

# Personality traits neuroticism and openness as well as early abnormal eye conditions as predictors of the occurrence of eye problems in adulthood

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## Abstract

This study set out to examine the associations between psychological, biomedical and socio-demographic factors in childhood and adulthood associated with the occurrence of self-reported eye conditions in adulthood. In total, 5706 participants with complete data on parental social class at birth, cognitive ability assessed at age 11 years, abnormal eye conditions by the age of 16 years diagnosed by medical professionals, educational qualifications obtained at age 33 years, the Big Five Factor personality traits measured at age 50 years, current occupational levels and self-reported eye conditions at age 54 years were included in the study. Logistic regression analysis showed that among all the factors examined early abnormal eye conditions, traits neuroticism and openness as well as sex were the significant predictors of self-reported eye conditions in adulthood.

## Keywords

early eye conditions, eye conditions in adulthood, personality traits, longitudinal

## Introduction

There is an extensive and growing literature in the associations between psychological factors and general health outcomes (Atherton et al., 2014; Chapman et al., 2011; Matthews et al., 2009). Many different health issues have been considered such as hypertension and asthma, yet few studies have looked at the specific associations between psychological factors and eye conditions. This study set out to explore the psychological, biomedical and socio-demographic factors in childhood and adulthood associated with self-reported eye conditions in adulthood using a large birth cohort in the United Kingdom.

Personality factors are related to health beliefs and behaviours which have long-term consequences, yet comparatively few studies have examined personality correlates of eye problems. It is possible that personality variables lead to behaviours that may influence the cause of eye problems, but also that eye problems could have a direct effect on personality. Thus, for instance, those who are prone to adventurousness and risk-taking may be more

likely to incur eye (and other) injuries which may in turn reduce their risk-taking behaviours. In order to explore these relationships, it is therefore necessary to conduct longitudinal studies, not just cross-sectional research. However, most of the results have been limited in terms of sample and personality measures.

Perhaps the first study in the area of personality and perception done almost 70 years ago was by Hibbeler (1947) who was interested in helping glaucoma patients deal with their affliction. He compared the personality of 27 glaucoma patients with a control group on a

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well-known questionnaire of that period (Minnesota Multiphasic Personality Inventory (MMPI)) (Schiele et al., 1943). He found evidence that the male patients tended to be high on depression and hysteria and the women on paranoia. Later Warrian et al. (2009) looked at personality factors in 148 patients with glaucoma or ocular hypertension using a new validated personality test (NEO PI-R) (Costa and McCrae, 1992). They found that the visual function questionnaire score of these patients was related to their Neuroticism, Extraversion and Conscientiousness. They argued that personality factors determine both how patients attach value to the treatments they receive and how they report the effects of treatment.

Cooke et al. (2003) compared keratoconic and myopic patients in terms of their personality, finding that myopes scored higher than keratoconics only on the Psychoticism scale, measuring tough-mindedness. However, the effect was small and became non-significant when corrected with Bonferroni procedure. In the same year, Spahn et al. (2003) looked at the personality profile of 24 patients with central serous chorioretinopathy. They found that the patients had elevated scores with regard to emotional instability (i.e. neuroticism) and insecure but also spontaneous and flexible compared to population norms. They recommended a longitudinal study with a bigger sample to understand the role of personality in this condition.

Giedd et al. (2005) aimed to define the personality profile of keratoconus patients with the Millon Behavioural Health Inventory (MBHI) (Sweet et al., 1985). Keratoconus is a corneal disease that manifests itself in young adulthood and decreases vision. The findings show that keratoconus patients scored lower than the normative population on the respectful coping style scale, suggesting that they could be less respectful towards practitioners, uncooperative and noncompliant with treatment plans. However, their scores were not associated with a history of penetrating keratoplasty or their rating of the effect of keratoconus on their lives.

Woods et al. (2008) assessed whether tolerance to dioptric spherical defocus is related to measures of personality using NEO PI-R and the California Adult Q-sort, finding that two perfectionism scales were significantly correlated with blur tolerance. Two clusters, 'low self confidence' and 'disorganisation', were positively related to blur tolerance. The findings show that people who lack self-confidence may need stronger evidence of blur before they have visual symptoms, while disorganised people may have better tolerance to blur because it is simply another manifestation of their untidy personal environments. This finding was replicated by the same authors and they argue that psychologically high-functioning (adjusted) people do not tolerate blur well, whereas low-functioning people may tolerate blur to their detriment because they lack the psychological resources to positively change their environments (Woods et al., 2010).

Na et al. (2015) looked at correlates of women suffering with dry eye disease. Controlling for age, lifestyle and medical factors, they found patients were much more likely to have experienced severe psychological distress, depressive moods, anxiety problems and a history of psychological counselling though the study was unable to examine whether these were causes or consequences of the problems.

In a recent cross-sectional study, Ichinohe et al. (2016) examined the associations between symptoms of dry eye disease and personality traits in a clinical sample ( $n=56$ ) using a Japanese version of the Big Five Personality Inventory based on the NEO Personality Inventory (Costa and McCrae, 1985). They found that among the Big Five personality factors, only neuroticism showed a significant correlation to the Dry Eye-Related Quality-of-Life Score ( $r=-0.35$ ,  $p<0.01$ ) and Ocular Surface Disease Index ( $r=-0.28$ ,  $p<0.05$ ).

Conscientiousness has been found to be associated with various health outcomes. In a meta-analysis, Bogg and Roberts (2004) quantitatively synthesised 194 studies and found that conscientiousness-related traits were negatively related to all risky health-related behaviours and positively related to all beneficial health-related behaviours. Similar findings were reviewed in Friedman and Kern (2014) study.

Some studies demonstrated the negative associations between intelligence and a number of health outcomes, for example, between childhood cognitive function and Type 2 Diabetes (Olsson et al., 2008) and between childhood intelligence and mortality (Batty et al., 2009). However, intelligence has also been found to be positively associated with excessive alcohol intake (Kanazawa and Hellberg, 2010). Previous studies have also established the link between socioeconomic conditions and health (Marmot, 2007; Wilkinson and Pickett, 2006). There seem far fewer studies on the relationship between intelligence and demography on eye problems.

## Hypotheses

This study has two strengths compared with many previous studies in the area. First, it used a large prospective birth cohort. Second, it looked at two main aspects of individual difference (personality and intelligence) and their associations with the health outcome in question. Based on the previous findings, it is hypothesised that (H1) abnormal eye conditions before puberty diagnosed by medical professionals would be significantly associated with self-reported eye conditions in adulthood; (H2) emotional stability would be significantly associated with the eye disorders in adulthood; (H3) conscientiousness would be significantly associated with the outcome variable; (H4) early eye impairment, traits emotional stability and conscientiousness would be independent predictors of the occurrence of eye conditions in adulthood.

## Method

### Sample

The National Child Development Study 1958 is a large-scale longitudinal study of the 17,415 individuals who were born in Great Britain in a week of March 1958 (Ferri et al., 2003). The following analysis is based on data collected when the study participants were at birth and at ages 11, 16, 33, 50 and 54 years. At birth, available information includes parental social class, gestational age and birth weight. At age 11 years, children completed cognitive ability tests. At age 16 years, mothers provided information on whether cohort members ever had eye conditions by the age of 16 years. At age 33 years, cohort members provided information on educational qualifications obtained. At age 50 years, participants completed a questionnaire on personality traits. Participants also provided information on their current occupation and whether they were having eye conditions at age 54 years. The analytic sample comprises 5706 cohort members (50.3% females) with complete data. Analysis of response bias in the cohort data showed that the achieved adult samples did not differ from their target sample across a number of critical variables (social class, parental education and gender), despite a slight under-representation of the most disadvantaged groups (Plewis et al., 2004).

### Measures

Childhood measures: parental social class at birth was measured by the Registrar General's measure of social class (RGSC). RGSC is defined according to occupational status and the associated education, prestige or lifestyle (Marsh, 1986) and is assessed by the current or last held job. When the father was absent, the social class (RGSC) of the mother was used. RGSC was coded on a six-point scale from unskilled to professional occupations (Leete and Fox, 1977). At birth, mothers were interviewed and provided information on gestational age and birth weight. Childhood cognitive ability tests (Douglas, 1964) were accessed when cohort members were at age 11 years consisting of 40 verbal and 40 non-verbal items and were administered at school. At age 16 years, mothers were interviewed and provided information on whether cohort members ever suffered from abnormal eye conditions diagnosed by medical professionals. Adulthood measures: at age 33, participants were asked about their highest academic or vocational qualifications. Responses are coded to the six-point scale of National Vocational Qualifications levels (NVQ) which ranges from 'none' to 'university degree/higher'/equivalent NVQ 5 or 6. Personality traits were assessed by the 50 questions from the International Personality Item Pool (IPIP) (Goldberg, 1999). Responses (five-point, from 'Strongly Agree' to 'Strongly Disagree') are summed to provide scores on the 'Big Five' personality traits: Extraversion, Emotionality/Neuroticism, Conscientiousness, Agreeableness and Intellect/Openness. At age 54 years, participants provided information

on their current or last occupation levels coded according to the Registrar General's Classification of social class (RGSC), described above, using a six-point classification described above. At age 54 years, participants provided information on whether they were having eye conditions (other than wearing glasses or contacts such as age-related macular degeneration/visual disturbances/glaucoma/cataracts) since previous interview five years ago with Yes/No response. In addition, 7.4 per cent of the total cohort members who had eye conditions also answered a question on eight specific eye problems: that they had diabetes-associated eye disease (6.4%); glaucoma (9.8%); cataracts (13.3%); age-related macular degeneration (3.5%); visual disturbances (1.4%); permanent loss of vision due to trauma (1.6%); blindness or loss of vision (3.8%); and another eye problem (58.7%). The response of general (non-specific) eye conditions was used as the outcome variable.

### Statistical analyses

To investigate the set of psychological, biomedical and socio-demographic factors associated with the occurrence of self-reported eye conditions in adulthood, first, the characteristics of the study population were examined; second, correlation analysis was conducted and all the variables used in the study were examined; third, logistic regression analysis was conducted using STATA version 14, and the response of self-reported eye conditions in adulthood was the dependent variable.

## Results

### Descriptive analysis

Table 1 shows the characteristics of the study population according to the occurrence of eye conditions at 54 years. The rate of eye conditions appears to be slightly higher among managerial or professionals than other groups in parental social class but current professional occupation tended to report less such health outcome. There were also gender differences: females reported more than males on eye conditions. Analysis of variance (ANOVA) showed that the differences were statistically significant ( $F(1, 5705) = 11.47, p < 0.001$ ).

### Correlational analysis

The correlation matrix is shown in Table 2, which shows that eye impairment by the age of 16 years and emotional stability were significantly associated with eye conditions in adulthood in the expected direction. Parental social class, childhood intelligence, agreeableness and openness as well as sex were also significantly associated with the outcome variable. Thus, hypotheses 1 and 2 were supported and hypothesis 3 was refuted, that there was no significant association between conscientiousness and the outcome variable.

**Table 1.** Social and demographic characteristics of the study population and occurrence of eye conditions at age 54 years.

	<i>n</i>	%	Occurrence of eye conditions %
<i>Gender</i>			
Male	2894	49.7	6.3
Female	2812	50.3	8.7
<i>Parental social class at birth</i>			
Unskilled (V)	412	7.2	4.1
Partly skilled (IV)	666	11.7	7.1
Skilled manual (III)	2778	48.7	7.5
Skilled non-manual (III)	638	11.2	7.4
Managerial/tech (II)	887	15.5	9.1
Professional (I)	325	5.7	8.3
<i>Educational qualifications at age 33 years</i>			
No qualifications	402	7.0	5.0
CSE 2–5/equivalent NVQ 1	641	11.2	6.1
O Level/equivalent NVQ 2	2002	35.1	7.6
A level/equivalent NVQ 3	869	15.2	8.6
Higher qualification/equivalent NVQ 4	906	15.9	7.7
University degree/equivalent NVQ 5, 6	886	15.5	7.8
<i>Own current social class</i>			
Unskilled (V)	121	2.1	5.8
Partly skilled (IV)	667	11.7	5.8
Skilled manual (III)	1011	17.7	7.5
Skilled non-manual (III)	1139	20.0	8.5
Managerial/tech (II)	2377	41.7	8.0
Professional (I)	391	6.9	4.6

NVQ: National Vocational Qualification; CSE: certificate of secondary education.

### Regression analysis

Table 3 shows the results of logistic regression. The model shows that abnormal eye conditions before puberty and traits emotional stability and openness as well as sex were significant and independent predictors of adult eye conditions. Thus, hypothesis 4 was partially supported, that early eye impairment and trait emotional stability were independent predictors of the occurrence of eye conditions in adulthood, but conscientiousness was not a significant predictor of the outcome variable.

### Discussion

This study looked at a set of psychological, biomedical and socio-demographic factors associated with self-reported eye conditions in adulthood using a large birth cohort in the United Kingdom. The correlational results showed seven modest correlates of eye conditions in adulthood: emotionally less stable, being females, with higher scores on parental social class and intelligence and higher scores on agreeableness and openness with eye impairment before puberty were more likely to report eye problems at age 54 years.

The results of the regression highlighted five factors: eye impairment 38 years earlier, gender, social class, emotional stability and openness. The fact that eye conditions at age

16 years were predictive of those 38 years later indicates possible genetic factors as well as issues with treatment. It is known that many eye conditions are chronic, slowly deteriorating over time even with treatment.

The association with social class may be due to various possible factors. Compared with unskilled manuals, cohort members who came from non-manual professional family tended to report more eye conditions in adulthood. It could be that middle-class people are more health conscious, more likely to have eye and other health check-ups and consequently more aware of, and likely to report, their eye conditions. Equally it may be that middle-class jobs involving considerable reading and detailed visual processing tax the eyes more and lead to more eye strains and problems.

The significant effects for sex and neuroticism on the outcome variable may have different possible explanations. The sex differences in self-reported eye conditions might be, in part, explained by the positive associations between females and depression (Beck, 1979) and between neuroticism and symptoms of anxiety and depression (Cheng and Furnham, 2003; Furnham, 2008). The well-established relationship between neuroticism and physical illness has been explained in terms of two factors. First is that neurotics over-report illness and are more prone to hypochondriasis. That is, while neurotics may have similar acute and chronic conditions compared to non-neurotics, the former are significantly more

**Table 2.** Pearson product-moment correlations of variables in the study.

Variables	Mean (SD)	1	2	3	4	5	6	7	8	9	10	11	12
1. Sex	0.49 (0.50)	—											
2. Eye conditions at age 54 years	0.07 (0.26)	0.045*	—										
3. Abnormal eye conditions at age 16 years	0.16 (0.37)	0.010	<b>0.035*</b>	—									
4. Parental social class at birth	3.33 (1.24)	-0.029	<b>0.036**</b>	0.051**	—								
5. Childhood intelligence	103.9 (12.87)	0.069***	<b>0.039***</b>	0.090***	0.264***	—							
6. Educational qualifications	2.68 (1.45)	-0.094***	<b>0.024</b>	0.071***	0.328***	0.485***	—						
7. Current occupational levels	4.08 (1.23)	-0.004	<b>0.008</b>	0.052***	0.221***	0.344***	0.457***	—					
8. Extraversion	29.43 (6.61)	0.069***	<b>0.001</b>	-0.048**	0.035*	0.023	0.077***	0.136***	—				
9. Emotional stability	29.11 (7.04)	-0.144***	<b>-0.037**</b>	-0.006	0.029	0.079***	0.086***	0.070***	0.224***	—			
10. Agreeableness	36.80 (5.24)	0.396***	<b>0.043**</b>	0.011	0.040*	0.111***	0.070***	0.120***	0.360***	0.057***	—		
11. Conscientiousness	34.04 (5.19)	0.098***	<b>-0.006</b>	0.006	-0.002	0.023	0.052**	0.080***	0.146***	0.176***	0.269***	—	
12. Openness	32.57 (5.17)	-0.029	<b>0.038**</b>	0.020	0.137***	0.266***	0.316***	0.250***	0.401***	0.103***	0.329***	0.220***	—

SD: standard deviation.

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ . Variables were scored such that a higher score indicated being female, the presence of eye conditions at teen and in adulthood, a more professional occupation for parents or cohort members, higher scores on childhood intelligence, highest educational qualification, higher scores on traits extraversion, emotional stability, agreeableness, conscientiousness and openness. Associations between eye problems in adulthood and other variables are in bold.

**Table 3.** Odds ratios (95% CI) for eye conditions at age 54 years according to childhood intelligence, abnormal eye conditions at teen, personality traits and socio-demographic variables.

Measures	Odds ratio (95% CI)	p value
Sex	1.39 (1.10, 1.99)**	0.007
<i>Parental social class at birth (unskilled as reference group)</i>		
Partly skilled	1.77 (1.00, 3.13)	0.051
Skilled manual	1.75 (1.05, 2.92)	0.965
Skilled non-manual	1.66 (1.24, 3.72)*	0.031
Managerial/tech	2.15 (1.24, 3.72)	0.086
Professional	1.91 (1.00, 3.64)*	0.048
Childhood intelligence	1.11 (0.63, 1.94)	0.268
Eye conditions at teen	1.35 (1.01, 1.80)**	0.006
<i>Educational qualifications (no qualification as reference group)</i>		
CSE 2–5/equivalent NVQ 1	1.11 (0.63, 1.94)	0.303
O Level/equivalent NVQ 2	1.30 (0.79, 2.15)	0.143
A level/equivalent NVQ 3	1.50 (0.87, 2.58)	0.333
Higher qualification/equivalent NVQ 4	1.31 (0.76, 2.28)	0.386
University degree/equivalent NVQ 5, 6	1.29 (0.72, 2.32)	0.697
<i>Current social class (unskilled as reference group)</i>		
Partly skilled	0.85 (0.86, 2.84)	
Skilled manual	1.30 (0.58, 2.94)	0.522
Skilled non-manual	1.09 (0.49, 2.44)	0.837
Managerial/tech	1.02 (0.46, 2.27)	0.967
Professional	0.54 (0.21, 1.38)	0.199
Extraversion	0.95 (0.85, 1.07)	0.405
Emotional stability	0.90 (0.81, 0.99)*	0.038
Agreeableness	1.19 (0.96, 1.23)	0.177
Conscientiousness	0.95 (0.85, 1.05)	0.311
Openness	1.15 (1.02, 1.29)*	0.025

CI: confidence interval; NVQ: National Vocational Qualification; CSE: certificate of secondary education.

\* $p < 0.05$ ; \*\* $p < 0.01$ . Adjusted for gestational age and birth weight.

likely to report the condition than the latter. Second, the anxiety and depression which are at the heart of neuroticism lead to a set of social and self-medication behaviours that are less adaptive and exacerbates the illness. Certainly, these confirm many of the studies mentioned above which, though they used different personality tests and were concerned with different eye conditions, all showed that anxiety/depression/distress are associated with eye conditions (Cooke et al., 2003; Hibbeler, 1947; Na et al., 2015; Spahn et al., 2003; Warrian et al., 2009).

The hypothesised association between conscientiousness and eye conditions, however, was not confirmed, either from the correlation analysis or regression analysis, which is not in line with previous findings which demonstrated the association between conscientiousness and a number of health outcomes (Bogg and Roberts, 2004; Friedman and Kern, 2014). Furthermore, it is not clear why openness marked by curiosity and imagination should be related to eye problems though it does confirm the findings of Spahn et al. (2003) study.

### Limitations

This study is based on available variables in the data set rather than being based on the study designed for the

purpose; thus, variables included in the study do not have a wide scope in investigating correlates of the outcome variable. For example, the outcome variable is vague without specific medically defined terms, though it is not uncommon to use lay terms rather than professional ones in large population-based surveys. Furthermore, the outcome variable is self-report rather than examined by medical professionals. However, research in self-reported health has found to be linked to mortality (Heistaro et al., 2001; Kaplan and Camacho, 1983). Also, personality traits were measured only once. Only with repetitive measures accessed periodically can the mechanisms and processes of these associations be better understood. Therefore, future studies should be conducted to confirm or refute the findings in this study. Nevertheless, this study did highlight the importance of studying personality factors in eye disorders.

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