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The Association Between Presenting Visual Impairment, Health, and Employment Status

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Abstract

Introduction: The purpose of this study was to investigate the impact of visual impairment and correctable visual impairment (i.e., uncorrected refractive errors) on being out of the labor force and on unemployment. The impact of health on labor force status was also investigated.

Method: National Health and Nutrition Examination Survey (NHANES) data from 1999 to 2008 (*N*=15,650) was used for this study. Participants were classified into three vision status groups: normal, correctable visual impairment (CVI), and visual impairment (VI). Statistical analyses utilized were chi-square and logistic regression.

Results: Having a VI was significantly associated with being out of the labor force, while having CVI was not. Conversely, having a CVI was associated with unemployment, while having a VI was not. Being out of the labor force was not significantly associated with health for those with a VI, although it was for those with CVI and normal vision.

Discussion: Given previous research, it was surprising to find that health was not associated with being out of the labor force for those with VI. Perhaps other disadvantages for those with VI identified in this study contribute to their higher out of the labor force rates, regardless of health.

Implications: Researchers utilizing national datasets that rely on self-report to identify VI should realize that some of those who self-identify with VI may actually have CVI. Current research is needed to understand why a majority of those with VI are not seeking employment and have removed themselves from the labor force.

The Association Between Presenting Visual Impairment, Health, and Employment Status

Employment rates for people with blindness or low vision (i.e., those with visual impairments) have historically been much lower and unemployment rates much higher than these rates for people without disabilities (McDonnall & Sui, 2019). In 2018, 44.9% of people with a visual impairment were employed and 9.3% were unemployed, compared to an employment rate of 77.8% and an unemployment rate of 4.5% for those without disabilities (U.S. Census Bureau, 2019). Slightly more than half of the population of people with visual impairments are out of the labor force, meaning they are not employed (i.e., currently working) or unemployed (i.e., currently looking for work). This compares to 18.5% of those without disabilities who are out of the labor force. One potential problem with this data obtained from the American Community Survey is its reliance on self-report of visual difficulties to identify visual impairment. This is a common disadvantage to all current national datasets that include labor force statistics: they use self-report to identify visual impairment, based on response to a question about vision that often differs from survey to survey (Crews et al., 2012). One national dataset that is an exception to this problem is the National Health and Nutrition Examination Survey (NHANES), which measured visual acuity of participants from 1999 to 2008.

Many people function with correctable visual impairment, often referred to by ophthalmologists as uncorrected refractive errors (Jeganathan, Robin, & Woodward, 2017; Naidoo et al., 2016; Schneider, Leeder, Gopinath, Wang, & Mitchell, 2010). In fact, many more people who present with a visual impairment have an uncorrected refractive error rather than a permanent visual impairment; 83% of those in one U.S. study who presented with a visual impairment could have their vision corrected to 20/40 or better (Vitale, Cotch, & Sperduto, 2006). In 2015 it was estimated that 8.2 million people in the U.S. had visual impairment due to

uncorrected refractive error (Varma et al., 2016). It is possible that people with uncorrected refractive errors may inaccurately be identified as visually impaired in national datasets that collect labor force information.

Studies Utilizing National Datasets to Evaluate Employment Status

Few studies have been conducted to evaluate the employment status of people with visual impairments utilizing national datasets. Only three studies were identified that utilized national datasets for this purpose and compared the employment status of those with visual impairments to other groups or considered potential confounding variables that may impact the employment status of this population (Houtenville, 2003; Kirchner, Schmeidler, & Todorov, 1999; Sherrod, Vitale, Frick, & Ramulu, 2014). In one of these studies, National Health Interview Survey data from 1983 to 1996 was used to compare the economic status of people with blindness to people without visual impairments as well as other disability groups (Houtenville, 2003). This study documented that men without visual impairments were 1.80 times more likely to be employed than men who were blind, and women without visual impairments were 2.31 times more likely to be employed than women who were blind. This study did not control for any other factors, such as personal characteristics, when calculating these rates.

The National Health Interview Survey on Disability (NHIS-D) of 1994-95 was used to evaluate the labor force status of people with visual impairments, with a specific focus on age and health as important factors related to employment for this population (Kirchner et al., 1999). The researchers concluded that self-reported health was strongly associated with whether a person who is legally blind would be employed, and to a smaller extent associated with employment for those with a less severe visual impairment. Kirchner and colleagues asserted that health had not been given enough attention when considering the employment status of this

population. This remains true today, as we are aware of only three additional studies since the Kirchner et al. study that included health as a predictor of employment for people with visual impairments (McKnight, Crudden, & McDonnall, in press; Cimarolli & Wang, 2006; McDonnall, 2010). In one of these studies, National Longitudinal Survey of Youth 1997 data was utilized to investigate variables that predict employment in terms of the annual number of hours worked for young adults with visual impairments (McDonnall, 2010), and self-reported health was found to be a significant predictor. The other study also documented a univariate association between health and employment, utilizing a small sample collected by the researchers (Cimarolli & Wang, 2006). However, the final study did not find a significant association between health and whether VR applicants with visual impairments would continue to work (McKnight et al., in press).

NHANES data was used to predict the work status of people with visual impairments determined by measured (non-correctable) visual impairment, as well as people with uncorrected refractive errors (Sherrod et al., 2014). This study is valuable because it considered both measured visual impairment and uncorrected refractive error, and it separately evaluated (a) employed versus not working (i.e., unemployed or out of the labor force) and (b) unemployed versus employed. Both non-correctable visual impairment and uncorrected refractive errors were associated with not working (with non-correctable visual impairment having a much stronger association), but neither was associated with being unemployed. The study did have limitations, however, including that visual impairment and uncorrected refractive error were defined with 20/50 acuity in the better eye, which is a lower threshold than typically used to define visual impairment in the blindness field, and individuals who were blind were excluded from the study. Also, although the presence of an illness (e.g., arthritis, congestive heart failure, stroke) was

included in the statistical models, self-reported health was not, nor was education level, which we know to be an important predictor of employment for people with visual impairments (Lund & Cmar, 2019a; Lund & Cmar, 2019b) and the general population.

This Study

The purpose of the present study was to build on the Sherrod et al. (2014) study by defining visual impairment and uncorrected refractive error (henceforth referred to as correctable visual impairment) more stringently and adding some additional variables to the prediction models. Prompted by Kirchner et al.'s (1999) findings, we were particularly interested in the impact of health on employment, and the interaction of health and vision status on employment. The purpose of this study was to (a) investigate the relationship between health and vision status, (b) investigate the impact of measured (non-correctable) visual impairment versus correctable visual impairment on being out of the labor force and on unemployment, and (c) determine whether the impact of health on being out of the labor force differs based on vision status.

Method

Data from the National Health and Nutrition Examination Survey (NHANES) was used for this study. The NHANES is a nationally representative study conducted by the Centers for Disease Control and Prevention (CDC) that produces vital and health statistics for adults and children in the United States. The NHANES includes interview data as well as laboratory examination data composed of medical, dental, and physiological measurements. The vision component in the NHANES with distance visual acuity and objective refraction measurements is only available in five data release cycles from 1999 to 2008.

The NHANES uses a stratified, multistage sampling design and generates weights to make the sample representative of the U.S. civilian population. We selected participants who had

information in the vision component from the 1999-2008 cycles. Vision status was categorized into three groups: (a) normal – if visual acuity was 20/30 or better in the better-seeing eye on presentation, (b) correctable visual impairment (CVI) – if visual acuity of the better-seeing eye was 20/60 or worse on presentation, but improved to 20/30 or better with auto-refraction (i.e., best correction), and (c) visual impairment (VI) – if the visual acuity was 20/60 or worse in the better-seeing eye even after best correction, or if self-reported as unable to see light. The International Classification of Diseases definition of moderate visual impairment is 20/70 or worse in the better eye (International Classification of Diseases, 2015). The criteria of 20/60 was utilized because 20/70 was not a measurement reported; 20/60 and 20/80 were the closest acuities to this threshold. People who had visual acuity of 20/40 and 20/50 in the better-seeing eye on presentation or with auto-refraction corrected were excluded from the sample because these people were not considered to have either normal vision or vision poor enough to be considered a visual impairment.

We selected other variables of interest for this study—demographics, employment status, self-reported general health, and other health-related conditions. Demographics included age, gender, race/ethnicity, and education level and were utilized as control variables. Employment status also indicated the "type of work done last week," which was categorized into three groups: (a) employed ("working at a job or business" and "with a job or business but not at work"), (b) unemployed ("looking for work"), and (c) out of the labor force ("not working at a job or business" and not looking for work). Self-reported general health was initially reported as being "excellent," "very good," "good," "fair," or "poor," and we categorized this variable into three groups: excellent/very good, good, and fair/poor. Other health-related conditions were

dichotomous variables (0 = condition not present, 1 = condition present) and included diabetes, arthritis, congestive heart failure, heart attack, stroke, and emphysema.

Our final sample included 15,650 participants between the ages of 20 to 64 years. The lower age limit was based on data availability for variables of interest and the upper age limit was selected to correspond with typical working age. After sampling weights were applied, the sample represented 149,841,538 individuals, which consisted of 49.5% men and 50.5% women with an average age of 40.8 (SE = 0.19). The most common race/ethnicity of participants was non-Hispanic White (70.3%), followed by Hispanic ethnicity (13.3%), non-Hispanic Black (11.0%), and other races (5.4%). Regarding education level, 16.7% had less than 12^{th} grade, 24.9% held a high school diploma, 31.6% attended some college, and 26.8% held college degrees. Over a half (54.6%) reported their general health as excellent or very good, nearly a third (31.2%) indicated good health, and 14.2% reported fair or poor health. In terms of other health-related conditions, 5.1% had diabetes, 17.7% had arthritis, 1.0% had congestive heart failure, 1.8% ever had a heart attack, 1.2% ever had a stroke, and 1.0% had emphysema. The majority (98.6%) of the sample had normal vision, 1.2% had correctable visual impairment, and only 0.2% had visual impairment or blindness. Table 1 presents the percentages of each variable by vision level.

All statistical analyses were conducted using SAS 9.4. Sample weights for the complex sampling design were utilized for statistical analysis. PROC SURVEYFREQ and PROC SURVEYMEANS were used to determine descriptive statistics (percentages, means, and standard errors). The Rao-Scott modified chi-square test using PROC SURVEYFREQ was utilized to examine the association between vision status and general health. Two separate logistic regression models were conducted using PROC SURVEYLOGISTIC to explore factors

associated with being out of the labor force and with being unemployed, both compared with being employed.

Results

Table 1 presents the percentages for each variable included in the logistic regression models by vision status group. Of the three groups, the VI group had the lowest rate of being employed. Other notable differences in study variables based on vision status included race/ethnicity (Hispanic and non-Hispanic Black overrepresented in VI and CVI groups), education (lower education levels in VI and CVI groups), health (poorer health particularly for VI group and somewhat for CVI group), and a larger percentage of those with VI who had diabetes.

A chi-square test to examine the relationship between vision status and general health was significant (Rao-Scott $\chi^2(4, N = 15{,}650) = 21.69$, $p < 0.01$), indicating that there is an association between vision status and health. Follow up tests were conducted which documented that the VI group had poorer health compared with the normal vision (Rao-Scott $\chi^2(2, N = 15{,}395) = 19.81$, $p < 0.01$) and CVI groups (Rao-Scott $\chi^2(2, N = 314) = 11.49$, $p < 0.01$).

Table 2 presents the regression estimates (*b*), standard errors (*SE*), observed significance levels (*p*), and odds ratios (OR) from two logistic regression models predicting the odds of being (a) out of the labor force and (b) unemployed. The control variables included in the out of the labor force model were associated with being out the labor force in the expected direction (i.e., older, female gender, lower education, having a health condition, and being in poorer self-reported health were associated with being out of the labor force). Race/ethnicity was the only control variable not associated with being out of the labor force. Having a VI was significantly associated with being out of the labor force, while having CVI was not.

We retained the interaction between vision status and health condition in the out of the labor force model as the type III analysis of the interaction effect closely approached significance ($F(4,72) = 2.33$, $p = .06$) and this was a primary focus of the study. The odds of being out of the labor force were calculated separately for each vision status based on general health. For people with VI, health was not associated with likelihood of being out of the labor force ($F(2,74) = 0.39$, $p = .68$). For people with CVI, there was a significant association between health and being out of the labor force ($F(2,74) = 5.57$, $p < .01$), but only being in fair/poor health (compared to excellent/very good health) was significantly associated with being out of the labor force, with an odds ratio of 3.78 (95% CI = 1.72, 8.31). There was also a significant association between health and being out of the labor force for the normal vision group ($F(2,74) = 65.97$, $p < .0001$). Both those with good health and fair/poor health were more likely to be out of the labor force compared to those with excellent/very good health, although the odds ratio was very small for good health (1.14 [95% CI = 1.01, 1.29]) and small for fair/poor health (2.45 [95% CI = 2.10, 2.86]).

Fewer factors were associated with being unemployed versus employed. The logistic regression results from the unemployment model indicate that those who were younger, non-Hispanic Black or other races, and in fair/poor health had higher odds of being unemployed. Having CVI was associated with an increased likelihood of being unemployed (compared to having normal vision), but having a VI was not associated with greater odds of being unemployed.

Discussion

This study adds to the literature in several ways. We utilized a nationally representative dataset that included measured visual acuity to identify VI rather than relying on self-report,

included both VI and CVI as separate groups in the analyses, and evaluated the association between vision status and not being in the labor force and unemployment separately. This was also done by Sherrod et al. (2014), but our sample included a more stringent definition of VI to more closely match individuals who would be served by professionals in the blindness and low vision field. In addition, in this study we included an investigation of the impact of health on labor force status by vision status, which has not been studied previously to the authors' knowledge.

We believe it is particularly relevant to evaluate differences between those with VI and CVI, as all current national labor market data relies on self-report to identify those with VI. While both groups are disadvantaged compared to those with normal vision, our results document some significant differences between those with VI and CVI. Given that the majority of people with presenting VI actually have CVI, this is particularly important. In our sample, almost five times as many people had CVI than VI. While we cannot be certain how individuals will respond to the vision questions in national surveys, it seems a safe assumption that a portion of those with CVI will respond affirmatively. The NHANES data allowed us to utilize a nationally representative sample of people with verified VI to investigate employment status, and compare the effect of VI versus CVI on not being in the labor force and on unemployment.

Visual impairment has been associated with poorer health in previous studies (Horowitz, Brennan, & Reinhardt, 2005; Tielsch, Sommer, Katz, Quigley, & Ezrine, 1991), as it was in this study. We found that the health status of people with VI was significantly worse than either those with CVI or those with normal vision, with more than one-third reporting fair or poor health. While a majority of people with normal vision reported excellent or very good

health, only 28.1% of those with VI did. The health of individuals with CVI fell in the middle, with worse health than those with normal vision but better health than those with VI.

Given that poorer health is more common among those with VI and previous research has suggested it is a significant factor associated with employment (Kirchner et al., 1999), it is important to consider how health impacts work status for this population. Surprisingly, when evaluating the odds or being out of the labor force for those with VI based on health, there were no significant differences. In other words, persons with VI who reported fair/poor health or good health were not significantly less likely to be out of the labor force than those reporting excellent/very good health. For people with CVI and with normal vision, those in fair/poor health were significantly more likely to be out of the labor force compared to those in excellent/very good health. Although it is clear that people with VI are much more likely to be out of the labor force than those with normal vision, this does not appear to be dependent on their health status. Conversely, being out of the labor force is associated with the health status of those with CVI and normal vision. Perhaps other disadvantages associated with poorer employment outcomes that were found to be more common among those with VI (i.e., lower education levels, female gender, minority status) contribute to their higher out of the labor force rates, regardless of health. These findings do not corroborate Kirchner et al.'s (1999) study findings of a strong association between health and employment for those with VI.

We found as Sherrod et al. (2014) did that VI was not associated with being unemployed. In the NHANES sample, unemployment was relatively low for those with VI (6.5%; McDonnall & Sui, 2019). This is only slightly higher than the 5% unemployment rate for the general population during the same time period (U.S. Bureau of Labor Statistics, 2019). In this study,

persons with CVI were more likely to be unemployed than those with normal vision, in contrast to Sherrod et al.'s (2014) finding.

Limitations

A number of limitations associated with this study should be acknowledged. First and foremost, the data used for the study is old. Although estimated employment rates for people who are visually impaired have not significantly changed over time (McDonnall & Sui, 2019), many factors about the labor market have, and using old data is a disadvantage. However, there is no current data available that provides measured visual acuity, and thus this study has value even though the data is older. Another limitation of the study is our inability to identify visual impairment based on visual field deficits and relying only on visual acuity to identify visual impairment. A small number of people identified with normal vision may have met the definition for visual impairment based on visual field deficits. Finally, although this was a national study that includes data collected over a 10-year period, the actual number of people identified with a visual impairment was small, given that this is a low incidence condition. Although the data was weighted to be nationally representative, the small number identified with visual impairment limits the power of some analyses.

Implications for Future Research

These findings bring some questions to mind, such as whether the unemployment rate for people with VI identified through self-report in national datasets are more representative of those with CVI rather than actual VI. Similarly, it raises the question of whether a greater percentage of those with VI are actually out of the labor force than the national estimates that rely on self-report indicate. The current out of the labor force rate for those with self-reported VI is 50.9% (U.S. Census Bureau, 2019), but perhaps if only considering those with measured VI, this rate

would be higher. While it is clear that those with VI in this study were more likely to be out of the labor force than those with normal vision or CVI, they were not more likely to be unemployed. Lack of a difference in unemployment rates for those with VI may be due to a percentage of this population having given up on finding employment, perhaps after failed attempts at locating a job. It is also possible that people with VI have not attempted to be part of the labor force, either due to lack of skills, lack of motivation, lack of confidence, fear of losing government benefits, or other unknown factors. A few studies have addressed reasons for not working for this population (Crudden & McBroom, 1999; Leonard, 2002; O'Day, 1999), but additional, and more current, research is needed to better understand their removal from the labor force. Given that more than half of the working age population is not part of the labor force, this is an important avenue of investigation. If barriers to labor force participation can be identified and addressed, there is the potential to improve employment rates for people with visual impairment.

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Table 1
Descriptive Statistics of Model Variables by Vision Status

Variables	Normal Vision	VI	CVI
Employment status			
Employed	76.6 (0.60)	40.8 (2.82)	67.6 (3.19)
Unemployed[a]	2.2 (0.16)	2.8 (1.37)	5.6 (1.42)
Out of the labor force	21.2 (0.59)	56.4 (3.24)	26.9 (3.07)
Gender			
Female	50.5 (0.35)	57.8 (3.69)	49.2 (3.52)
Male	49.5 (0.35)	42.2 (3.69)	50.8 (3.52)
Race			
Non-Hispanic White	70.7 (1.36)	36.1 (4.08)	40.8 (3.96)
Non-Hispanic Black	10.9 (0.80)	27.9 (3.58)	19.7 (2.33)
Hispanic	13.1 (0.99)	30.5 (2.80)	27.6 (3.07)
Other races	5.3 (0.39)	5.6 (0.16)	11.9 (2.96)
Education			
Less than 12th grade	16.4 (0.59)	49.4 (3.95)	34.6 (3.59)
High school with diploma	24.9 (0.62)	16.4 (3.02)	18.9 (2.71)
Some college	31.7 (0.54)	14.9 (1.27)	28.5 (3.14)
College graduate or above	26.9 (0.98)	19.3 (0.55)	18.0 (3.00)
Health			
Excellent/very good	54.7 (0.75)	28.1 (2.51)	48.7 (3.88)
Good	31.2 (0.53)	35.3 (2.59)	32.2 (3.54)
Fair/poor	14.1 (0.44)	36.7 (1.85)	19.1 (2.91)
Diabetes	5.1 (0.23)	11.6 (2.31)	4.3 (1.45)
Arthritis	17.7 (0.51)	14.1 (2.61)	14.2 (2.08)
Congestive heart failure	1.0 (0.10)	3.4 (1.05)	1.2 (0.70)
Heart attack	1.8 (0.15)	1.6 (1.63)	0.4 (0.19)
Stroke	1.2 (0.12)	1.9 (1.63)	0.4 (0.30)
Emphysema	1.0 (0.12)	2.1 (2.15)	0.7 (0.67)
Age (*M*)	40.9 (0.19)	38.6 (0.61)	35.7 (0.81)

Note. Figures are percentages and standard errors except for age, for which values are means and standard errors. N = 15,650, representing 149,841,538 people (with weights applied). For normal vision, n = 15,336, representing 147,713,847 individuals. For VI, n = 59, representing 360,895 individuals. For CVI, n = 255, representing 1,766,797 individuals. VI = visual impairment. CVI = correctable visual impairment. Data from NHANES, 1999-2008.

[a] The unemployed category represents the percentage of people in each vison status who are unemployed, out of all people in that vision status, and does not correspond to the official U.S. government definition of unemployment.

Table 2

Logistic Regression Models Predicting Odds of Being Out of the Labor Force and Unemployed

	Out of the Labor Force vs Employed (*n* = 15,283)				Unemployed vs Employed (*n* = 11,506)			
	b	*SE*	*p*	OR	*b*	*SE*	*p*	OR
Age	0.01	0.003	<.01	1.01	-0.04	0.01	<.01	0.96
Female	1.05	0.05	<.01	2.85	-0.17	0.12	0.17	0.84
Race (ref = Non-Hispanic White)								
Non-Hispanic Black	0.04	0.06	0.53	1.04	0.51	0.14	<.01	1.67
Hispanic	-0.13	0.08	0.09	0.88	-0.33	0.20	0.10	0.72
Other races	-0.03	0.12	0.81	0.97	0.61	0.26	0.02	1.84
Education (ref = HS)								
Less than 12th grade	0.49	0.07	<.01	1.64	0.20	0.16	0.24	1.22
Some college	-0.19	0.07	<.01	0.82	0.24	0.13	0.08	1.27
College graduate or above	-0.57	0.08	<.01	0.57	-0.63	0.20	<.01	0.53
Diabetes	0.27	0.10	<.01	1.32	0.40	0.29	0.17	1.50
Arthritis	0.38	0.08	<.01	1.47	-0.15	0.20	0.46	0.86
Congestive heart failure	0.97	0.26	<.01	2.64	-1.48	1.27	0.25	0.23
Heart attack	0.49	0.16	<.01	1.63	0.76	0.71	0.29	2.13
Stroke	0.74	0.21	<.01	2.10	-0.67	1.05	0.52	0.51
Emphysema	0.69	0.16	<.01	1.99	-0.97	1.04	0.36	0.38
Vision (ref = Normal)								
VI	1.89	0.56	<.01	-	0.63	0.72	0.38	1.88
CVI	0.004	0.28	0.99	-	0.75	0.30	0.02	2.11
Health (ref = Excellent/very good)								
Good	-	-	-	-	0.21	0.15	0.17	1.24
Fair/poor	-	-	-	-	0.41	0.16	0.02	1.51
Vision * Health (ref = Excellent/very good)								
Normal * Good	0.13	0.06	0.04	[a]				
Normal * Fair/poor	0.89	0.08	<.01	[a]				
VI * Good	-0.03	0.81	0.97	-				
VI * Fair/poor	-0.48	0.62	0.45	-				
CVI * Good	0.70	0.42	0.10	-				
CVI * Fair/poor	1.33	0.40	<.01	[a]				

Note. Out of the labor force, *n* = 4,144, representing 32,047,125 individuals (with weights applied). Unemployed, *n* = 367, representing 3,314,371 individuals. Employed, *n* = 11,139, representing 114,480,042 individuals. SE = standard error. VI = visual impairment. CVI = correctable visual impairment. Data from NHANES, 1999-2008.

[a] ORs associated with the interaction were calculated separately and significant ORs are reported in text.