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Visual Acuity and Self-Reported Vision Status: Their Associations With Social Isolation in Older Adults

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Abstract

Objectives—This study examined the associations of two measures of vision impairment (i.e., a clinical measure of visual acuity and self-reported vision status) and social isolation in a nationally representative sample of Americans aged 60 and older.

Method—Five cycles of the National Health and Nutrition Examination Survey (NHANES IV; 1999–2008) were used to estimate successive logistic regression models, holding constant demographic characteristics, chronic illness, functional limitations, and disability.

Results—Effects of both measures of vision impairment in predicting social isolation were substantially reduced or eliminated in adjusted models. Where significant effects of vision impairment on social isolation remained, a strong effect was found for self-reported poor vision (odds ratio = 1.53; 95% confidence interval = [1.08, 2.16]).

Discussion—As one of the better vision-related predictors of social isolation, self-reported vision is among the easiest and inexpensive to assess. The use of self-reported vision as a screening criterion for social isolation is discussed.

Keywords

vision impairment; older adults; disability; social isolation

Introduction

Social isolation is a known risk factor for a number of negative health outcomes including co-morbid chronic illnesses (Havens, Hall, Sylvestre, & Jivan, 2004), increased risk for institutionalization (Mistry, Rosansky, McGuire, McDermott, & Jarvik, 2001), falls (Faulkner, Cauley, Zmuda, Griffin, & Nevitt, 2003), and even mortality (Steptoe, Shankar, Demakakos, & Wardle, 2013). Thus, one task for researchers, policymakers, and long-term

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care providers is to identify and intervene on factors that may contribute to the social isolation of older adults.

Sensory impairments are a substantial challenge, which many older adults face that is thought to be associated with social isolation. Based on findings from the 2012 National Health Interview Survey (NHIS), more than one quarter of adults aged 65 or older report some vision impairment (Blackwell, Lucas, & Clarke, 2014). As life expectancies increase, the greatest proportion of adults with vision impairment will continue to be among the oldest old. The effects of vision impairment on the well-being of older people are many. Vision impairment greatly influences the ability of older adults to function in their communities. As prior research suggests, vision impairment in later life is strongly related to functional decline and physical disability (Rudberg, Furner, Dunn, & Cassel, 1993; Turano et al., 2004). In part, this association can be attributed to lost muscle or limb function that results from age-related limitations that are exacerbated by decreases in physical activity due to worsening vision (Lord, Smith, & Menant, 2010; Steinman, 2008). There is also evidence correlating vision impairment with poor health (Crews, Chou, Zhang, Zack, & Saaddine, 2014), and disability and social participation limitations (Steinman & Allen, 2012; West et al., 2002). For example, vision impairments often limit the execution of common participation activities (e.g., driving, dialing a telephone, or watching television).

Indicators of Social Isolation

Risk of isolation, such as risk for vision impairment, increases with age, due to various life-course changes, including loss of network members to death (particularly spouse/partners), the onset of chronic illness or functional decline, disability, and the geographic dispersion of families (Braver & Lamb, 2013; Krieger & Higgins, 2002). Older women, in particular, are at greater risk of isolation, because they live longer than men on average (Crooks, Lubben, Petitti, Little, & Chiu, 2008), and often outlive their spouses and other members of their social networks. This is important because being unmarried (e.g., divorced, widowed, never married) is a strong predictor of isolation. For example, being unmarried is often associated with living alone (Yeh & Lo, 2004) and also suggests lacking of one of the most intimate social ties to be had (Walen & Lachman, 2000). A number of additional factors have been implicated in placing adults at risk of isolation in later life. For example, relational needs fulfilled by friendships are distinct from those fulfilled by other family relationships (Adams & Blieszner, 1994; Akiyama, Antonucci, Takahashi, & Langfahl, 2003) and provide affirmation of worth and peer-companionship that contributes to social integration in later life (Crohan & Antonucci, 1989; Messeri, Silverstein, & Litwak, 1993). Thus, an absence of friendships can contribute to the risk of social isolation among older adults by reducing the individual's integration in groups of their peers. Furthermore, rates of isolation, characterized by having no one with whom they can discuss important matters, are differentially distributed across race and education levels. Specifically, those with higher education levels have denser kin and non-kin social networks, and when compared with Whites, Black Americans have smaller social networks (McPherson, Smith-Lovin, & Brashears, 2006). It has been widely recognized that the type of support provided by social network members varies to include both emotional support and instrumental support. For example, the provision of financial support functions as an indicator of instrumental support.

Older adults who are considered socially isolated are less likely to receive this type of support (House, 2001).

The relationship between vision loss and social isolation has been studied indirectly. In one study of non-institutionalized older adults, Crews and Campbell (2004) found that more than one third of those with vision impairment reported that they were not getting as much social interaction as they would like, compared with one fifth of those without vision impairment. Difficulties re-establishing social relationships following vision loss were related to lack of visual social cues as well as a lack in understanding by others in the social network (Wang & Boerner, 2008). There is also evidence of a decrease in social network size over time for those with chronic impairments, such as vision loss (Reinhardt, Boerner, & Horowitz, 2009). These findings suggest that vision status is related to social isolation. Nevertheless, the direct relationship between vision statuses, in particular, vision impairment, and social isolation has yet to be empirically documented, and this association is not considered in vision rehabilitation services.

Vision impairments may contribute to isolation in a number of ways. First, both vision and hearing impairments have been associated with communication disruptions in older adults (Berry, Mascia, & Steinman, 2004; Heine, Erber, Osborn, & Browning, 2002) that, over time, could lead to withdrawal from social settings and relationships and result in increased risk for social isolation. In addition, mobility difficulties associated with vision impairment may limit the extent to which an older adult can leave his or her home to spend time with family or to engage socially in groups with peers (Jang et al., 2003; Wallhagen, Strawbridge, Shema, Kurata, & Kaplan, 2001). For example, good visual acuity is a prerequisite for driving, one of the important enabling factors for participation in social activities, especially in the United States, and thus, effects of vision impairment may restrict opportunities for social activities and other social interactions (Jang et al., 2003). Reduced mobility and functional limitations can directly result in a shrinking of the individual's social networks by reducing access to family and friends (McLaughlin, Vagenas, Pachana, Begum, & Dobson, 2010). In an earlier study, Crews and Campbell (2001) found that individuals with self-reported vision impairments were less likely to get together with friends or participate in social activities, and similar patterns have been found using clinical measures of visual acuity (Alma et al., 2011).

By acquiring a better understanding of how different measures of vision impairment are associated with social isolation, the ability to screen for, and intervene on, social isolation risk factors can be facilitated and improved. Thus, one important task is to identify best measures of vision status for predicting deleterious outcomes such as social isolation. Generally, the relationship between clinical and self-reported measurements of vision is not well understood, although self-reported vision is frequently used as a proxy for objective measures of vision status (Centers for Disease Control and Prevention, 2011). Whereas some have argued that inherent differences between the measures make them difficult to use interchangeably (El-Gasim, Munoz, West, & Scott, 2012), others have noted their moderate strength of association and argued that the simplicity of self-reported assessments often make them useful and practical indicators of vision impairment more broadly (Whillans &

Nazroo, 2014). Conceptually, these two measures of vision impairment are important to assess separately in relation to social isolation.

The purpose of this study is to document the contributions of both clinically assessed visual acuity and self-reported vision status to risk of social isolation among a national sample of adults, aged 60 and older. Toward this purpose, we draw on the epidemiological model of the disability process described by Nagi (1965, 1976) to illustrate the reduced effects of vision impairments, when covariates representing other health dimensions are statistically controlled. The model consists of four main stages that progress from risk factors (e.g., demographic traits) to pathology and impairments to result in loss of functioning and, finally, difficulty in the performance of routine and discretionary daily life activities, or disability (Verbrugge & Jette, 1994). We hypothesize as follows:

Hypothesis 1: Because of shared variance with other health dimensions, the influence of clinically assessed and self-reported vision impairments will be reduced in fully adjusted models but still remains significant contributors to risk of isolation.

Method

Data used in this study came from combining five cycles (1999–2008) of the National Health and Nutrition Examination Survey (NHANES IV). When weighted, NHANES is a nationally (U.S.) representative, cross-sectional sample of the non-institutionalized population, age 2 and above. The survey over-samples racial minorities and persons age 60 and above, to improve statistical power in analyses of these groups. Prior to our analyses, we limited cases to NHANES participants, age 60 and older, leaving a weighted sample of $N=8,806$. Statistical analyses were conducted using Statistical Analysis Software (SAS), Version 9.4 for Windows. Analytical models were modified using “PROC SURVEY” SAS commands to adjust for the complex sampling design used by NHANES, and data were weighted to account for pooling across survey years to assure that the sample remained nationally representative across models (Centers for Disease Control and Prevention, 2013).

Independent Variables

Sociodemographic measures—All models, except unadjusted baseline models (Model 0), included four sociodemographic traits as control variables: age, gender, race, and educational attainment. Age was analyzed as a dichotomous variable, where individuals age 70 and older were compared against a reference group who were less than 70 years old (age $70+ = 1$). In NHANES, all persons age 85+ are grouped together (to make data less identifiable), making it difficult to include the age variable as a continuous variable. This information coupled with the age distribution of the data prompted the investigators to dichotomize age 70+ and below age 70 as a way of distinguishing between the young old and the oldest old. Gender and race were also coded into dummy variables with “male” and “White” as reference groups. Education was coded into an ordered categorical variable with three levels, including a group with less than a high school diploma, a group with a high school diploma or equivalent, and a group with some college or a college degree.

Visual acuity—Clinically assessed visual acuity was included in analyses as a key explanatory independent variable. Measures of presenting visual acuity with usual correction were acquired for both eyes, during the “Medical Examination” section of NHANES. Visual acuity measures were recoded into dichotomous dummy variables according to U.S. definitions of vision impairment (Tielsch, Sommer, Witt, Katz, & Royall, 1990). Participants with *low vision* (20/40 up to 20/200) and *legal blindness* (20/200 or worse) in their better seeing eye were evaluated relative to a group of participants with *normal vision* (better than 20/40).

Self-reported vision—A measure of self-reported general vision functioning was included in analyses as a key explanatory variable. Respondents to the “Interview” section of NHANES were asked to rate their present eyesight with glasses or contact lenses if she or he used them. Respondents could rate their vision status as *excellent*, *good*, *fair*, *poor*, or *very poor*. We recoded this item into three dichotomous dummy variables, where those who reported their vision as *poor* or *very poor* made up one group, those who rated their vision as *fair* made up a second group, and survey participants who rated their vision as *good* or *excellent* composed a third group, which served as a reference category in the models.

Chronic conditions—We used a combination of items from multiple sections of NHANES survey to create variables for six covariates representing chronic health problems commonly experienced by older people. Within the “Diabetes” section of the questionnaire, survey participants were asked whether a doctor had ever told them that they had diabetes or sugar diabetes. Those who stated that they had been told they had diabetes or that they were borderline diabetic were categorized together into a dummy variable (*has diabetes* = 1). As part of the “Medical Conditions” section of the NHANES questionnaire, participants were asked to report whether a doctor ever told them that they had congestive heart failure, coronary heart disease, angina pectoris, heart attack, emphysema, chronic bronchitis, arthritis, stroke, or cancer. The four heart-related conditions were combined into a dummy variable indicating whether participants had ever been told they had *any* heart problem (*has heart problem* = 1). Similarly, items that assessed emphysema and bronchitis were also combined to create a dummy variable indicating *any* respiratory problem (*has respiratory problem* = 1). We recoded each of the remaining chronic condition indicators (for arthritis, stroke, and cancer) to create similar dummy variables (*has condition* = 1).

Functional limitations—We used 10 measures of mobility and physical functioning found in the “Physical Functioning” section of the NHANES questionnaire to quantify functional limitations in our models. Survey participants were asked whether due to a health problem, they ever had difficulty walking a quarter mile; walking up 10 steps; stooping, crouching, or kneeling; lifting or carrying; walking between rooms on the same floor; standing up from an armless chair; standing for about 2 hr; sitting for long periods; reaching up over head; and grasping small objects. These functional items were recoded into dummy variables that indicated *any* difficulty or not being able to do the activity (*any difficulty/unable* = 1). Participants who reported no difficulty served as the reference category in analyses.

Disability—Six covariates representing disability were created from measures included in the “Physical Functioning” section of NHANES. In accordance with Nagi’s (1965, 1976) model, items were chosen to represent the disability dimension of health if they assessed the ability of individuals to perform activities in age-appropriate domains of life. In studies of older adults, “age appropriate” activities are often operationalized to include traditional activities of daily living (ADLs) and instrumental ADLs (IADLs). Within the “Questionnaire” section of NHANES, participants were asked whether due to a health problem they ever had difficulty managing money, doing chores around the house, preparing meals, getting in and out of bed, using a fork/knife or drinking from a cup, and dressing themselves. These disability items were recoded into dummy variables that indicated *any* difficulty or not being able to do the activity (*any difficulty/unable* = 1). Participants who reported no difficulty served as the reference category in analyses.

Dependent Variables

With the exception of *marital status*, which came from the demographics questionnaire, all other dependent variables in this study were derived from the “Social Support Questionnaire” (SSQ) section of NHANES. This section provided data on emotional, financial, and network support systems that participants had available to them. These measures are drawn from the Yale Health and Aging Study (Seeman & Berkman, 1988) and the social network index developed by Berkman and Syme (1979) in their seminal work on isolation. In creating our key dependent variables, we followed the methods of Mick, Kawachi, and Lin (2014) who used components of the SSQ to assess social isolation among older adults with hearing loss. In their study, three items from SSQ and marital status were combined into a summary measure of social isolation they called the “social isolation score” (SIS). The SIS is composed of the four items described below, which we included in models independently and as an aggregate SIS measure, per Mick et al. (2014). Beyond the extensive employment of such an index in prior studies, marital status, availability of friends or confidants, and the availability of instrumental support are conceptually supported by the literature reviewed previously in this article. By addressing how vision status is associated with each individual social isolation indicator as well as with the overall SIS measure, we can begin to explore the specific ways in which vision affects social isolation and generate hypothesis as to whether there is a cumulative effect.

Marital status—Within the “Demographics” section of the NHANES questionnaire, participants were asked to report their marital status. Those who stated that they were unmarried (i.e., *widowed, divorced, separated, or never married*) were coded as “at risk” (*unmarried* = 1). Participants who were coded as *married* included those who said they were *living with a partner*.

Inadequate emotional support—A variable indicating whether participants had adequate emotional support was created based on two items. Survey participants were asked whether they could count on anyone to provide them with emotional support, such as talking over problems or helping them make a difficult decision. Participants could answer *yes, no*, or they could state that they *did not need help*. Participants were then asked whether in the last 12 months they could have used more emotional support than they received. These items

were combined such that a person scored a point if they had nobody to provide emotional support, or had at least one person to provide support, but could have used more emotional support. In the combined variable, participants who were “at risk” were coded in the positive direction (*inadequate emotional support* = 1).

Inadequate financial support—A variable indicating whether participants had adequate financial support was created based on an item that asked whether, if they need some extra help financially, they could count on anyone to help, for example, by paying any bills, housing costs, hospital visits, or providing him or her with food or clothes. Participants could answer *yes*, *no*, or they could state that they *had been offered help but would not accept it*. Participants who stated that they did not have adequate financial support were coded as “at risk” (*inadequate financial support* = 1).

Number of close friends—Within the “SSQ” section, participants are asked in general how many close friends they have. Number of friends indicates a quantitative description of social network members, whereas lacking emotional support speaks directly to the availability of persons in which to confide.

The whole number response to this item was dichotomized to indicate whether participants had at least one or more close friends. Those without at least one close friend were coded as “at risk” (*<1 friend* = 1).

SIS—Following the methods of Mick et al. (2014), we created the aggregate SIS in two steps. First, we summed the four individual indicators of risk for social isolation. Thus, scores following this initial step ranged from 0 to 4, with higher scores indicating greater risk for isolation. Next, we created a dummy variable from the aggregate score to be used in analyses. Participants were coded as at risk for being “socially isolated” if their aggregate score was two or greater (*social isolation* = 1). Not surprisingly, social isolation index scores were positively skewed. Conceptually, it would follow that those with the highest possible scores can be considered socially isolated (Shankar et al., 2011). This dichotomization is consistent with prior work using NHANES (Ford, Loucks, & Berkman, 2006; Pantell et al., 2013).

Statistical Analyses

Initially, we conducted bivariate correlations to assess the strength of association between our key vision status variables. Results of this preliminary analysis showed a weak to moderate correlation between visual acuity and self-reported vision status ($r = .30, p < .001$). Thus, in remaining analyses, we assessed each vision status category independently in descriptive statistics and logistic regression models.

We calculated basic descriptive statistics for selected sociodemographic variables, clinical and self-reported vision status, and social isolation indicators. For each social isolation indicator, we calculated percentages representing the proportion of individuals in each vision status group, whose status in each indicator and/or the aggregate measure placed them at risk for social isolation. We computed the Wald χ^2 to identify overall statistical differences between vision groups. Follow-up tests (Wald χ^2) to assess pairwise differences between

vision status groups were conducted separately on each pair. As an index of effect size, Cramer's V was calculated. According to Green and Salkind (2013), Cramer's V values of 0.10, 0.30, and 0.50 represent effect sizes that are small, medium, and large, respectively.

Our main analyses consisted of a series of binomial logistic regressions to estimate the effects of visual acuity and self-reported vision status in models that controlled health dimensions included in Nagi's (1965, 1976) model of disability. In accordance with Nagi's model, we included controls for sociodemographic risk factors (age, gender, race, and education) and other covariates representing diagnosed chronic conditions, functional limitations, and indicators of disability in daily self-maintenance activities. We used statistical formulas described by Clogg, Petkova, and Haritou (1995) to compare regression coefficients between models, to assess the statistical impact of each health dimension on the dependent variables. Below, we report odds ratios (ORs) and 95% confidence intervals (CIs) that reflect the likelihood of being at risk for each social isolation indicator and SIS by each measure of vision status. Subscripts indicate statistical differences between models.

Results

Table 1 displays unadjusted descriptive statistics for demographic variables by visual acuity and self-reported vision status. With respect to visual acuity (top panel), a smaller proportion of study participants with normal vision (47%) were age 70 or older, compared with those who have low visual acuity (72%) and those with blindness (81%), $\chi^2 = 307.9$ (2), $p < .0005$, Cramer's $V = 0.19$. Those with normal visual acuity were slightly more likely to be male, $\chi^2 = 6.3$ (2), $p < .05$, Cramer's $V = 0.03$; White, $\chi^2 = 94.2$ (2), $p < .0005$, Cramer's $V = 0.10$; and to have attained some college education, $\chi^2 = 122.9$ (2), $p < .0005$, Cramer's $V = 0.12$.

Similarly, with respect to self-reported vision status (Table 1, bottom panel), a smaller proportion of survey participants with good vision (49%) were aged 70 and older, compared with those with fair vision (60%) and those with poor self-reported vision (69%), $\chi^2 = 129.6$ (2), $p < .0005$, Cramer's $V = 0.12$. Those with good self-reported vision were more likely to be male, $\chi^2 = 13.6$ (2), $p < .005$, Cramer's $V = 0.04$; White, $\chi^2 = 132.0$ (2), $p < .0005$, Cramer's $V = 0.12$; and to have attained some college education, $\chi^2 = 274.6$ (2), $p < .0005$, Cramer's $V = 0.17$, than those with fair or poor self-reported vision.

Table 2 displays unadjusted descriptive statistics for social isolation indicators by visual acuity and self-reported vision status. With respect to visual acuity (top panel), study participants with normal visual acuity were less likely than their counterparts with low visual acuity and blindness to be at risk for social isolation due to their marital status, $\chi^2 = 177.5$ (2), $p < .0005$, Cramer's $V = 0.14$; levels of emotional support, $\chi^2 = 32.4$ (2), $p < .0005$, Cramer's $V = 0.06$; and the number of friends they reported having, $\chi^2 = 15.6$ (2), $p < .0005$, Cramer's $V = 0.04$. Risk of social isolation due to inadequacy of financial support was not significantly different between the visual acuity groups. Individuals who have low visual acuity or are blind were statistically more likely to be categorized as at risk according to their SIS status, $\chi^2 = 61.9$ (2), $p < .0005$, Cramer's $V = 0.09$.

With respect to self-reported vision status (Table 2, bottom panel), survey participants with good self-reported vision were less likely than their counterparts with fair or poor vision to be at risk for social isolation due to their marital status, $\chi^2 = 164.0$ (2), $p < .0005$, Cramer's $V = 0.13$; levels of emotional support, $\chi^2 = 114.4$ (2), $p < .0005$, Cramer's $V = 0.11$; levels of financial support, $\chi^2 = 16.4$ (2), $p < .0005$, Cramer's $V = 0.04$; and the number of friends they reported having, $\chi^2 = 65.4$ (2), $p < .0005$, Cramer's $V = 0.08$. Individuals with fair and poor self-reported vision were statistically more likely than counterparts with good vision to be categorized as at risk according to their SIS status, $\chi^2 = 161.4$ (2), $p < .0005$, Cramer's $V = 0.14$.

Table 3 shows binary logistic regression results of five models that included all vision status variables (i.e., for both visual acuity [low visual acuity and blind relative to normal visual acuity] and self-reported vision [fair vision and poor vision relative to good self-reported vision]). With respect to risk associated with marital status, individuals in all four of the vision impairment categories were at greater risk of social isolation due to being unmarried relative to their non-visually impaired counterparts when all covariates were in the model. Only those with poor self-reported vision were at increased risk due to inadequate emotional support when all covariates were in the model (OR = 1.47, 95% CI = [1.01, 2.14]). Participants who are blind were significantly less likely to be at risk due to inadequate financial support (OR = 0.44, 95% CI = [0.25, 0.78]), and participants with fair self-reported vision were about 59% more likely to be at risk for social isolation due to having fewer than one close friend (OR = 1.59, 95% CI = [1.11, 2.29]). Finally, with respect to the SIS variable, individuals with low visual acuity were 21% more likely to be at risk for social isolation (OR = 1.21, 95% CI = [1.02, 1.43]) than individuals with normal visual acuity, and individuals with poor self-reported vision were about 53% more likely to be at risk for social isolation (OR = 1.53, 95% CI = [1.08, 2.16]) than individuals with good self-reported vision when all vision status variables and covariates were included in the model.

Discussion

This study explored the relationship between different measures of vision impairment and social isolation among older adults, with statistical adjustments for health and disability factors. In line with our hypothesis that visual acuity and self-reported vision status would exercise their effects independently, we reported differences with respect to the social isolation risk factors that are associated with each respective measure of vision impairment. In examining associations between vision impairment and individual components of the SIS, we found that participants with clinical measures of low visual acuity and blindness, as well as fair and poor self-reported vision, were at a greater risk of being unmarried in fully adjusted models. This is important because marriage is among the most intimate of social ties, and thus, being unmarried can be a major contributor to social isolation (Braver & Lamb, 2013; Steptoe et al., 2013). An adverse social network factor such as unmarried status, either single, divorced, or widowed, is known to be associated with an increased risk of a range of chronic diseases (e.g., diabetes) and mortality (Cornelis et al., 2014; Johnson, Backlund, Sorlie, & Loveless, 2000). Thus, it is likely that unmarried adults may not notice any subtle changes in health, or in this case vision, whereas those with a spouse may get noticed earlier. Positive support from spouse may also have an important role in health care-

seeking behavior and decision making that may have implications for eye health, cataract surgery, or use of corrective support.

Only individuals with poor self-reported vision were at risk for social isolation due to having inadequate emotional support. In addition, participants who are blind by clinical standards were at significantly lower risk of having inadequate financial support, compared with those with normal visual acuity. Being recognized as legally blind often qualifies individuals to a wide array of resources, including some financial support related to disability (Rein et al., 2006). Only individuals with fair self-reported vision were at risk for social isolation due to having less than one close friend. Finally, both low visual acuity and poor self-reported vision measures remained significant predictors of risk, with respect to the SIS index.

Generally, these findings are consistent with previous work pointing to associations between vision impairment and increased risk of social isolation (La Grow, Alpass, & Stephens, 2009); however, our results go further to suggest that self-reported measures of poor vision may be adequate, and perhaps even better, indicators for risk of social isolation than other measures that are more costly to acquire. One plausible explanation for why self-reported vision is strongly associated with social isolation relies on a holistic view of self-reported measures as being closely related across multiple domains. For example, beliefs that individuals maintain about their ability to be successful in social settings are likely to be highly correlated with their perceptions regarding their vision status. Indeed, it follows that a perception of poor vision status may inhibit some adults from engaging themselves socially. Similarly, the construct of self-efficacy (Bandura, 1997)—which asserts that personally held beliefs about one's ability to complete tasks and achieve goals are often extended across domains—has been found to mediate the relationship between vision impairment and quality of life (Brown & Barrett, 2011) and to influence degrees of physical activity among older adults (McAuley et al., 2011). Thus, it is possible that the self-reported measures of vision status that we assessed are associated with many extraneous variables, beyond vision impairment, that are unaccounted for in our models such as the concept of self-efficacy in domains that have bearing in cases of social isolation.

A second key finding of our study involved the shared variance between vision measures, and covariates, with respect to their relationship with social isolation. We conceived our models so that we could observe the individual effects of each of Nagi's (1965, 1976) health dimensions, as they related to our key dependent variables. In many cases, the effects of vision impairments were reduced with the addition of covariates, though no statistically significant differences were evident in coefficients between Models 0 and 4, suggesting that demographic covariates may be sufficient to account for variability associated with other health dimensions.

Our results do not refute previous work that reported associations between chronic illness and functional limitations and risk for becoming isolated (Grenade & Boldy, 2008; Victor, Scambler, Bond, & Bowling, 2000). Functional limitations in particular can disrupt the ability to perform activities that allow independent living and social interaction. The circumstances of decreased mobility may often lead to diminished social contacts through fewer outings outside of the home. Nevertheless, this study highlights the fact that beyond

other health dimensions that could impede the ability to engage in social relationships or activities outside of the home, some measures of vision impairment are independently associated with higher risk of social isolation—namely, low vision acuity and poor self-reported vision status.

Although our results demonstrate important relationships between vision impairment and social isolation, there are several limitations to this study, which warrant mentioning. First, the cross-sectional structure of the NHANES data set limits our ability to infer a causal relationship between key independent and dependent variables. Because we do not have information regarding the onset or duration of vision impairment, or the origins of each indicator of social isolation risk, we cannot say with certainty which factor precedes the other. Thus, a more rigorous future study should include longitudinal data to confirm or refute the findings reported here.

Second, there is a need for a validated tool to improve the ability to measure social isolation. Although the measures we used to operationalize this construct have been used elsewhere, it is unclear whether the composite measure (i.e., SIS) is the most appropriate for this purpose. As part of our study, we also ran models to assess the independent effects of covariates on each individual component contained in SIS. Regardless of vision status, marital status appears to be a strong driver of isolation risk in this population. However, it is important to keep in mind that social isolation is multifaceted and that one can be unmarried and not socially isolated or one may be married and isolated (Cornwell & Waite, 2009).

Finally, the number of participants characterized in NHANES as having severe vision impairments (i.e., blind and/or poor vision) was very small. In fact, small numbers necessitated that we analyze the SIS variable as a dichotomous variable, rather than as a continuous or ordinal-level variable. Although our methods followed those of Mick et al. (2014)—whose analyses were also conducted using NHANES data—it is possible that our results would differ if a finer grained dependent measure of social isolation could be assessed. Thus, our results corresponding to these groups must be interpreted with some caution.

Despite these limitations, results from this study extend existing knowledge by specifying poor self-reported vision as a significant indicator of social isolation risk. Our results have potential to inform practitioners from a wide range of professions, who may wish to identify or intervene on vision-related social isolation risk among older adults, but who have little access to clinical measures of vision impairment. As a potential screening tool for professionals who have a stake in maintaining the health and quality of life for older individuals who have vision impairments, a simple and inexpensive assessment of self-reported vision may suffice in detecting isolation risk. One important goal for future research is to identify possible mechanisms that link these constructs. Qualitative methods, in particular, may be effective in identifying additional intervention points for reducing or preventing isolation among older adults with vision impairments, as well as advancing the conceptual framework that guides research on isolation and disability.

Results from this study have direct implications for rehabilitation programs or training programs designed for older adults with vision impairment. Evidence of effective interventions designed to address social isolation among this group are limited; however, in general programs in which older people are active participants or that involve group interaction have been found to be most effective at alleviating social isolation (Dickens, Richards, Greaves, & Campbell, 2011). Incorporating social aspects into rehabilitation curricula and modifying existing programs for older persons with vision impairments and limited social networks (i.e., family, friends, or caregivers) are an important consideration. Based on results from this study, interventions that encourage social inclusion of older adults with vision impairments may reduce risk of social isolation and improve the health status and quality of life for this particularly vulnerable group.

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Unadjusted Descriptive Statistics for Demographic Variables by Visual Acuity and Self-Reported Vision Status (NHANES IV, 1999–2008, Weighted).

Table 1

Visual acuity	Normal (<i>n</i> = 7,424)	Low (<i>n</i> = 1,236)	Blind (<i>n</i> = 146)	Total (<i>N</i> = 8,806)	
Indicators	% in category			Wald $\chi^2(df)$	Cramer's <i>V</i>
% of total	84.3	14.0	1.7	100.0	
Age (70)	47.2 _a	71.8 _b	80.7 _c	51.2	307.9 (2) *** 0.19
Gender (Male)	44.7 _a	42.0 _{ab}	37.0 _b	44.1	6.3 (2) * 0.03
Race/ethnicity					
White	83.8 _a	73.4 _b	69.4 _b	82.1	94.2 (2) *** 0.10
Black	7.6 _a	10.0 _b	13.4 _b	8.0	13.7 (2) ** 0.04
Other	3.0 _a	5.2 _b	4.0 _a	3.3	16.3 (2) *** 0.04
Hispanic	5.6 _a	11.4 _b	13.2 _b	6.6	69.6 (2) *** 0.09
Education					
<HS diploma	24.7 _a	40.8 _b	55.0 _c	27.5	193.0 (2) *** 0.15
HS diploma	29.4 _a	27.9 _{ab}	24.3 _b	29.1	2.7 (2) <i>ns</i> 0.02
Some college	45.9 _a	31.3 _b	20.7 _c	43.5	122.9 (2) *** 0.12

Self-reported vision status	Good (<i>n</i> = 7,138)	Fair (<i>n</i> = 1,528)	Poor (<i>n</i> = 562)	Total (<i>N</i> = 9,229)	
Indicators	% in category			Wald $\chi^2(df)$	Cramer's <i>V</i>
% of total	77.4	16.6	6.1	100.0	
Age (70)	49.2 _a	59.9 _b	69.4 _c	52.2	129.6 (2) *** 0.12
Gender (Male)	44.8 _a	41.6 _b	38.1 _b	43.9	13.6 (2) ** 0.04
Race/ethnicity					
White	83.9 _a	73.0 _b	72.1 _b	81.3	132.0 (2) *** 0.12
Black	7.3 _a	12.3 _b	12.4 _b	8.4	52.6 (2) *** 0.08
Other	3.5 _a	3.8 _a	3.7 _a	3.6	0.3 (2) <i>ns</i> 0.01
Hispanic	5.3 _a	11.0 _b	11.8 _b	6.7	90.5 (2) *** 0.10
Education					
<HS diploma	23.2 _a	42.4 _b	55.6 _c	28.3	445.8 (2) *** 0.22
HS diploma	29.5 _a	28.7 _a	22.2 _b	28.9	13.5 (2) ** 0.04

Self-reported vision status		Good (n = 7,138)	Fair (n = 1,528)	Poor (n = 562)	Total (N = 9,229)			
Indicators		% in category				Wald $\chi^2(df)$	Significance	Cramer's V
Some college		47.3 _a	29.0 _b	22.2 _c		42.7	274.6 (2)	***
								0.17

Note. Subscripts represent pairwise differences, significant at $p \leq .05$. NHANES = National Health and Nutrition Examination Survey; HS = high school.

* $p < .05$.

** $p \leq .005$.

*** $p \leq .0005$.

Unadjusted Descriptive Statistics for Social Isolation Indicators by Visual Acuity and Self-Reported Vision Status (NHANES IV, 1999-2008, Weighted).

Table 2

Visual acuity	Normal (n = 7,424)	Low (n = 1,236)	Blind (n = 146)	Total (N = 8,806)
Indicators		% at risk ^a		
Marital status	34.3 _a	51.3 _b	64.6 _c	37.2 177.5 (2) *** 0.14
Emotional support	17.0 _a	23.4 _b	23.6 _b	18.0 32.4 (2) *** 0.06
Financial support	20.5 _a	20.9 _a	15.1 _a	20.4 2.7 (2) ns 0.02
1 friend	2.7 _a	4.5 _b	5.6 _b	3.0 15.6 (2) *** 0.04
SIS	15.7 _a	24.2 _b	26.8 _b	17.1 61.9 (2) *** 0.09

Self-reported vision status	Good (n = 7,138)	Fair (n = 1,528)	Poor (n = 562)	Total (N = 9,228)
Indicators		% at risk ^a		
Marital status	35.6 _a	46.5 _b	59.4 _c	38.8 164.0 (2) *** 0.13
Emotional support	16.2 _a	23.8 _b	31.2 _c	18.4 114.4 (2) *** 0.11
Financial support	19.5 _a	22.0 _b	26.0 _b	20.4 16.4 (2) *** 0.04
1 friend	2.4 _a	5.3 _b	7.3 _b	3.2 65.4 (2) *** 0.08
SIS	15.0 _a	23.7 _b	33.5 _c	17.6 161.4 (2) *** 0.14

Note. Subscripts represent pairwise differences, significant at $p < .05$. NHANES = National Health and Nutrition Examination Survey; SIS = social isolation score.

^aValues represent percent in each vision category at risk from negative outcomes associated with indicators (e.g., having *inadequate* emotional support).

* $p < .05$.

** $p < .005$.

*** $p < .0005$.

Logistic Regression Models Testing the Effects of Visual Acuity and Self-Reported Vision Status on Social Support Indicators (NHANES IV, 1999–2008, Weighted).

Indicator	N (Models 0/1/2/3/4)	Vision status	Model 0 ^a		Model 1 ^b		Model 2 ^c		Model 3 ^d		Model 4 ^e	
			OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Marital status	(7,512, 7,502, 7,457, 7,398, 7,381)	Low	1.82_a	[1.53, 2.17]	1.59_a	[1.33, 1.90]	1.57_a	[1.31, 1.88]	1.51_a	[1.26, 1.81]	1.46_a	[1.24, 1.80]
		Blind	2.39_a	[1.57, 3.64]	2.03_a	[1.31, 3.13]	2.00_a	[1.31, 3.06]	1.84_a	[1.22, 2.79]	1.86_a	[1.23, 2.82]
		Fair	1.44_a	[1.23, 1.68]	1.25_a	[1.05, 1.49]	1.24_a	[1.04, 1.48]	1.19_a	[1.00, 1.42]	1.19_a	[1.00, 1.41]
		Poor	1.92_a	[1.45, 2.55]	1.59_a	[1.19, 2.12]	1.52_a	[1.13, 2.03]	1.36_a	[1.02, 1.83]	1.36_a	[1.00, 1.83]
Emotional support	(7,626, 7,492, 7,447, 7,388, 7,371)	Low	1.26	[1.04, 1.52]	1.11	[0.92, 1.32]	1.11	[0.93, 1.33]	1.09	[0.91, 1.30]	1.08	[0.89, 1.29]
		Blind	0.86	[0.47, 1.60]	0.80	[0.43, 1.48]	0.83	[0.45, 1.55]	0.85	[0.45, 1.59]	0.81	[0.43, 1.55]
		Fair	1.61_a	[1.31, 1.98]	1.47_a	[1.18, 1.82]	1.40_a	[1.13, 2.71]	1.23_a	[1.00, 1.51]	1.21	[0.99, 1.49]
		Poor	2.40_a	[1.70, 3.39]	2.06_a	[1.44, 2.94]	1.89_a	[1.32, 2.71]	1.57_a	[1.08, 2.28]	1.47_a	[1.01, 2.14]
Financial support	(7,541, 7,408, 7,365, 7,309, 7,292)	Low	0.95	[0.79, 1.15]	0.97	[0.80, 1.17]	0.97	[0.80, 1.18]	0.94	[0.77, 1.13]	0.94	[0.78, 1.14]
		Blind	0.53_a	[0.31, 0.90]	0.53_a	[0.31, 0.92]	0.51_a	[0.29, 0.90]	0.44_a	[0.25, 0.79]	0.44_a	[0.25, 0.78]
		Fair	1.16	[0.96, 1.40]	1.13	[0.93, 1.38]	1.09	[0.90, 1.31]	0.99	[0.83, 1.19]	1	[0.83, 1.20]
		Poor	1.59_a	[1.22, 2.07]	1.50_a	[1.15, 1.96]	1.35_a	[1.02, 1.79]	1.18	[0.87, 1.59]	1.19	[0.88, 1.62]
1 friend	(7,562, 7,432, 7,388, 7,329, 7,315)	Low	1.36	[0.89, 2.08]	1.06	[0.69, 1.63]	1.04	[0.68, 1.59]	1.03	[0.67, 1.59]	1.04	[0.68, 1.56]
		Blind	1.17	[0.50, 2.72]	1.05	[0.45, 2.42]	1.06	[0.46, 2.48]	1.06	[0.44, 2.52]	1.03	[0.44, 2.39]
		Fair	2.16_a	[1.52, 3.07]	1.69_a	[1.15, 2.49]	1.70_a	[1.15, 2.51]	1.61_a	[1.11, 2.33]	1.59	[1.11, 2.29]
		Poor	2.41	[1.48, 3.91]	1.55	[0.91, 2.65]	1.55	[0.91, 2.61]	1.39	[0.83, 2.34]	1.27	[0.76, 2.12]
SIS	(7,350, 7,340, 7,297, 7,241, 7,227)	Low	1.43_a	[1.21, 1.69]	1.27_a	[1.08, 1.49]	1.26_a	[1.07, 1.48]	1.21_a	[1.03, 1.43]	1.21_a	[1.02, 1.43]
		Blind	1.11	[0.65, 1.89]	1.01	[0.60, 1.69]	1.00	[0.60, 1.69]	0.89	[0.53, 1.51]	0.9	[0.53, 1.53]
		Fair	1.69_a	[1.37, 2.08]	1.46_a	[1.17, 1.81]	1.39_a	[1.12, 1.73]	1.23	[0.99, 1.52]	1.22	[0.99, 1.51]
		Poor	2.54_a	[1.88, 3.43]	2.10_a	[1.54, 287]	1.89_a	[1.37, 2.61]	1.56_a	[1.10, 2.21]	1.53_a	[1.08, 2.16]

Note. OR with “Normal” and “Good” self-reported vision as the reference groups. Bold entries significant at $p < .05$. Subscripts indicate statistical differences between models. NHANES = National Health and Nutrition Examination Survey; OR = odds ratio; CI = confidence interval; SIS = social isolation score.

^aModel 0 controlled only visual acuity and self-reported vision (i.e., vision status).

^bModel 1 controlled vision status and sociodemographic variables (i.e., age category, gender, race, education).

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- c Model 2 controlled vision status, sociodemographic variables, and chronic diseases.
- d Model 3 controlled vision status, sociodemographic variables, chronic diseases, and functional difficulty.
- e Model 4 controlled vision status, sociodemographic variables, chronic diseases, functional difficulty, and disability.