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Preliminary communication

Influence of visual acuity on anxiety, panic and depression disorders among young and middle age adults in the United States

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ABSTRACT

Background: Previous research, albeit limited, has demonstrated an association of visual acuity with depression and anxiety. However, these studies are limited in that they have focused on older adults, used a convenient sample, and/or used a subjective assessment of visual function. As a result, the purpose of this study was to examine the association of objectively-measured visual acuity with depression and anxiety (and panic disorder) among a national sample of young- and middle-age U.S. adults (20–39 years).

Methods: Using data from the 2003–2004 NHANES ($n=602$), the presence of anxiety, depression, and panic disorders was assessed from a diagnostic interview. Visual acuity was assessed from a vision exam using the Nidek Auto Lensmeter Model (LM-990A) and expressed as LogMAR units.

Results: After adjusting for age, gender, race-ethnicity, body mass index, mean arterial pressure, cotinine, diabetes, and physical activity, visual acuity was not associated with panic disorder ($p=0.71$) or depression disorder ($p=0.20$), but for every 0.1 LogMAR unit change in vision, participants had a 14% ($OR=1.14$; $p=0.04$) higher odds of having an anxiety disorder.

Limitations: The main limitation of this study was the cross-sectional design.

Conclusion: Young- and middle-age U.S. adults with worse visual function are at increased odds of having an anxiety disorder. Strategies to prevent and treat anxiety among those with worse visual function are needed.

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1. Introduction

While vision loss is typically thought of as an affliction of old age, it does not escape all younger adults. Estimates among Americans in 2006 indicate that approximately 14 million individuals aged 12 years and older have visual impairment (Vitale et al., 2006). Even those not classified as elderly experience physical and psychological challenges associated with vision loss (Crewe et al., 2011). Various physical challenges such as loss of balance and relearning how to traverse and function in the world pose massive hurdles to those who experience any form of vision loss (Grue et al., 2009). Further, vision loss is also associated with psychological well-being (Karlson, 1998). For example, studies have shown that loss of vision increases an individual's likelihood of developing disorders related to depression and anxiety (Bernabei et al., 2011). Despite these noted associations between vision and psychological well-being, most of these studies were conducted among the elderly population (Bernabei et al., 2011; Kempen et al., 2012), individuals with pre-existing conditions (Robertson et al., 2006; Kulaksizoglu, 2007), or in narrow geographic population samples

(Bernabei et al., 2011). Further, most research on this topic did not employ an objective measure of vision impairment but rather used self-report methodology (Karlson, 1998) or recruited pre-diagnosed individuals seeking vision rehabilitation (Kempen et al., 2012).

To address these gaps in the literature, the purpose of this brief study was to examine the association between objectively-measured visual function and various affect-related parameters, including depression, anxiety, and panic disorder. Further, given that most of the studies to date on this topic have utilized elderly samples, here we examine these associations among young- and middle-age adults. Lastly, to increase generalizability of our findings, we utilize data from the 2003–2004 National Health and Nutrition Examination Survey (NHANES); in the 2003–2004 NHANES only adults 20–39 years were eligible for both the diagnostic interview (to assess anxiety, panic, and depression disorders) and objective assessment of vision.

2. Methods and materials

2.1. Design and participants

The National Health and Nutrition Examination Survey (NHANES) is an ongoing survey conducted by the National Center

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for Health Statistics which evaluates a representative sample of non-institutionalized U.S. civilians. Participants are selected by a complex, multistage probability design. All procedures for data collection were approved by the NCHS ethics review board, and all participants provided written informed consent prior to data collection. 602 participants between 20 and 39 years of age provided data on the study variables.

2.2. Measurement of anxiety, depression, and panic disorders

As reported elsewhere (NHANES, 2006), three modules from the automated version of the World Health Organization Composite International Diagnostic Interview (CIDI-Auto 2.1) were administered to each participant. The CIDI is a comprehensive, fully standardized interview that is used to assess mental disorders and provide diagnoses according to definitions and criteria of the tenth revision of the International Classification of Diseases and the fourth edition of the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders. The NHANES CIDI consisted of three diagnostic assessments that addressed diagnoses present in the past 12 months. These assessments were generalized anxiety disorder, depressive disorders, and panic disorder.

2.3. Measurement of vision

Details regarding the NHANES vision assessment are described elsewhere (Loprinzi et al., 2013b, 2014a, 2014b). Briefly, participants participated in a vision exam using the Nidek Auto Lensmeter Model LM-990A, with presenting visual acuity assessed with participants wearing their presenting correction (if any). Visual acuity of the better-seeing eye was used given that sight in the better eye is most relevant to disability in numerous visual disorders (Scilley et al., 2002; Richman et al., 2010). Presenting visual acuity of the better-eye was treated as a continuous variable expressed in logMAR units (logarithm of the minimum angle of resolution) (Holladay, 1997).

2.4. Measurement of covariates

Covariates included: age, gender, race-ethnicity, body mass index (BMI), mean arterial pressure, cotinine, diabetes, and physical activity.

Questionnaires were completed to assess age, gender, and race/ethnicity. BMI was calculated from measured weight and height (kg/m^2). Blood pressure was measured 3 or 4 times, and the average mean arterial pressure ($[\text{diastolic blood pressure} \times 2 + \text{systolic blood pressure}]$) was calculated. Serum cotinine was measured by isotope dilution high performance liquid chromatography/atmospheric pressure chemical ionization tandem mass spectrometry. Participants were also considered to have diabetes if they were taking insulin or diabetic pills to lower blood sugar, had a HgbA_{1c} of 6.5% or greater, or had a fasting glucose level of 126 mg/dL or higher. Lastly, based on the Global Physical Activity Questionnaire (Bull et al., 2009), participants were asked, "During the past 30 days, did you do moderate or vigorous activities for at least 10 minutes." Responses were coded as *yes* or *no*.

3. Data analysis

All statistical analyses (STATA, version 12.0, College Station, TX) accounted for the complex survey design used in NHANES by using survey sample weights, clustering, and primary sampling units. Means and standard errors were calculated for continuous variables and proportions were calculated for categorical variables. Three multivariable logistic regression models were computed to examine the association between visual acuity (independent

Table 1
Characteristics of the analyzed sample, NHANES 2003–2004 ($n=602$).

Variable	Mean/proportion (95% CI)
Age (yr)	29.4 (28.7–30.1)
% Male	51.2 (46.2–56.2)
Race-ethnicity (%)	
Non-Hispanic white	66.0 (58.5–73.6)
Other	33.9 (26.3–41.4)
Body mass index (kg/m^2)	27.9 (27.3–28.4)
Cotinine (ng/mL)	65.8 (53.2–78.3)
Mean arterial pressure (Pm)	84.6 (83.8–85.4)
Diabetes (%)	
Yes	2.2 (0.6–3.7)
No	97.8 (96.2–99.3)
MVPA in last 30 days (%)	
Yes	76.0 (71.1–80.6)
No	24.0 (19.3–28.8)
Diagnosis of anxiety (%)	
Yes	16.0 (11.9–19.8)
No	84.0 (80.1–88.0)
Diagnosis of panic disorder (%)	
Yes	28.4 (22.4–34.2)
No	71.6 (65.7–77.5)
Diagnosis of depression (%)	
Yes	19.1 (13.9–24.2)
No	80.9 (75.7–86.0)
Visual acuity, LogMAR	0.07 (0.05–0.08)

LogMAR=logarithm of the minimum angle of resolution. MVPA=Moderate-to-vigorous physical activity.

variable; continuous) and psychological functioning (outcome variable); one model included anxiety disorder (yes/no) as the outcome variable; the second model included panic disorder (yes/no) as the outcome variable; and the last model included depression disorder (yes/no) as the outcome variable. All models controlled for age, gender, race-ethnicity, cotinine, BMI, mean arterial pressure, diabetes, and physical activity. Statistical significance was established as $p < 0.05$.

4. Results

Table 1 displays the characteristics of the analyzed sample. The mean age was 29.4 years (range 20–39 yrs); gender was proportional (51.2% male); the majority (66.0%) were non-Hispanic white; and 16%, 28%, and 19% of the sample, respectively, were diagnosed as having an anxiety disorder, panic disorder, and a depression disorder.

Table 2 shows the multivariable logistic regression results examining the association between visual function and psychological function. After adjustments, visual acuity was not associated with panic disorder ($p=0.71$) or depression disorder ($p=0.20$), but for every 0.1 LogMAR unit increase (indicating worse vision), participants had a 14% ($\text{OR}=1.14$; $p=0.04$) higher odds of having an anxiety disorder. Although not the primary focus of this study, individuals with higher cotinine levels were more likely to be diagnosed with an anxiety and depression disorder.

5. Discussion

Previous studies have examined the effect of vision function on selected aspects of psychological well-being. However, most of these studies were conducted among the elderly population

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