Visual Impairment and Quality of Life Among Older Adults: An Examination of Explanations for the Relationship

Robyn Lewis Brown¹ and Anne E. Barrett²

¹Department of Sociology, DePaul University, Chicago, Illinois. ²Department of Sociology, Florida State University, Tallahassee, Florida.

Objectives. We examine 4 potential explanations for the lower quality of life reported by older adults with greater visual impairment.

Methods. Using 2 waves of data from a nationally representative sample of older persons (a subsample of the Americans' Changing Lives Study, 1986 and 1989), we run residual change regression analysis to assess the extent to which the effect of visual impairment on quality of life, indicated by depressive symptoms and life satisfaction, is explained by changes in each of the following: (1) activity limitations; (2) socioeconomic resources, measured as income and financial strain; (3) social resources, indicated by social integration and perceived support; and (4) psychological resources, measured by self-efficacy.

Results. Higher levels of visual impairment are associated with more depressive symptoms and lower life satisfaction over the 3-year period. Each hypothesized mediator plays a role in explaining the effect of visual impairment on declines in quality of life; however, the strongest mediating effects are found for self-efficacy.

Discussion. By identifying multiple pathways through which visual impairment diminishes quality of life among older adults, this study highlights the importance of multipronged intervention efforts.

Key Words: Coping resources-Quality of life-Visual impairment.

JISUAL impairment—a condition affecting a sizable proportion of the elderly population-profoundly influences quality of life. Although prevalence rates vary depending upon the definition applied, current population estimates indicate that about one fifth of adults over the age of 60 experience some degree of visual impairment (Eye Diseases Prevalence Research Group, 2004; Lighthouse Research Institute, 1995; Pleis & Lethbridge-Çejku, 2007; Steinmetz, 2006). These impairments often result from agerelated eye disorders that are less amenable to correction with glasses or contact lenses, such as glaucoma, cataract, macular degeneration, and diabetic retinopathy (Prevent Blindness America, 2008). Although visually impaired older adults generally retain some degree of residual vision (Harvey, 2003; Prevent Blindness America, 2008), adjusting to visual impairment after a lifetime as a sighted person is a difficult experience (Brennan & Cardinali, 2000; Horowitz, 2004; McKinzie, Reinhardt, & Benn, 2007), as indicated by research examining quality of life. Visually impaired older adults score consistently lower than their unimpaired peers on two common indicators of quality of life: They rate their life satisfaction lower and are between two and five times more likely to experience depression (DiNuzzo, Black, Lichtenstein, & Markides, 2001; Horowitz, 2003; Horowitz, Brennan, & Reinhardt, 2005; Reinhardt, 1996). Concerns about the diminished quality of life of visually impaired older adults are magnified by the adverse

outcomes associated with low quality of life, including poorer physical health and increased risk of mortality (Lyyra, Tormakangus, Read, & Rantanen, 2006; Maier & Smith, 1999).

Although the negative effects of visual impairment on quality of life are well documented, we know little about the underlying mechanisms. Several mediating processes are suggested by studies reporting that greater visual impairment is associated with having more activity limitations and fewer economic, social, and psychological resources (Furner, Rudberg, & Cassel, 1995; McAuley et al., 2006; Ormel et al., 1997; Reinhardt, Boerner, & Benn, 2003; Verbrugge & Patrick, 1995; Vu, Keeffe, McCarty, & Taylor, 2005). However, few studies directly examine these associations as possible explanations for the lower quality of life of visually impaired older adults. The handful of studies that have explored this issue focus on a single explanation rather than on a more comprehensive set that would allow an assessment of their relative contributions. Existing studies also are limited by their tendency to rely on relatively small nonrepresentative samples and cross-sectional data.

Our study addresses these limitations by using two waves of nationally representative data to examine four potential explanations for the negative impact of visual impairment on quality of life, as indicated by depressive symptoms and life satisfaction, among older adults. The explanations center on the effect of visual impairment on activity limitations

© The Author 2011. Published by Oxford University Press on behalf of The Gerontological Society of America. All rights reserved. For permissions please e-mail: journals.permissions@oup.com. Received July 28, 2010; Accepted February 06, 2011 and economic, social, and psychological resources. Because each of these processes points to a different intervention approach, clarifying our understanding of the underlying mechanisms is a precursor to enhancing the quality of life of visually impaired older adults.

Explanations for the negative consequences of visual impairment for quality of life

The influence of vision loss on activity limitations is one possible mechanism that reduces quality of life. Visual impairments require a renegotiation of basic activities of daily life, such as bathing and dressing, as well as instrumental tasks, like housekeeping and running errands. Compared with other common age-related conditions, visual impairment more strongly impacts the ability to carry out such activities (Furner et al., 1995; Verbrugge & Patrick, 1995). Visually impaired older adults experience greater activity limitations-and a steeper decline over time-than those without visual impairment (Brennan, Su, & Horowitz, 2006; Crews & Campbell, 2001; DiNuzzo et al., 2001; West et al., 2002). Although these patterns suggest that increases in activity limitations may underlie the negative effect of visual impairment on quality of life, this possibility has not been directly examined using large samples of adults with a wide range of visual functioning. However, studies using small samples of adults with visual impairments suggest that activity limitations make a modest contribution to explaining the diminished quality of life of visually impaired adults. For example, a longitudinal study using a sample of 51 respondents diagnosed with bilateral age-related macular degeneration revealed that the strength of the association between degree of visual impairment and depressive symptoms diminished with activity limitations controlled, but the relationship remained significant (Rovner & Casten, 2002).

Visual impairment also may reduce quality of life by challenging one's economic security. Compared with the unimpaired, visually impaired individuals have lower income and greater financial strain (Horowitz et al., 2005; Horowitz, Brennan, & Reinhardt, 2005; Salive et al., 1992; Tielsch et al., 1991)—factors that predict lower quality of life (Kessler, 2010; Silver, Mulvey, & Swanson, 2002). Socioeconomic status (SES) is typically included in studies of visual impairment and quality of life, but, to our knowledge, it has not been examined as a potential mediator (e.g., Brennan et al., 2006; Furner et al., 1995). Instead, it is treated as a control variable because financial constraints are a risk factor for visual impairment, as evidenced by the observation that common eye diseases are often undiagnosed or untreated among people of limited means (Horowitz et al., 2005; Horowitz, Brennan, & Reinhardt, 2005). Though receiving less attention, the opposite causal direction also seems likely: Visual impairment may prompt or exacerbate financial hardship. Research finds that the effect of visual impairment on quality of life remains significant with indicators of SES controlled (Congdon, Friedman, & Lietman, 2003; Tielsch et al., 1991). However, a rigorous test of the mediating role of socioeconomic resources requires longitudinal data in order to disentangle the likely bidirectional relationship between visual impairment and socioeconomic resources.

A third explanation for the negative effect of visual impairment on quality of life centers on social resources. Visual impairment is associated with lower social integration and perceived support (Mitchell; the Australian National Health and Medical Research Council, 2001; Reinhardt et al., 2003; Vu et al., 2005), which diminish psychological well-being (Miech & Shanahan, 2000; Turner & Brown, 2010). The challenges of maintaining supportive social ties are illustrated by research and personal accounts documenting frequent expressions of pity or sympathy toward people with visual impairments, as well as social avoidance (Kleege, 2005; Monbeck, 1973). However, the role of social resources in explaining the diminished quality of life of people with visual impairments may be modest. Providing support for this claim, a community study of Dutch older adults finds that social support does not account for the greater psychological distress reported by people with visual impairments compared with their unimpaired counterparts (Ormel et al., 1997). This conclusion is limited, however, by two features of the study. It relies on crosssectional rather than longitudinal data and does not present analyses permitting the consideration of the unique mediating role of social resources independent of personal resources and activity limitations. Research employing samples limited to persons with visual impairments also suggests that social resources account for only a modest portion of variation in depressive symptoms. For example, a longitudinal study of 313 older adult applicants to a vision rehabilitation agency found that greater family support was associated with fewer depressive symptoms at baseline but was not associated with changes in depressive symptoms over a one-year period; in contrast, greater friend support predicted a decline in symptoms over time but was not associated with baseline depressive symptoms (Reinhardt, Boerner, & Horowitz, 2009).

Similar to its impact on social resources, visual impairment may reduce quality of life by diminishing psychological resources such as self-efficacy—a concept referring to the perceived ability to control one's life circumstances (Bandura, 1997). Persons with greater visual impairments report less control over their life circumstances and environment, which is associated with lower quality of life (McAuley et al., 2006; Ormel et al., 1997). Although the cross-sectional study of Dutch older adults previously mentioned indicates that self-efficacy partially mediates the association between visual impairment and psychological distress (Ormel et al., 1997), the analyses did not allow for an examination of the explanatory contribution of this psychological resource relative to other potential mediators. The explanatory capacity of self-efficacy receives additional, albeit indirect, support from a study of older adults seeking vision rehabilitation services (n = 584), which finds that lower feelings of self-efficacy are associated with increased risk of subthreshold and major depression (Horowitz, Reinhardt, & Kennedy, 2005). However, the study did not consider the independent influence of self-efficacy, and because data were cross-sectional, it is not clear whether declines in self-efficacy over time provide a further explanation for reductions in quality of life among people with visual impairments.

In summary, studies documenting the negative effect of visual impairment on activity limitations and the availability of socioeconomic, social, and psychological resources point to several pathways generating diminished quality of life among visually impaired older adults. However, few studies directly examine potential explanations for the effect of visual impairment on quality of life, and none of those of which we are aware examine the relative contributions of multiple explanations. Studies also are limited by their tendency to use data drawn from small nonrepresentative samples comprised entirely of persons with visual impairments (e.g., Reinhardt et al., 2009; Rovner & Casten, 2002). Although such examinations are useful for understanding within-group variation among people with visual impairments, they provide limited insight into the mechanisms generating diminished quality of life among those with visual impairments-compared with their unimpaired counterparts. Another limitation is introduced by the reliance of most studies on crosssectional data (e.g., Horowitz et al., 2005; Horowitz, Brennan, & Reinhardt, 2005; Ormel et al., 1997) that prevents an examination of changes not only in quality of life over time but also activity limitations and resources that may influence them. Addressing these limitations, we examine four potential explanations for the diminished quality of life of visually impaired older adults using two waves of a nationally representative sample followed over a three-year period. We test the following three hypotheses (with each referring to effects net of control variables):

Hypothesis 1: Compared with their less impaired counterparts, older adults with greater visual impairment report lower quality of life and greater decline in quality of life between the two waves.

Hypothesis 2: Compared with their less impaired counterparts, older adults with greater visual impairment report more functional limitations and fewer socioeconomic, social, and psychological resources. They also report greater increases in functional impairment and greater declines in these resources over the two waves.

Hypothesis 3: The negative effect of visual impairment on quality of life is partially mediated by each of the following factors: functional limitations and socioeconomic, social, and psychological resources. Collectively, these factors account for the negative effect of visual impairment on quality of life.

DESIGN AND METHODS

Data

Data are drawn from the first two waves (T1 and T2) of the nationally representative Americans' Changing Lives Study collected in 1986 and 1989 (for details, see House, 1997). Our study sample (n = 1,221) includes respondents who were between 60 and 96 years at T1. The lower age boundary was derived from evidence indicating that beyond 60 years the prevalence of visual impairment increases substantially among White-and particularly among African American-older adults (Eye Diseases Prevalence Research Group, 2004). The baseline study implemented a multistage stratified area probability sampling strategy with African Americans and individuals over 60 sampled at twice the rate of their counterparts. The second wave had a success rate of 73% among this sample. Although two additional waves of data were later conducted (in 1994 and 2006), we limit our analyses to the first two waves of the study because of the large number of cases lost after T2. More than 40% of the respondents aged 60 years or older at T1 did not complete the T3 survey, and more than 75% did not complete the survey in 2006.

Respondents with missing or incomplete data at T2 (n = 448) and those of race–ethnic groups other than White or African American (n = 25) are excluded from analyses. Omitted respondents reported significantly more depressive symptoms, lower life satisfaction, and greater visual impairment at T1 than those included in the study sample. These patterns suggest that our results may underestimate the effects of visual impairment on quality of life.

Measures

Summary statistics for all study variables are found in Table 1. We examine two indicators of quality of life that have been argued to assess different dimensions: (1) depressive symptoms, based on psychiatric standards of life quality and (2) life satisfaction, viewed as an overall assessment of life experiences (Campbell, 1981; Campbell, Converse, & Rodgers, 1976; Schuessler & Fisher, 1985). Although conceptually similar, depressive symptoms reflect present emotional affect, whereas life satisfaction represents more stable and cognitive dimensions of life quality (George, 2006, 2010).

The depressive symptoms measure is an abbreviated form of the 20-item Center for Epidemiological Studies– Depression scale (National Center for Health Statistics, 1980; Radloff, 1977). The 11-item summated measure has high reliability ($\alpha = .83$) and produces results similar to the full scale (National Center for Health Statistics, 1980). Respondents were asked how often in the past week they felt each of the following (with responses of hardly ever, some of the time, or most of the time): depressed, that everything was an effort, sleep was restless, happy, lonely, that people

Table 1. Means and Standard Deviations of Variables (N = 1,221)

Characteristics	Range	M (SD)	
Depressive symptoms			
Depressive symptoms T1**	0-20	4.212 (3.726)	
Depressive symptoms T2	0-18	5.691 (3.498)	
Life satisfaction			
Life satisfaction T1**	-2.810 to 1.926	1.519 (0.993)	
Life satisfaction T2	-1.135 to 1.156	0.534 (0.544)	
Visual impairment (T1)	-1.041 to 4.290	0.295 (1.056)	
Activity limitations			
Activity limitations T1	-0.493 to 3.027	0.233 (1.117)	
Δ Activity limitations	-4.175 to 4.033	0.033 (1.180)	
Economic resources			
Income T1	-0.948 to 3.941	-0.206 (0.923)	
Δ Income	-5.871 to 4.976	-0.091 (0.852)	
Financial strain*	-1.271 to 2.786	-0.119 (0.789)	
Δ Financial strain	-3.455 to 3.570	0.031 (0.892)	
Social resources			
Social integration T1**	-2.796 to 2.061	0.145 (1.020)	
Δ Social integration	-3.626 to 3.497	-0.052 (0.953)	
Social support T1	-2.323 to 1.329	-0.062 (1.002)	
Δ Social support	-2.643 to 2.661	-0.015 (1.115)	
Personal resources			
Self-efficacy T1**	-3.805 to 1.132	0.093 (1.000)	
Δ Self-efficacy	-4.502 to 4.626	-0.391 (1.000)	
Control variables			
Use of visual aid	0-1	0.945	
Age	60–96	69.349 (6.986)	
Women	0-1	0.693	
African American	0-1	0.279	
Education	0-17	10.592 (3.588)	
Chronic conditions	0–7	2.008 (1.374)	

Note: *significant at .01; **significant at .001 (two-tailed *t* test of mean differences in T1 and T2 variables).

were unfriendly, enjoyed life, poor appetite, sad that people disliked me and that I couldn't get "going." Life satisfaction is assessed by responses to the question, "Now please think about your life as a whole. How satisfied are you with it?" Responses range from *not at all satisfied* (1) to *completely satisfied* (5). Prior research indicates that this single-item measure is consistent with multiple-item life satisfaction measures (Thoits & Hewitt, 2001).

Our focal independent variable is visual impairment, measured at T1. The Americans' Changing Lives Study uses two items to assess self-reported visual impairment. The first item asks whether respondents use a visual aid (1 = yes)0 = no). Those answering affirmatively are asked how well they can see even with a visual aid-not at all well, not too well, somewhat well, quite well, or very well. Using the same five response categories, those who do not use a visual aid are asked how well they can see. We elected to combine these measures because the majority of the sample (94.5%)report using some forms of visual aid; but, we control for the use of visual aids in all analyses (see control variables below). Higher scores on the visual impairment indicator reflect greater self-assessed impairment. It should be noted that self-report measures of visual impairment used in survey research are found to describe visual impairment less precisely than clinical measures (for a review, see Horowitz, 2004).

However, because visual acuity is only one aspect of visual function, self-assessments may provide a fuller understanding of functional visual status (Horowitz, 2004; Smeeth & Iliffe, 1998). We note that visual impairment was not assessed at the second wave, thus preventing an examination of change in vision over time. We also note that additional analyses were conducted examining visual impairment as a dichotomous variable (coded 1 for not at all well and not too well and 0 for somewhat well, quite well, and very well in response to the question of how well one can see). Results did not differ substantively from those using the indicator capturing the full range of responses (i.e., visual impairment predicts lower quality of life and the pattern of mediation is similar). We retain the continuous measure to provide a clearer understanding of the association between degree of visual impairment and changes in quality of life.

We explore four sets of potential mediators of the effect of visual impairment on quality of life. For each, we examine baseline (T1) levels of these factors, as well as changes in levels from T1 to T2 (Δ Variable = T2 Value – T1 Value). Higher values on the change measure reflect greater change from T1 to T2, with positive values reflecting increases and negative values reflecting decreases. The *t* tests of differences between mean values from T1 to T2, as reported in Table 1, reveal several significant differences: On average, income, social integration, and self-efficacy declined, whereas financial strain increased.

Activity limitations are assessed by a standardized index ($\alpha = .84$) drawn from 12 items that gauge ability to perform activities of daily living (ADLs) and instrumental activities of daily living (IADLs). The ADLs include tasks related to self-care, such as bathing, dressing, and grooming; IADLs include tasks that one must be able to perform in order to live independently, such as housekeeping, grocery shopping, and meal preparation. Responses were *none*, *a little*, *some*, *a lot*, or *cannot do* (coded 0 to 4).

Socioeconomic resources are assessed by two measures income and financial strain. Total household income before taxes is a 10 category variable: less than \$5,000; \$5,000 to \$9,999; \$10,000 to \$14,999; \$15,000 to \$19,999; \$20,000 to \$24,999; \$25,000 to \$29,999; \$30,000 to \$39,999; \$40,000 to \$59,999; \$60,000 to \$79,999; and \$80,000 or higher. Responses were coded to the midpoint of each category, and means were imputed for missing cases (n = 311). Financial strain is a standardized index ($\alpha = .79$) using three items assessing how difficult they found their financial situation, meeting monthly payments on bills, and their finances working out at the end of the month. Responses ranged from *not difficult* (0) to *extremely difficult* (4).

Social resources are measured by two indices: social integration and perceived support. Social integration is a standardized index ($\alpha = .74$) summing responses to four items—two tapping informal social integration (i.e., frequency of visiting with friends and talking on the telephone with friends, neighbors, or relatives) and two measuring

formal social integration (i.e., frequency of attendance at church or club/organization meetings and frequency of volunteering). Responses to each item range from *never* (0) to *more than once a day* (5). Perceived support is a standardized index ($\alpha = .72$) that sums responses to six items assessing the extent to which friends or relatives make the respondent feel loved and cared for. Responses to each item range from *not at all* (0) to *a great deal* (4).

Our psychological resource measure, self-efficacy, is a standardized index based on the degree to which respondents disagree or agree with five statements: "All in all, I am inclined to feel that I am a failure"; "I can do just about anything I set my mind to"; "Sometimes I feel that I am being pushed around in life"; "There is really no way I can solve the problems I have"; and "At times I think I am no good at all." Responses—ranging from strongly agree (0) to strongly disagree (3)-were coded so that higher values reflect greater self-efficacy. The Cronbach's alpha for this index (.69) is at the threshold of acceptability. We retain this measure because evidence of its validity and reliability has been reported (e.g., House, Lantz, & Herd, 2005; Maciejewski, Prigerson, & Mazure, 2000). Providing further support for the construct's validity, our data reveal patterns consistent with research using other samples. Lower selfefficacy is associated with reporting more depressive symptoms, lower life satisfaction, and greater visual impairment (e.g., Ormel et al., 1997). Patterns consistent with those observed in other samples also are found for the social distribution of self-efficacy, such as lower self-efficacy among women and those of lower SES (e.g., Turner & Roszell, 1994).

Control variables include sociodemographic characteristics, use of a visual aid, chronic conditions, and baseline measures of quality of life. Sociodemographic characteristics are age (years, ranging from 60 to 96), gender (1 =women, 0 = men, race/ethnicity (1 = A frican American, 0 =White), and education (number of years of school completed, ranging from 0 to 17). The use of a visual aid is a dichotomous variable (1 = yes, 0 = no). Chronic conditions are indicated by a count of the following 10 conditions currently experienced: arthritis or rheumatism; lung disease; hypertension; heart disease, heart attack, or other heart trouble; diabetes or high blood sugar; cancer or malignant tumors; circulation problems; stroke; fractured or broken bones; and bladder problems/incontinence. Baseline measures of depressive symptoms and life satisfaction (collected at T1) are measured using items identical to those tapping these dimensions of quality of life at T2. An examination of the latent roots and latent vectors of a pairwise correlation matrix including all study variables and variance inflation factors provided no evidence of multicollinearity.

Analytic Strategy

We use residual change regression models (Allison, 1990; Kessler & Greenberg, 1981) to assess the influence of

visual impairment at T1 on changes in quality of life from T1 to T2. In order to investigate potential explanations for this effect, we compare the coefficient and level of significance for visual impairment before and after the hypothesized mediator is added to the model, with a reduction in the magnitude of the effect of visual impairment on quality of life providing support for the mediational hypothesis. We use Sobel–Goodman tests to formally assess the extent to which a mediator carried the influence of visual impairment to quality of life (MacKinnon & Dwyer, 1993; Mackinnon, Warsi, & Dwyer, 1995; Preacher & Hayes, 2004).

We present six regression models for each of the two indicators of quality of life. Model 1 regresses the dependent variables (i.e., depressive symptoms and life satisfaction at T2) on the T1 measures of visual impairment, use of a visual aid, age, gender, race–ethnicity, education, and chronic conditions. It also includes T1 measures of quality of life in order to assess the influence of visual impairment on changes in quality of life from T1 to T2. Models 2 through 5 each include a hypothesized mediator. Model 6 includes all variables entered in previous models in order to assess their collective role in explaining the effect of visual impairment on change in quality of life.

RESULTS

As part of our examination of whether the Sobel-Goodman criteria for mediation are met (Mackinnon et al., 1995; Preacher & Hayes, 2004), we conducted ordinary least squares (OLS) regression predicting each of the hypothesized mediators as a function of visual impairment, use of a visual aid, age, gender, race-ethnicity, education, and chronic conditions. These analyses, presented in Table 2, reveal that visual impairment is significantly associated with each of the following hypothesized mediators at T1: activity limitations, income, financial strain, social integration, and self-efficacy. Visual impairment also is a significant predictor of change from T1 to T2 in activity limitations, financial strain, social integration, and self-efficacy. Each of these associations is in the expected direction: Greater visual impairment predicts more limitations and financial strain and fewer resources. The finding that visual impairment predicts increases in financial strain is also noteworthy because it provides support for the argument that visual impairment influences financial hardship rather than simply being a consequence of it.

Table 3 presents the results of OLS regression analyses examining the effect of visual impairment (b_a) on depressive symptoms. Net of the control variables and baseline measure of depressive symptoms, greater visual impairment significantly predicts an increase in depressive symptoms over the three-year period (Model 1). We note that use of a visual aid is not significantly associated with change in depressive symptoms.

	Activity limitations		Economic resources			
	Activity limitations T1	Δ Activity limitations	Income T1	Δ Income	Financial strain	Δ Financial strain
Visual impairment	0.164 (0.028)***	0.099 (0.030)***	-0.053 (0.022)*	0.002 (0.021)	0.118 (0.025)***	0.054 (0.021)*
Use of visual aid	0.183 (0.128)	-0.072 (0.138)	0.197 (0.104)	0.087 (0.095)	-0.167 (0.116)	-0.159 (0.099)
Age	0.022 (0.004)***	0.020 (0.004)***	-0.021 (0.003)***	-0.009 (0.003)**	-0.026 (0.003)***	-0.010 (0.003)**
Women	0.101 (0.056)*	0.099 (0.057)	-0.266 (0.051)***	-0.124 (0.047)**	0.097 (0.056)	0.049 (0.048)
African American	0.030 (0.068)	0.022 (0.074)	-0.258 (0.055)***	-0.143 (0.052)**	0.588 (0.062)***	0.119 (0.055)*
Education	-0.018 (0.008)*	-0.012 (0.008)	0.080 (0.007)***	0.033 (0.007)***	-0.039 (0.008)***	-0.021 (0.007)**
Chronic conditions	0.272 (0.022)***	0.116 (0.024)***	-0.038 (0.017)*	-0.025 (0.016)	0.093 (0.019)***	0.043 (0.016)**
Constant	-1.868 (0.345)***	-1.396 (0.375)***	0.554 (0.280)*	0.178 (0.257)	1.826 (0.313)***	0.886 (0.270)***
R^2	.227	.198	.252	.141	.216	.291
		Social resou	irces		Personal	resources
	Social integration T1	Δ Social integration	Social support T1	Δ Social support	Self-efficacy T1	Δ Self-efficacy
Visual impairment	-0.109 (0.027)***	-0.073 (0.024)**	0.029 (0.028)	-0.007 (0.025)	-0.187 (0.026)***	-0.037 (0.015)**
Use of visual aid	0.230 (0.126)	0.172 (0.111)	-0.034 (0.129)	-0.001 (0.117)	-0.169 (0.119)	0.005 (0.067)
Age	0.008 (0.003)	-0.005 (0.003)	-0.011 (0.004)*	-0.008 (0.003)*	0.011 (0.003)**	-0.005 (0.002)*
Women	0.412 (0.061)***	0.137 (0.055)*	-0.087 (0.062)	-0.087 (0.057)	-0.064 (0.058)	-0.042 (0.032)
African American	0.167 (0.067)*	0.056 (0.060)	-0.141 (0.069)*	0.013 (0.063)	0.058 (0.064)	-0.081 (0.036)*
Education	0.054 (0.008)***	0.030 (0.007)***	0.033 (0.009)***	0.009 (0.008)	0.053 (0.008)***	0.012 (0.004)**
Chronic conditions	-0.020 (0.021)	-0.022 (0.098)	0.014 (0.021)	-0.011 (0.019)	-0.117 (0.020)***	-0.007 (0.011)
Constant	-1.511 (0.339)***	-0.141 (0.302)	0.448 (0.346)	0.476 (0.316)	-0.806 (0.321)**	0.699 (0.182)***
R^2	.101	.195	.030	.348	.135	.268

Table 2. Ordinary least squares (OLS) Regression of Hypothesized Mediators on Visual Impairment (N = 1,221)

Note: Standard errors in parentheses; *significant at .05; **significant at .01; ***significant at .001; change models control for T1 measures of the variables assessed (all of which were significant, p < .001).

Models 2 through 5 test our hypothesized mediators of the influence of visual impairment on change in depressive symptoms. Model 2 reveals that baseline levels and increases in activity limitations significantly predict increases in symptoms between the waves, and they jointly account for about 28% of the relationship between visual impairment and depressive symptoms. Additional analyses (not presented) indicate that each accounts for about half of the observed mediating effect. Model 3 demonstrates that higher baseline levels and increases in financial strain are associated with more symptoms and they collectively explain about 12% of the influence of visual impairment on

Table 3. Ordinary least squares (OLS) Regression of Depressive Symptoms (T2) on Visual Impairment (T1) (N = 1,221)

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	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
b _a : Visual impairment T1	0.329 (0.097)***	0.238 (0.094)**	0.290 (0.096)**	0.294 (0.096)**	0.217 (0.083)**	0.121 (0.091)
Use of visual aid	0.004 (0.390)	0.044 (0.378)	0.134 (0.389)	0.089 (0.390)	0.071 (0.373)	0.096 (0.366)
Age	0.001 (0.012)	-0.017 (0.013)	0.009 (0.013)	0.001 (0.012)	-0.007 (0.012)	-0.017 (0.013)
Women	0.504 (0.188)**	0.437 (0.183)**	0.454 (0.190)**	0.585 (0.192)**	0.496 (0.180)**	0.376 (0.182)*
African American	0.308 (0.207)	0.324 (0.201)	0.108 (0.214)	0.343 (0.207)	0.259 (0.199)	0.119 (0.203)
Education	-0.081 (0.026)**	-0.071 (0.026)**	-0.059 (.028)*	-0.070 (0.027)**	-0.053 (0.026)*	-0.023 (0.027)
Chronic conditions	0.237 (0.067)***	0.125 (0.068)*	0.209 (0.067)**	0.232 (0.067)***	0.196 (0.064)**	0.119 (0.066)*
Depressive symptoms T1	0.376 (0.025)***	0.346 (0.025)***	0.355 (0.025)***	0.370 (0.025)***	0.309 (0.026)***	0.272 (0.026)***
Activity limitations T1		0.553 (0.096)***		_	_	0.478 (0.093)***
Δ Activity limitations		0.683 (0.078)***	_	_	_	0.604 (0.075)***
Income T1			-0.073 (0.119)	_	_	-0.090 (0.112)
Δ Income			-0.090 (0.116)	_	_	-0.125 (0.109)
Financial strain			0.436 (0.120)***	_	_	0.220 (0.114)
Δ Financial strain			0.379 (0.112)***	—	_	0.151 (0.106)
Social integration T1				-0.194 (0.097)*	_	-0.055 (0.092)
Δ Social integration				-0.354 (0.099)***	_	-0.164 (0.094)
Social support T1				0.105 (0.107)	_	0.026 (0.097)
Δ Social support				0.085 (0.094)	_	0.079 (0.088)
Self-efficacy T1					-0.908 (0.111)***	-0.814 (0.112)***
Δ Self-efficacy					-1.604 (0.158)***	-1.433 (0.156)***
Constant	3.921 (1.060)***	5.338 (1.050)***	3.277 (1.018)***	3.753 (1.065)***	5.047 (1.022)***	5.840 (1.048)***
R^2	.284	.328	.295	.292	.345	.389
% Change in b _a		-28%	-12%	-11%	-35%	-64%
with adjustment ^a						

Notes: Standardized regression coefficients reported; standard errors noted in parentheses; *significant at .05; **significant at .01; ***significant at .001. ^aPercentage change in b_a from Model 2.

Table 4. Ordinary least squares (OLS) Regression of Life Satisfaction (T2) on Visual Impairment (T1) (N = 1,221)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
b _a : Visual impairment T1	-0.058 (0.016)***	-0.043 (0.016)**	-0.036 (0.016)*	-0.039 (.016)*	-0.023 (0.015)	-0.002 (0.015)
Use of visual aid	0.137 (0.066)*	0.138 (0.066)*	0.104 (0.065)	0.110 (0.065)	0.107 (0.062)	0.101 (0.061)
Age	0.003 (0.002)	0.004 (0.002)*	0.001 (0.002)	0.002 (0.002)	0.004 (0.002)*	0.001 (0.002)
Women	-0.001 (0.031)	0.001 (0.031)	0.005 (0.032)	-0.039 (0.032)	0.017 (0.030)	-0.011 (0.030)
African American	0.007 (0.035)	0.007 (0.035)	0.061 (0.035)	-0.011 (0.034)	0.025 (0.033)	0.048 (0.034)
Education	-0.008 (0.004)*	-0.008 (0.004)*	-0.012 (0.004)*	-0.011 (0.004)*	-0.012 (0.004)*	-0.022 (0.004)**
Chronic conditions	-0.030 (0.067)**	-0.022 (0.011)*	-0.021 (0.010)*	-0.028 (0.011)**	-0.019 (0.010)	-0.013 (0.011)
Life satisfaction T1	0.193 (0.014)***	0.187 (0.014)***	0.166 (0.015)***	0.181 (0.014)***	0.156 (0.014)***	0.134 (0.014)***
Activity limitations T1		-0.032 (0.016)*		_		-0.001 (0.015)
Δ Activity limitations		-0.024 (0.013)*	_	—	_	-0.002 (0.012)
Income T1			-0.018 (0.019)	—	_	-0.012 (0.018)
Δ Income			-0.010 (0.019)	—	_	-0.009 (0.018)
Financial strain			-0.138 (0.020)***	—	_	-0.097 (0.019)***
Δ Financial strain			-0.110 (0.019)***	—	_	-0.083 (0.018)***
Social integration T1				0.083 (0.016)***	_	0.067 (0.015)***
Δ Social integration				0.061 (0.017)***	_	0.033 (0.015)*
Social support T1				0.060 (0.018)**	_	0.045 (0.016)*
Δ Social support				0.024 (0.015)	_	0.018 (0.014)
Self-efficacy T1					0.192 (0.017)***	0.165 (0.018)***
Δ Self-efficacy					0.282 (0.026)***	0.257 (0.026)***
Constant	0.285 (0.176)*	0.216 (0.179)*	0.541 (0.177)**	0.415 (0.179)**	0.174 (0.168)***	0.466 (0.174)**
R^2	.154	.158	.191	.182	.249	.286
% Change in b _a with adjustment ^a		-26%	-38%	-33%	-61%	-97%

Notes: Standardized regression coefficients reported; standard errors noted in parentheses; *significant at .05; **significant at .01; ***significant at .001. ^a Percentage change in b_a from Model 2.

change in symptoms. Mediation tests of each economic resource (not shown) reveal that baseline financial strain accounts for the majority of this effect. Model 4, which examines social resources, indicates that higher baseline levels and increases in social integration predict declines in symptoms between waves. Separate tests show that baseline levels and increases in social integration play nearly equal roles in explaining the elevated symptoms of more visually impaired older adults. Contrary to a large body of research (e.g., Turner & Brown, 2010), we do not find that perceived support significantly predicts depressive symptoms. However, we note that cross-sectional analyses using the first wave (not presented) indicate that perceived support predicts depressive symptoms with the effects of visual impairment, social integration, and the control variables held constant. Of the mediators that we examined, psychological resources play a largest role in accounting for the elevated depressive symptoms of the visually impaired (Model 5). Higher baseline levels and increases in self-efficacy are associated with declines in symptoms and account for about 35% of the association between visual impairment and change in depressive symptoms. When the collective contribution of the four hypothesized mediators is considered (Model 6), the coefficient for visual impairment is reduced by 64% and does not reach significance.

Table 4 presents the results of the regression of life satisfaction on visual impairment. Greater visual impairment predicts a decrease in life satisfaction from T1 to T2 (Model 1). We also note that using visual aids emerges as a signifi-

cant variable; it predicts increases in life satisfaction between the waves. Model 2 demonstrates that activity limitations and changes in activity limitations-both significant predictors of declines in life satisfaction-explain about 26% of the relationship between visual impairment and change in life satisfaction, with further tests (not presented) revealing that baseline impairment plays a larger role. Turning to economic resources, 38% of the relationship between visual impairment and change in life satisfaction is explained by the effect of financial strain (Model 3). Separate mediation tests (not shown) reveal that financial strain accounts for the largest proportion of this effect. Model 4 reveals that the positive effects of social integration and perceived support and increases in social integration on life satisfaction account for 33% of the effect of visual impairment on change in life satisfaction over the three-year period. Separate analyses (not shown) reveal near-equivalent mediating effects of baseline level and change in social integration. Of the four sets of explanations that we examined, the strongest effects are found for psychological resources. Both initial levels and changes in self-efficacy are significant predictors of quality of life (Model 5). With self-efficacy controlled, the effect of visual impairment on change in life satisfaction declines by 61% and is no longer significant, with further tests (not presented) revealing that nearly all of this effect is explained by baseline level of self-efficacy. In Model 6, which includes all variables entered in previous models, the effect of visual impairment on change in life satisfaction declines by 97% and fails to reach significance.

DISCUSSION

Although visual impairment is a common occurrence in later life, it is nevertheless characterized by lower quality of life (Brennan & Cardinali, 2000; DiNuzzo et al., 2001; Horowitz, 2003, 2004). Research has given little attention to specific mechanisms through which visual impairment diminishes quality of life. Furthermore, none of the studies directly testing explanations for this relationship examine multiple processes or employ longitudinal data. Drawing on previous research documenting the associations of visual impairment with activity limitations and economic, social, and psychological resources, we examine each of these sets of factors as a potential explanation for the lower quality of life of visually impaired older adults. We explore these possibilities using a two-wave panel study of a nationally representative sample of adults aged 60–96 years.

Our findings provide further evidence of the negative effect of visual impairment on quality of life and a range of factors that influence it. Consistent with previous work and supporting our first hypothesis, we find significantly greater declines in quality of life, as indicated by more depressive symptoms and lower life satisfaction, among older adults who report a greater degree of visual impairment. Our results also support our second hypothesis. We find that experiencing greater visual impairment is significantly associated with more activity limitations and fewer socioeconomic, social, and psychological resources at baseline. In addition, greater visual impairment significantly predicts increases in activity limitations and financial strain and declines in social integration and self-efficacy over three years.

We elaborate on prior studies of visual impairment by examining multiple processes that may contribute to reduced quality of life. The results for depressive symptoms and life satisfaction support our third hypothesis predicting that the negative effect of visual impairment on change in quality of life is partially mediated by each of the following factors: activity limitations and economic, social, and psychological resources. We further hypothesized that these factors collectively explain the negative effect of visual impairment on quality of life. We find that these factors explain 64% of the effect of visual impairment on depressive symptoms and 97% of its effect on life satisfaction. With these four sets of factors included in the models, visual impairment significantly predicts neither depressive symptoms nor life satisfaction.

Although we find some evidence to support each of the four processes we examined, the results reveal that their contributions to explaining the lower quality of life of more visually impaired older adults, compared with their less impaired counterparts, vary. Self-efficacy plays the largest mediating role. It accounts for about 35% of the effect of visual impairment on depressive symptoms and over 60% of the effect on life satisfaction. Considerably smaller—though significant—mediating effects are observed for other explanations that we examined. However, the magnitude of these

effects differed for depressive symptoms and life satisfaction. Our findings suggest that economic and social resources play larger roles in explaining the effect of visual impairment on more stable and cognitively based appraisals, such as life satisfaction, compared with more emotional dimensions of life quality, as indicated by depressive symptoms. An exception is found for activity limitations, which nearly equally account for the effects of visual impairment on depressive symptoms and life satisfaction.

These patterns have implications for interventions aimed at increasing the quality of life of older adults with visual impairments. In general, our findings suggest the value of pursuing multiple interventions that improve physical functioning, economic circumstances, social involvement, and, particularly, perceptions of control over one's life. However, they also reveal that interventions may have different degrees of success for reducing depressive symptoms compared with enhancing life satisfaction. Assessments of life satisfaction, given their more cognitive than emotional nature, may be more strongly impacted by efforts to improve the structural features of the lives of visually impaired older adults, such as reducing financial strain and providing opportunities for greater social integration. Consistent with this conclusion, we find that use of visual aids is associated with improvements in life satisfaction but not depressive symptoms. Although our study suggests that improving structural conditions is important, particularly to enhancing life satisfaction, the findings also imply that intervention efforts will be limited if they fail to consider more subjective aspects of living with a visual impairment-particularly its effect on one's sense of personal agency.

Our study contributes to the literature by identifying multiple pathways through which the quality of life of visually impaired older adults may be improved; however, its limitations should be noted. Although this represents the first attempt (of which we are aware) to explore multiple explanations for the visual impairment-quality of life association using longitudinal data, our study includes only two waves and spans just three years. Across the explanations we examined, we find that in some instances, baseline levels (i.e., of activity limitations and resources) exert stronger mediating effects than do changes over the study period, whereas in other cases, the reverse is true. These patterns should be reexamined using data following adults over a longer span of time. We also are limited in our ability to assess change in visual impairment over time. Common age-related eye disorders, such as glaucoma, cataract, and macular degeneration, tend to be associated with a gradual course of decline (Harvey, 2003). As a result, we may be underestimating the extent to which visual impairment reduces quality of life over time. The ability to consider changes in visual impairment also would allow for a clearer assessment of the potentially bidirectional relationship of visual impairment and economic resources. We find that greater visual impairment predicts increases in financial

strain but is unable to determine whether financial strain influences degree of visual impairment. Another possible concern is that our data were collected two decades ago. We do not believe that this limitation renders our study irrelevant for understanding the association between visual impairment and quality of life because, while there have been some advances in the treatment of aging-related eye disorders (most notably for the treatment of cataract; Harvey, 2003), visual impairment remains a common problem and the use of aids does not eliminate its negative effect on quality of life.

In addition to examining effects of visual impairment on quality of life as they unfold over a longer time span, future research should examine whether the strength of the effects or underlying processes vary across segments of the elderly population. Sources of potential variation include gender, race–ethnicity, and SES, as well as the community-dwelling population compared with nursing home residents; each of these contrasts points to variation in levels of resources to address challenges faced in later life, including visual impairment.

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Correspondence

Correspondence should be addressed to Robyn Lewis Brown, PhD, Department of Sociology, DePaul University, 990 West Fullerton Avenue, Suite 1100, Chicago, IL 60614. E-mail: rbrown50@depaul.edu

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