people with diabetes and a leading cause of blindness in American adults aged 20–74 years (National Eye Institute, NIH, n.d.; NIH, n.d.). It is also the leading cause of vision impairment and blindness among working-age adults in developed countries (Solomon et al., 2017)Also according to the NIH, diabetic retinopathy is the most common cause of vision loss among people with diabetes and the leading cause of vision impairment and blindness among working-age adults (NIH, n.d.). Recent statistics from the CDC indicate that among adults aged 45 and over with diagnosed diabetes, 32.2% had cataracts, and 9.2% had vision loss due to cataracts (Cha, Villarroel, & Vahratian; NCHS, 2019).

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This association between diabetes and vision loss in older people has been identified in previous research. For example, more than three decades ago, Klein and Klein (1990) found that blindness and vision loss are common complications in the diabetic population. More recent research suggests that older Americans with diabetes are one and a half times more likely than their age-matched nondiabetic counterparts to develop vision loss and blindness (Tumosa, 2008). Diabetic retinopathy progresses slowly and may not present vision symptoms in the early stages of disease progression. Therefore, for patients with diabetes, regular eye checkups with early detection and treatment of vision-threatening retinopathy may prevent vision loss. Despite the documented increased risk for vision loss among people with diabetes in the U.S. population and the importance of routine eye examinations, the frequency of eye examinations is very low among people in the general population with diabetes (Benoit, Swenor, Geiss, Gregg, & Saaddine, 2019).

The management of kidney disease in older people remains challenging because of the interactions between age and other risk factors in kidney disease progression. The associations of CKD in older people with other comorbidities are understudied and poorly understood. Additionally, despite the documented increased risk for vision loss among people with diabetes in the U.S., national population-based data on the utilization of vision-related health services among older Americans with diabetes remain scarce. The purpose of this study is to answer three research questions concerning the relationship between diabetes and eye-care utilization among

- What proportion of older people with diabetes saw an eye doctor in the last year?
- Does time since diabetes diagnosis matter?
- What is the likelihood of seeing or talking to an eye doctor in the past year among older people with diabetes and kidney disease?

METHOD

Study design and data source

Data for this analysis are from the National Health Interview Survey (NHIS), conducted from 2010 to 2015 (Minnesota Population Center & State Health Access Data Assistance Center (SHADAC), 2012). With limitations outlined in the following, the NHIS is an important instrument for monitoring the health of the U.S. population because NHIS variables are consistently coded, well-documented, and capture a rich profile of its respondents, including many factors on health status, health conditions, and healthcare utilization. Details of the study sample and research methods have been published previously (Davern, Blewett, Lee, Boudreaux, & King, 2012).

Study population

Sociodemographic information and data related to health and health service utilization for a population of insured older American adults, aged 65 years and older (n = 80,153), were extracted for this analysis. Using complex survey sample designs, such as NHIS, can introduce unwanted bias, where the population of interest is stratified on several dimensions and oversampled within certain of these strata. This bias was minimized in the current study by employing the subpopulation option(s) and the sampling weights in the calculation of the estimates.

Main independent variables

Three independent variables of interest are weak or failing kidneys, diabetes status, and time since diabetes diagnosis. Classification for weak or failing kidneys was based on information reported in response to whether the respondent was told they had weak/failing kidneys in the past 12 months. The variable weak or failing kidneys was categorized with a binary indicator as yes (1) and no (0). Classification for diabetes was based on information reported in response to whether the respondent was ever told they had diabetes. Diabetes status was categorized as no (0), yes (1), and borderline (2). Time since diabetes diagnoses was classified as 0–2 years, 3–5years, 6–10 years, and more than 10 years.

Outcome variables

The dependent variable, eye care utilization, was based on/defined as whether the respondent saw or talked to an eye doctor in the past 12 months. The measure was assessed dichotomously: saw an eye doctor (1) and did not see an eye doctor (0).

COVARIATES

Demographic characteristics

Basic demographic characteristics (age, race/ethnicity, and gender) were included in the analyses for the purpose of adjustment. Classification for race/ethnicity was based on information reported for each respondent and was categorized into six categories (American Indians and Alaska Natives, non-Hispanic White, non-Hispanic Black, Asian/Pacific Islander, Hispanic/Latino, and other races). Non-Hispanic White is the reference category. Age was classified into two ordinal categories (65–84yrs, and 85+yrs) that captured group-specific effects in older adult populations. Gender was assessed with a binary indicator (0 = male; 1 = female). For age and gender, the lower categories served as reference.

Data analysis/analytic strategy

Data were analyzed descriptively using cross tabulations, and inferential statistics were assessed using logistic regressions. Logistic regression analyses were conducted to estimate odds ratios (OR) and p-values for the association between past-year eye doctor visits or communication and diabetes in a multivariate context, adjusting for age, sex, and race/ethnicity factors. STATA 12 survey commands were used to adjust for the complex survey design and to weight the NHIS samples to provide estimates for the U.S. population. Statistical significance was assessed as $p < 0.05$. The present study is exempted from the internal review board process because it used a secondary data source that is publicly available.

RESULTS

Figure 1 illustrates the percentage, by time, of older people who saw or talked with an eye doctor in the past 12 months since diabetes diagnosis. Percentages range from a low of 62.2% among those older people who had received a diagnosis in the past two years or less, to a high of 66.7% among those people who had received a diagnosis more than 10 years ago. Nevertheless, past-year visits or communication with an eye doctor did not achieve statistical significance. Weighted cross-tabulations analysis reveals a Pearson's chi-square F-statistic score of 2.0407 and a p-value of 0.1069 (not shown).

Table 1 shows that past-year visits or communications with eye doctors vary by diabetes status. Older people with diabetes are most likely to make such visits (65.4%), followed by those with borderline diabetes (59.3%), and those with no diabetes (56.7%). Pearson's chi-square F-statistic and p-value show that this relationship is statistically significant (69.48; $p < .0001$).

Analysis of the association between diabetes status and past-year visits or communication with eye doctors, stratified by the presence or absence of a weak or failing kidneys, is shown in **Table 2.** Unadjusted and adjusted odds ratios of the association between diabetes status and past-year visits/communications with an eye doctor were positive and statistically significant. The likelihood of past-year visits/communications with an eye doctor was highest among people with both conditions (diabetes and kidney disease). After adjusting for age, sex, and race/ethnicity, older people with diabetes who also had weak or failing kidneys were 1.640 times more likely to visit/communicate with an eye doctor than their counterparts without diabetes ($p < .0001$). Whereas older people with diabetes who did not have weak or failing kidneys were only 1.497 times more likely to visit/communicate with an eye doctor as their counterparts without diabetes ($p < .0001$). There are no age, gender, or race/ethnicity subgroup differences in this association.

DISCUSSION

The older adult population is rapidly increasing and is expected to represent 20% of the total U.S. population by 2050 (Ortman, Velkoff, & Hogan, 2014). Chronic conditions, such as diabetes, eye disease, and kidney disease, play roles in functional limitations among older adults in later years. Identifying factors such as eye disease before they occur could steer intervention and prevention efforts, reduce the incidence of functional disability, reduce the use of social services, preserve quality of life, and delay nursing home admittance. Keeping older adults healthy for as long as possible is also economically beneficial to individuals and society.

The American Diabetes Association recommends annual or biennial eye exams. However, given the close connection between aging, diabetes, and kidney disease, annual visits to eye physicians should be part of routine care for older people with risk factors for eye disease, such as diabetes and kidney failure. Previous research using population data has found that the annual frequency of eye examinations is about 50% among people in the general population with diabetes (Benoit et al., 2019). The current study found that a higher percentage of older people with diabetes (65.4%) saw an eye doctor in the past year. While 65% is an improvement compared to 50%, this finding adds to the abundant literature pointing out that systemic changes in healthcare may be needed to detect and prevent vision-threatening eye disease among people with diabetes.

Additional results suggest that having both kidney disease and diabetes increases the likelihood of past-year visits or communication with eye doctors among older U.S. adults. Results also suggest that the likelihood of seeing an eye doctor increases with the length of diabetic diagnosis. Retinal disease is a common concomitant of diabetes.

There are some limitations to our study. Using data from an existing national survey limits the types of questions available to respond to the research question because the questions pre-exist and cannot be altered, and additional questions could not be added. For example, the survey does not include questions about the specific types of diabetes, length of CKD diagnosis, and reasons for delaying medical care. Moreover, the survey did not capture whether an actual eye examination was performed during each encounter with an eye doctor.

IMPLICATIONS

Living with diabetes can be difficult, especially when it is discovered late or uncontrolled for long periods. Older people with diabetes can develop complications that cause burden to families. Health at old age is greatly influenced by long-term health history—by a long line of events in the health status of individuals and their families, and by health beliefs.

Additionally, CKD has devastating medical, social, and economic impacts for patients and their families. The rates of older patients living with CKD is also expected to grow (U.S. Renal Data System (USRDS), 2012). Concurrently, the aging process may lead to more complex medical and psychosocial impacts.

To help prevent vision loss and blindness, it is important for older people with diabetes to have a comprehensive dilated eye examination at least once a year to detect potential diabetic eye disease early. Such examinations are performed by eye doctors. The findings in this research provide supportive and consistent evidence that older insured people with diabetes alone and with both diabetes and CKD are more likely to have annual eye checkups. This is good news; however, at 65%, their utilization of such services may not be ideal. Owing mainly to the aging of the U.S. population (Varma et al., 2016), the prevalence of visual disabilities is expected to increase markedly during the next 20 years. Retinopathy progresses slowly, and even when it becomes sight threatening, it may not present symptoms involving vision. When symptoms do occur, it is often too late to restore full vision or to stop further deterioration from retinal photocoagulation. Therefore, timely observation of early changes in eye health can be important in preventing and addressing blindness before physiological changes or structural, neurological, or acquired damage to one or both eyes occur.

The prevalence of comorbidities is common among older adults with chronic health problems. Uncontrolled diabetes can be the cause of complications, such as stroke, heart attack, impaired circulation to the feet, amputations, kidney disease, and blindness. Ageing, diabetes, and hypertension are major risk factors for an increased probability of death due to CKD (Bowe et al., 2018). Consequently, collective efforts to mitigate risk factors, such as better control of hypertension and diabetes, will likely helped to abate rates of CKD. For instance, the available evidence indicates that early identification of CKD may allow physicians to aggressively modify cardiovascular risk, which, in turn, has the potential to improve patient outcomes in older people (Dukkipati, Adler, & Mehrotra, 2008).

Given the practical benefits of being able to detect and treat eye disease before it is too late, early identification of potential eye diseases and appropriate care can have a similar result as when targeting risk factors for early identification of CKD. Further studies to better explore such initiatives, as well as patterns of behavior in older populations, would be useful to improve patient care and outcomes. Studies are also needed to understand better the health-related behaviors and practices of older populations with CKD, diabetes, eye disease, and other comorbid conditions, such as hypertension.

Nephrology social workers should be included in interdisciplinary teams to ease the burdens associated with CKD-multimorbid chronic illnesses and to promote optimal outcomes for patients. Nephrology social work offers excellent opportunities to make significant differences in the lives of older people who are faced with the challenges of managing multiple conditions. Nephrology social workers can help patients self-manage both their CKD and diabetes. They can also play a critical role in encouraging individuals and their families to seek early and frequent eye examinations and help address any psychosocial barriers to these exams.

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TABLE 1. Past-year eye doctor visits/communications among older people with and without diabetes, stratified by kidney disease status, NHIS 2010–2015

	Visits to eye doctors		
	Yes (%)	**No (%)**	**[b]F-Statistic and *p*-value[b]**
Total			F (2.00, 599.99) = 69.48
Diabetes Status[a]			$p < .0001$
No	15,397 (56.7)	12,128 (43.1)	
Yes	4,976 (65.4)	2,742 (34.6)	
Borderline	623 (59.3)	413 (40.7)	

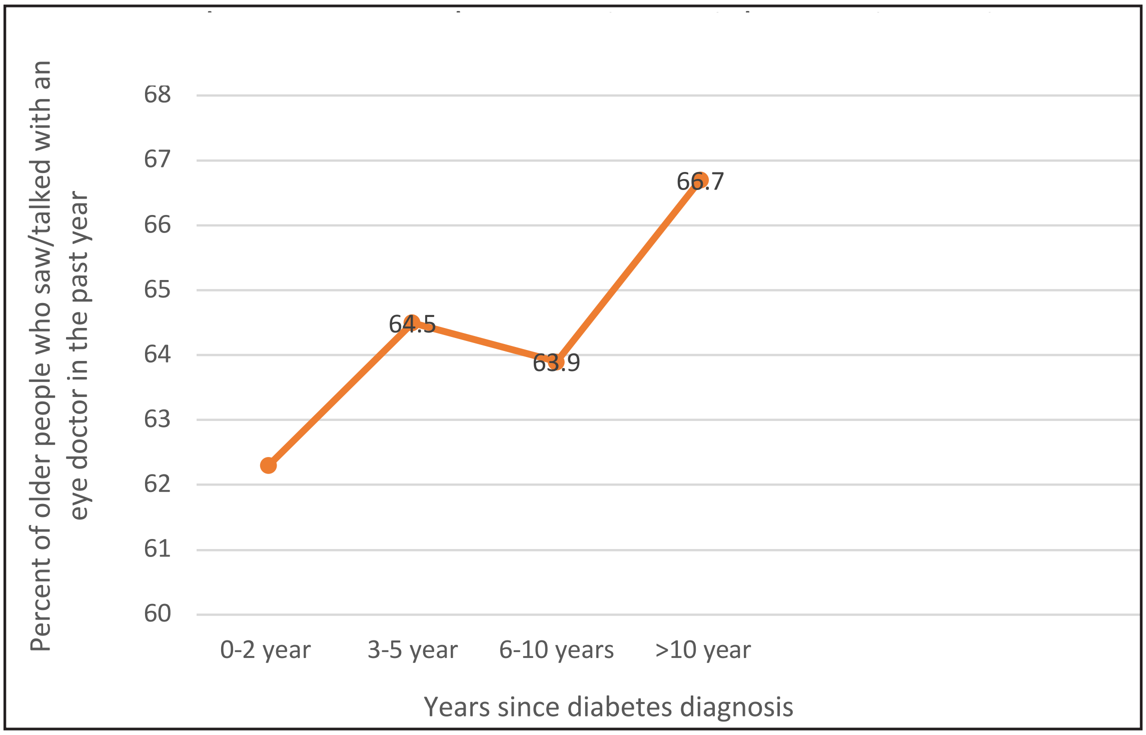
Note: **a** Sample weights are applied to the diabetes variable. **b** χ2 test; *p*-value are generated by Pearson's chi-squared F-statistic and *p*-value using SVY, tabulate, and subpopulation analysis.

TABLE 2. Likelihood of visits to an eye doctor in the past year among older people with and without diabetes, stratified by kidney disease status and adjusted for age, sex and race/ethnicity, NHIS 2010–2015

	Saw/Talked to an eye doctor				*Saw/Talked to an eye doctor*			
	Weak Kidney		*Weak Kidney*		*No Weak Kidney*		*No Weak Kidney*	
	Odds Ratio	***P-value***	**Odds Ratio**	***P-value***	**Odds Ratio**	***P-value***	**Odds Ratio**	***P-value***
No diabetes	1.000		1.000		1.000		1.000	
Diabetes	1.577	0.000	1.640	0.000	1.418	0.000	1.497	0.000
Borderline diabetes	1.748	0.060	1.807	0.048	1.074	0.304	1.122	0.106
Age			1.014	0.108			1.018	0.000
Sex			1.010	0.922			1.278	0.000
Race/Ethnicity			0.969	0.323			0.925	0.000
N	78964		78964		79608		79608	

Note: All analyses were weighted. Comparison groups included: non-Hispanic White, age 65–84 yrs, and male. Results from binary outcome, logistic regression is displayed.

FIGURE 1. Percentage of older adults with last year doctor contact by year since diabetes diagnosis



Note: F-Statistic Score = 2.0407