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Childhood onset of migraine, gender, parental social class, and trait neuroticism as predictors of the prevalence of migraine in adulthood

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ABSTRACT

This study investigated the effects of socio-demographic and psychological factors in childhood and adulthood on the prevalence of migraine in adulthood using data from The National Child Development Studies (NCDS), a birth cohort in the UK. The analytical sample comprises 5,799 participants with complete data. Logistic regression analysis showed that higher professional parental social class (OR=2.0: 1.05, 3.86), female sex (OR=2.24: 1.68-2.99, $p<.001$), migraine in childhood diagnosed by physicians (OR=1.76: 1.23-2.50, $p<.01$), and higher trait neuroticism (OR=0.83: 0.74-0.94, $p<.01$) were all significantly and independently associated with the prevalence of migraine in adulthood. Both socio-demographic and personality factors were significantly associated with the prevalence of migraine in adulthood.

Keywords: Migraine; Gender; Parental Social Class; Trait Neuroticism; Cross-sectional and Longitudinal

Introduction

Migraine is a primary headache disorder of neurovascular origin (de Tomasso et al., 2014), associated with autonomic symptoms such as cranial throbbing and unilateral pain. Further symptomology can include neurological aura symptoms, which are present in roughly one-third of patients (Goadsby et al., 2002). Migraines have been described as the most burdensome of the headache disorders (Stovner et al., 2007; Hamelsky et al., 2005) affecting roughly 18% of women and 6% of men (Lipton et al., 2007; Lipton et al., 2001). Migraine prevalence is highest between ages 25 – 55 years (Lipton & Bigal, 2005), and more than half of migraine sufferers reported functional impairment or severe impairment in activities or required bed rest; the proportion of respondents reporting severe disability was similar between females and males (Lipton et al., 2001).

In a number of studies, migraine has been found to be associated with lower household income in the USA (Stewart et al., 1992; Lipton et al., 2001; Stang, Stern, & Sidney, 1996). However, the inverse relationship between migraine and socioeconomic status has not been confirmed in studies outside the United States (Launer, Terwindt, Ferrari, 1999; O'Brien, Goeree, Streiner, 1994; Rasmussen, 1992; Waldie et al., 2002), in these studies no difference in migraine prevalence by socioeconomic status was found. Nevertheless, the links between social class and health outcomes have well been demonstrated in the literature (Wilkinson & Marmot, 2003; Wilkinson & Pickett, 2006).

Litghart and Boomsma (2012) examined monozygotic twins discordant in psychiatric disorder to assess the appropriateness of genetic causality (one trait causing the other) and pleiotropy (one gene causing multiple effects) in explaining migraine prevalence. Their investigation supported genetic causality, finding the risk of migraine was far greater in the twin with higher Neuroticism (Ligthart & Boomsma, 2012). Neurological correlates have been implicated in connecting the disorders, specifically the neurotransmitter serotonin,

which has been postulated to underlie the migraine-psychiatric disorder comorbidity (Syvälahti, 1994; Owens & Nemeroff, 1994; Staley et al., 1998; Lipton et al., 2001).

The presence of mental stressors is also recurrently cited within the literature as corollaries and aggravators for migraine attacks (Martin & Theunissen, 1993). Both patients and physicians assign large importance to stressful events as triggers for migraines, with 62% of patients retrospectively reporting psychosocial stress precipitating the attacks (Robbins, 1994; Schoonman et al., 2007).

Research has demonstrated that personality variables also play an important role in migraine prevalence (Hampson & Freidman, 2008). Neuroticism, in particular, has been strongly implicated with numerous health outcomes and longevity (Bogg & Roberts, 2004; Chapman et al., 2011; Goodwin & Friedman, 2006; Hagger-Johnson et al., 2012; Kern & Friedman, 2008). Earlier Eysenck (1985) noted that individuals high in Neuroticism and low in Conscientiousness were more prone to developing chronic psychosomatic illnesses.

Neuroticism has been found to be a correlate of migraines; studies using the MMPI find the 'neurotic triad', comprising of hypochondria, hysteria, and depression (Boz et al., 2004). Furthermore, research utilising the Eysenck Personality Questionnaire (EPQ; Eysenck, 1985) has repeatedly demonstrated that migraine patients have significantly higher Neuroticism scores than non-migraine controls (Brandt et al., 1990; Breslau & Andreski, 1995; Rasmussen, 1992).

Conscientiousness has been found to be positively associated with various health outcomes (Friedman & Kern, 2014) and longevity (Kern & Friedman, 2008). Bogg and Brent (2006) conducted a meta-analysis of conscientiousness-related traits and the leading behavioural contributors to mortality in the United States. Based on 194 studies that were quantitatively synthesized results showed that conscientiousness-related traits were

negatively related to all risky health-related behaviours and positively related to all beneficial health-related behaviours (Bogg & Brent, 2006).

However, the use of different personality conceptualisations and inventories making it difficult to generalise across studies (Manlick et al., 2012). The current study has used the primary comprehensive taxonomy of personality, the Big Five personality factors, to find personality correlates of migraines.

Intelligence has been found to link with various health outcomes (e.g. Batty et al., 2005; Chandola et al., 2006) and mortality (Batty et al., 2009).

In the current study, we are particularly interested in the links between individual differences (intelligence and personality) and migraine as these two components are, to some extent, inter-correlated (Furnham, 2008) but few studies have looked at them together. We also included all these other social and childhood biomedical variables as potential confounders (factors driving both adult personality and migraine risk) to determine whether and to what extent each of these factors would affect the outcome variable.

Hypotheses

This study has drawn data from a large, representative longitudinal sample, investigating childhood and adulthood factors that potentially would influence the instance of adult migraine prevalence. Parental social class at birth, sex, childhood instance of migraine, intelligence, education, occupation, and the Big Five personality traits were investigated in relation to adulthood migraine instance. Due to evidence that demonstrates the biological and aetiological determinants of illness, our first hypothesis was that childhood migraine would be significantly associated with migraine instance in adulthood (H1). Based on the link between socio-economic conditions and health outcomes it was hypothesised that parental social class would be significantly and negatively associated with the prevalence of migraine

in adulthood (H2). Based on the previous findings, it was hypothesised that childhood intelligence would be significantly and negatively associated with migraine in adulthood (H3). Furthermore, based on the literature that implicates the influence of personality traits on a number of health outcomes trait neuroticism was predicted to be significantly and positively associated with migraine (H4) and trait conscientiousness was predicted to be significantly and negatively associated with the outcome variable (H5).

Method

Sample

The National Child Development Study (the 1958 British birth cohort) is a large-scale longitudinal study of the 17,415 individuals who were born in Great Britain in a week in March 1958 (Ferri, Bynner, & Wadsworth, 2003). The following analysis is based on data collected at birth, at ages 7, 11, 33 and at 50 years. Information of migraine onset in childhood was provided at age 7 years (response = 94%). Children at age 11 years completed tests of cognitive ability (response = 87%). At the age 33 years respondents provided information on educational qualifications. At age 50 years, participants completed a questionnaire on personality traits (response = 69%), and provided information on the prevalence of migraine (response = 79%). Participants also provided information on their current occupational levels. The analytic sample comprises 5,799 cohort members (51% 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 sex), despite a slight under-representation of the most disadvantaged groups (Fogelman, 1976). Bias due to attrition of the sample during childhood has been shown to be minimal (Plewis, Calderwood, Hawkes, & Nathan, 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. Where the father was absent, the social class (RGSC) of the mother was used. RGSC was coded on a six-point scale: I professional; II managerial/tech; IIIN skilled non-manual; IIIM skilled manual; IV semi-skilled; and V unskilled occupations (Leete, 1977). At birth mothers were interviewed and provided information on gestational age and birth weight, and mothers were interviewed again when participants were at age 7 on whether cohort members ever had migraine diagnosed by physicians by the time of interview. Childhood cognitive ability tests (Douglas, 1964) were accessed when cohort members were at age 11, consisting of 40 verbal and 40 non-verbal items, and were administered at school. Scores from these two set of tests correlate strongly with scores on an IQ-type test used for secondary school selection (r=0.93, Douglas, 1964) suggesting a high degree of validity.

Adulthood measures: At age 33 years, 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. Data on current or last occupation held by cohort members at age 50 years were coded according to the Registrar General's Classification of Occupations (RGSC), described above (parental social class), using a 6-point classification mentioned above. Personality traits were assessed by the 50 questions from the International Personality Item Pool (IPIP) (Goldberg, 1999). Responses (5-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. Z-scores were used for the regression analysis. Alphas for the Big-Five

factors ranged from .73 to .88. Migraine at age 50 years was assessed by a question "Are you currently suffering from Migraine?" with Yes/No response.

Statistical Analysis

First, the characteristics of the study population were examined. Second, correlational analysis on the measures in the study were conducted to examine bivariate associations. Third, logistic regression analysis was conducted using STATA version 12 with migraine at age 50 as the dependent variable, adjusting for all predictors simultaneously to determine their unique risk. Further, gestational age and birth weight were controlled in the model as findings show the link between these conditions and health outcomes (Boyle et al., 2012; Vohr et al., 2000).

Results

Descriptive Analysis

Table 1 shows the characteristics of the study population according to the rate of migraine at 50 years. Results showed the percentage of the prevalence of migraine in adulthood was 8.1 for the total sample. There were sex differences in the prevalence of migraine in adulthood, women had greater rate of migraine than for men (11.4% vs 4.6%). ANOVA showed that the sex differences in the prevalence of migraine in adulthood were statistically significant ($F(1,5797) = 90.93$, $p < .001$). There were no significant differences between males and females for the occurrence of migraine in childhood.

Table 1 shows there were no clear pattern on the prevalence of migraine among the different educational levels. It appeared that for both parental and own occupational levels, the highest level, the professional showed a greater percentage of the prevalence of migraine, though for own occupation, the lowest level, the unskilled showed the greatest percentage of the prevalence of migraine in adulthood.

Inset Table 1 about here

Table 2 shows that among social demographic, biomedical, and psychological factors in childhood and adulthood migraine in childhood, the highest parental social class level, sex, and trait emotional stability were significant predictors of the prevalence of migraine in adulthood. Women showed a greater prevalence of migraine in adulthood then men. Cohort members who were from professional family background were more likely to suffer from migraine in adulthood. Cohort members who scored lower on neuroticism were less likely to report migraine in adulthood. Thus H1 and H4 were supported, H3 and H5 were not supported, and H2 was refuted.

Inset Table 2 about here

Discussion

This study demonstrates a number of findings part replicative and part new. First, sex was a predictor of migraine aged 50 years. Nearly all studies in this area confirm this finding and many hypotheses have been proposed to explain these differences including fluctuations in sex hormone and receptor binding, genetic factors, differences in exposure to environmental stressors, as well as differences in response to stress and pain perception. It is possible that each and all of these nature/nurture factors plays a part.

Second, migraine in childhood diagnosed by physicians was a predictor of migraine at aged 50 years. The stability of this symptom over time could be interpreted as evidence of a biologically caused illness that is evidenced early in life. It may also be in part, due to the genetically based susceptibility to pain.

Third, trait neuroticism was a predictor of adult migraine, after taking account the effects of socio-demographic, biomedical, and intelligence factors on adult migraine. As neuroticism is significantly associated with symptoms of anxiety and depression (Cheng & Furnham, 2003; Furnham, 2008), treatment for migraine might be more effective when interventions such as cognitive behavioural therapy (CBT) (Beck, 1979), one of the most effective interventions for depression, are used together with medical treatment (Chan, Cardoso, & Chronister, 2009).

The World Health Organisations International Classification of Diseases (ICD-10) uses Neuroticism as a central organising principle considering the stress-related, somatoform and dissociative disorders, the nature, diagnosis and treatment of Neuroticism continues to be discussed (Barlow, Sauer-Zaval, Carl, Bullis & Ellard, 2014). It has long been recognised a psychological trait of profound public health significance. Neuroticism is a robust correlate and predictor of many different mental and physical disorders (Lahey, 2009). It has been shown that Neuroticism is the most powerful Big-Five personality predictor of mental well-being (Furnham & Cheng, 1999), physical health (Sutin, Terracciano, Deiana, Naitza, Ferrucci, Uda, Schlessinger, & Costa, 2010), and work success (de Fruyt et al., 2009). People with high scores on Neuroticism scales are prone to anxiety, depression and hypochondriasis which affects all aspects of their educational, social and work lives.

Fourth, parental professional status predicted migraine at age 50 years, cohort members who came from more professional family tended to report more migraine in adulthood compared to cohort members who came from families of unskilled parents. This is an unexpected finding, as most studies have shown a negative association between higher social class and various health problems (Wilkinson & Marmot, 2003; Wilkinson & Pickett, 2006). It could be argued, that the pressing life demands of today's professional families might function as an environmental risk factor for children, particularly if the children are

under stress from high achievement expectations of high achieving parents. Unalp, Dirik, and Kurul (2007) found a positive association between the high education level of parents and migraine and tension-type headache in their adolescent offspring. Moreover, the relationship between socioeconomic status and migraine might be more complex. There is evidence that socioeconomic status has a differential effect on individuals with and without migraine family history (Bigal et al., 2007). Future studies are required to clarify the role of socioeconomic status and identify possible moderating factors.

Interesting a number of possible correlates were not significant: Thus there was no relationship between intelligence, education level, conscientiousness and migraine which dispel some myths about "brainy people getting headaches" (Furnham, 2008). Similarly the regression indicated that only one personality variables in the Big Five was associated with migraines so contradicting some earlier findings

Strengths and Limitations

The current study has two strengths. First, it used a large, nationally representative longitudinal birth cohort; second, it is among the first that examined socio-economic (parental social class, education, occupation), biomedical (migrant onset in childhood diagnosed by physicians), and psychological (intelligence and personality) factors together to ascertain whether and to what extent each type of factors explain the unique variance of the outcome variable.

As with all research using cohort studies, this work is constrained by available variables in the dataset 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. Another limitation is the attrition of respondents over time. It may be that missing data at the individual level and at the variable level has affected the validity of the

results. Sample attrition is greatest amongst individuals in more deprived circumstances, our results may thus be a conservative estimate of the long term influence of childhood experience. Further, the outcome variable was self-reported measure rather than diagnosed by physicians, though research in self-reported heath has found to be linked to mortality (Heistaro et al., 2001; Kaplan & Camacho, 1983). Moreover, personality traits were only measured once, at age 50 years, therefore the findings in part, are cross-sectional and longitudinal data of personality traits are required to confirm the findings. Besides, it is not clear whether high Neuroticism is due to over-reporting migraine as high Neuroticism is putatively a marker of somatization or it is caused by true neurobiological underpinnings of the measure. Genetic and neurobiological data are required to ascertain these questions.

Future research would benefit by having more details about the acute and chronic nature of a person's migraines, as well as how they personally "cope" when experiencing one. It may be that these factors are differentially and sensitively related to the variables assessed in this study. The role trait Neuroticism plays in migraines suggests, as many clinicians know, that migraine suffers may benefit from various talking therapies aimed at helping people with high neuroticism cope with their anxiety and depression.

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Table 1. Social and demographic characteristics of the study population in childhood and adulthood and the prevalence of migraine at age 50.

Measures	**n**	**%**	**Prevalence of migraine %**
Sex			
Male	2869	49.4	4.6
Female	2930	50.6	11.4
Parental social class at birth			
Unskilled (V)	419	7.2	6.4
Partly skilled (IV)	665	11.5	7.5
Skilled manual (III)	2825	48.7	8.4
Skilled non-manual (III)	653	11.3	6.3
Managerial/tech (II)	917	15.8	8.6
Professional (I)	320	5.5	10.3
Educational qualifications at age 33			
No qualifications	404	7.0	7.2
CSE 2-5/equivalent NVQ1	651	11.2	7.7
O Level/equivalent NVQ2	2002	34.5	9.0
A level/equivalent NVQ 3	901	15.5	6.9
Higher qualification/equivalent NVQ4	956	16.5	8.4
University Degree/equivalent NVQ 5, 6	885	15.3	7.3
Own current social class at age 50			
Unskilled (V)	115	2.0	11.3
Partly skilled (IV)	614	10.6	9.8
Skilled manual (III)	1014	17.5	5.7
Skilled non-manual (III)	1205	20.8	10.7
Managerial/tech (II)	2476	42.7	7.6
Professional (I)	375	6.5	5.3

Table 2. Odds ratios (95% CI) for migraine at age 50, according to parental social class, migraine in childhood, sex, childhood intelligence, educational qualifications, occupation, and personality traits.

Measures	**Odds ratio (95% CI)**	***p*-value**
Sex	2.24 (1.68, 2.99)***	<0.001
Parental social class at birth (*unskilled as reference group*)		
Partly skilled	1.35 (0.71, 1.94)	0.296
Skilled manual	1.26 (0.77, 2.08)	0.358
Skilled non-manual	0.92 (0.50, 1.69)	0.784
Managerial/tech	1.57 (0.90, 2.72)	0.109
Professional	2.01 (1.05, 3.86)*	0.035
Migraine in childhood	1.76 (1.23, 2.50)**	0.002
Childhood intelligence	1.01 (0.87, 1.17)	0.913
Educational qualifications (*no qualification as reference group*)		
CSE 2-5/equivalent NVQ1	0.93 (0.52, 1.65)	0.797
O Level/equivalent NVQ2	1.10 (0.66, 1.83)	0.711
A level/equivalent NVQ 3	0.97 (0.54, 1.72)	0.907
Higher qualification/equivalent NVQ4	1.32 (0.75, 2.32)	0.330
University Degree/equivalent NVQ 5, 6	0.86 (0.45, 1.62)	0.640
Own social class (*unskilled as reference group*)		
Partly skilled	0.73 (0.34, 1.55)	0.415
Skilled manual	0.65 (0.31, 1.39)	0.267
Skilled non-manual	0.81 (0.39, 1.65)	0.558
Managerial/tech	0.59 (0.29, 1.20)	0.144
Professional	0.47 (0.19, 1.17)	0.104
Extraversion	0.90 (0.79, 1.02)	0.093
Neuroticism	1.17 (1.26, 1.06)**	0.003
Agreeableness	1.10 (0.95, 1.28)	0.202
Conscientiousness	0.94 (0.83, 1.06)	0.292
Openness	1.14 (0.99, 1.31)	0.069

Note: *p<.05; **p<.01;***p<.001. Adjusted for gestational age and birth weight.

Appendix 1. 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.	Migraine at age 50	.08 (.27)	_											
2.	Sex	.51 (.50)	**.124****	_										
3.	Parental social class	3.34 (1.24)	**.109****	-.018	_									
4.	Childhood migraine	.08 (.27)	**.040***	-.005	-.038*	_								
5.	Childhood intelligence	104.1 (12.8)	**.018**	.076**	.256**	-.018	_							
6.	Educational qualifications	2.69 (1.45)	**-.006**	-.082**	.325**	-.037*	.485**	_						
7.	Own occupational levels	4.11 (1.20)	**-.022**	-.013	.209**	-.009	.323**	.454**	_					
8.	Extraversion	29.47 (6.60)	**-.014**	.080**	.033*	.022	.018	.071**	.123**	_				
9.	Neuroticism	28.94 (7.06)	**.069****	.134**	-.028	.010	-.088**	-.084**	-.075**	-.209**	_			
10.	Agreeableness	36.85 (5.28)	**.062****	.404**	.042*	-.016	.119**	.083**	.107**	.361**	.055**	_		
11.	Conscientiousness	34.00 (5.27)	**.001**	.104**	.015	.001	.039*	.066**	.087**	.144**	.182**	.277**	_	
12.	Openness	32.53 (5.17)	**.017**	-.013	.141**	.014	.278**	.325**	.246**	.395**	.094**	.338**	.225**	_

Note: **p*<.05; ***p*<.01. Variables were scored such that a higher score indicated being female, the occurrence of migraine in childhood or adulthood, a more professional occupation for parents or cohort members, higher scores on childhood intelligence, highest educational qualification, higher scores on traits extraversion, neuroticism, agreeableness, conscientiousness, and openness. Associations between migraine in adulthood and other variables are in bold.