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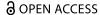
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ABSTRACT

This study explored a set of psychological and socio-demographic factors in childhood and adulthood associated with migraines assessed at age 42 years. Data were drawn from a large, nationally representative, prospective longitudinal study: the 1970 British Cohort Study (BCS70). In total, 5628 cohort members with data on parental social class at birth, cognitive ability (intelligence), self-esteem and locus of control at age 10 years, psychological distress and educational qualifications at age 34, and current occupation at age 42 years were examined. We assessed whether or not they regularly experienced migraines at age 42 years. Logistic regression analysis showed that childhood migraine, gender and adult psychological distress, as well as childhood locus of control (for females only), were significant and independent predictors of the prevalence of migraine in adulthood. Childhood migraine seemed to have a long-lasting effect on adult migraine, and psychological distress also appeared to detrimentally affect adult migraine over time.

Introduction

Migraines are severe, recurring and painful headaches. They can be defined as a primary headache disorder of neurovascular origin associated with autonomic symptoms. Migraines have been described as the most burdensome of the headache disorders (Stovner et al., 2018) There are considerable socio-economic costs of migraines (Cerbo et al., 2001). The cost to any economy of migraine is high (Seddik et al., 2020).

In a recent systematic review and meta-analysis of 302 community-based studies (6,216,995 participants), Woldeamanuel and Cowan (2016) reported that the global migraine prevalence was 11.6% (13.8% among females, 6.9% among males). The prevalence of migraine is twice common in females. Higher prevalence was found among school/college students and urban residents. In the US, the rate is even higher, with a prevalence of 15.3% of an overall self-reported migraine and severe headache in the US adult population (9.7% of males and 20.7% of females; Stovner et al., 2018).

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However, the exact causes of migraines are unknown. Possible triggers include hormonal changes (e.g., menstruation), psychological triggers (stress, anxiety, depression, etc.), physical triggers (e.g., fatigue, sleeping disorder), dietary and environmental triggers such as changes in the climate (Burstein et al., 2015). There are a number of studies going back over 25 years concerning personality and individual difference correlates of migraine (Baskin, 1995; Breslau & Andreski, 1995; Cao et al., 2002; Mongini et al., 2003; Silberstein et al., 1995; Smitherman & Ward, 2011) which have been reviewed by Davis et al. (2013). This study will examine psychological and demographic indicators of migraines in adults, as well as whether mother's report on childhood migraines at aged 10 years is related to adult reports 32 years later.

Locus of control

Locus of control refers to the extent to which people feel a sense of agency with respect to all aspects of their life: do they feel able to control what happens to them or not? The literature on locus of control beliefs with respect to health, education and relationships shows that fatalistic beliefs (external beliefs) are in many ways maladaptive, while instrumental beliefs (internal beliefs) are adaptive, though there are various caveats concerning very high-level internal beliefs. Locus of control beliefs is found to be associated with mental and physical health, education and relationships (Cheng et al., 2016).

In a study using the same data as this, Gale et al. (2008) found that the internal locus of control measured at age 10 was significantly associated with reduced risk of obesity and reduced risk of high blood pressure at age 30 years. In the current study, we examined the associations between childhood locus of control and adult reported migraines at age 42 years, in effect 32 years later.

Self-esteem

Self-esteem is usually defined as the way we perceive and value ourselves from multiple points of view. Self-esteem has been acknowledged as one of the key variables that influence depression (Beck, 1979) and well-being (Argyle, 2001; Cheng & Furnham, 2003). Previous studies have shown the associations between socio-economic conditions and low self-esteem and greater prevalence of depression and low sense of self-worth. People from lower social classes tend to have lower self-esteem and a greater incidence of depression. There is also evidence that self-esteem is directly related to childhood migraines (Esposito et al., 2013). The present study explored the association between childhood self-esteem/sense of self-worth measured at 10 years and reported migraine in adulthood, 32 years later.

Psychological distress

We measure this using the concept and measurement of *malaise*, which includes two related themes: a physical condition of general bodily weakness or discomfort, often marking the onset of an illness, and a vague feeling of discomfort or unease which is related to psychological distress and depression. It has both state and trait features and may be considered

a measure of minor psychiatric morbidity and trait Neuroticism. Data suggests that, like Neuroticism, it is stable over time in adulthood (Furnham & Cheng, 2015).

Psychological distress has been found to be related to health outcomes in a number of studies. For examine, Paine et al. (2019) found that psychological distress was related to poor health behaviours in a clinical sample, while in a population sample, McLachlan and Gale (2018) found that distress significantly increased risk of incident arthritis, cardiovascular disease and chronic obstructive pulmonary disease in a dose–response pattern after controlling for a set of socio-demographic indicators. In the current study, we investigated the association between psychological distress at age 34 years and migraine measured 8 years later.

Childhood intelligence

Childhood intelligence has been linked to better health and lower rate of mortality (Leon et al., 2009). Childhood intelligence has also been found to be related to type 2 diabetes (Olsson et al., 2008) and obesity (Chandola et al., 2006) in adulthood: less intelligent children are more likely to be both diabetic and obese. In this study, we explored the relationship between childhood intelligence assessed at age 10 years and migraine at age 42 years.

Social demographic indicators

The link between socio-demographic indicators and health has been well documented (Wilkinson & Marmot, 2003). Buse et al. (2012, 2020) have reviewed sociodemographic factors associated with migraine. They found that females more than males, and lower rather than high socio-economic groups, experienced more migraine and that it appeared to peak when people were in their forties. In a number of studies, migraine has been found to be associated with lower household income in the USA (Lipton et al., 2001). However, no significant association between migraine and socioeconomic status has been confirmed in studies outside the United States. This study explored the relationship between parental social class, education and occupation both measured at aged 34, and the outcome variable, measured at age 42 years.

This study

Our main aim was to examine to what extent a set of psychological factors (locus of control, self-esteem, psychological distress, etc.) are associated with a health outcome, the prevalence of migraine in adulthood, taking account of a set of socio-demographic factors (parental social class, gender, education, occupation, etc.).

Based on the literature reviewed above, five hypotheses were tested: (H1) Parental social class would be negatively associated with migraine in adulthood; (H2) Childhood migraine (assessed age 10 yrs) would be positively associated with migraine in adulthood (assessed age 42 yrs); (H3) Childhood internal locus of control (assessed age 10 yrs) would be negatively associated with migraine in adulthood; (H4) Childhood self-esteem (assessed age 10 yrs) would be negatively associated with migraine in adulthood; (H5)

Psychological distress (assessed age 34 yrs) would be positively associated with the outcome variable.

Method

Sample

The study participants were recruited as part of a perinatal mortality survey (BCS70) of individuals who were born in Great Britain in a week in April 1970 (Elliott, C., Murray, D. & Pearson, L, 1978). At age 42 years, 12,198 were successfully traced and eligible, of which 9,841 cohort members were interviewed and 9,812 participants provided information on whether they suffered from migraine in the past 12 months (survey response rate = 80.4.%).

The following analysis is based on data collected at birth, at age 10, age 34 and age 42 years. The analytic sample comprises 5,628 cohort members (53.5% males) where we had full and complete data sets. Analysis 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). Bias due to attrition of the sample during childhood has been shown to be minimal (Butler et al., 1997).

Measures

(1) *Parental Social Class* at birth was measured by the Registrar General's Measure of Social Class (RGSC). RGSC is defined according to occupational status (Marsh, 1986). Where the father was absent, the social class (RGSC) of the mother's father was used. RGSC was coded on a 6-point scale: I professional; II managerial/ technical; IIIN skilled non-manual; IIIM skilled manual; IV semi-skilled and V unskilled occupations (Leete & Fox, 1977).

(2) *Childhood migraine*. Mothers were interviewed when cohort members were at age 10 and provided information on whether cohort members had ever had migraine diagnosed by physicians by the time of the interview.

(3) *Childhood Intelligence* was assessed at age 10 in school using a modified version of the British Ability Scales (BAS) which can serve as a measure for childhood IQ (Elliott, C., Murray, D. & Pearson, L, 1978). The assessment involved the administration of four subscales: word definitions and word similarities which were used to measure verbal ability, and recall of digits and matrices which were used to measure non-verbal ability.

(4) *Locus of Control* was measured at age 10. Cohort members completed a 16-item Locus of Control Scale (Yes/No; Gammage, 1975). High scores indicate internal locus of control. In the current study, the alpha was .66.

(5) *Self-esteem* was measured at age 10. Cohort members completed a 12-item Self-Esteem Scale (Yes/No) (Lawrence, 1978). High scores indicate high self-esteem. In the current study, the alpha was .73

(6) *Psychological Distress* used the Malaise Inventory which was assessed at age 34. It is a 9-item self-completion instrument, measuring depression, anxiety and

psychosomatic illness (Rutter et al., 1970) and it correlates significantly with previously diagnosed and currently treated depression. Recent research has demonstrated that it is fairly stable over time (Furnham & Cheng, 2015). In the current study, the alpha was .78.

(7) *Educational Qualifications* was assessed at age 34; participants were asked about their highest academic or vocational qualifications. Responses are coded to the 6-point scale of National Vocational Qualifications levels (NVQ) which ranges from 'none' to 'university degree/higher'/equivalent NVQ 5 or 6.

(8) *Occupation* was measured at age 42. Current or last occupation held by cohort members was coded according to the Registrar General's Classification of Occupations (RGSC), described above, using a 6-point classification mentioned above.

(9) *Migraine in Adulthood* was measured at age 42. Response was coded as 1 = Yes and 0 = No.

Results

Descriptive analysis

Table 1 shows the characteristics of the study participants according to the prevalence of migraine at 42 years. It shows that the prevalence of migraine in adulthood seemed to be greater among cohort members who were from lower parental social background (unskilled) compared to (managerial/technician/professional), and those who had less education. There were sex differences in the prevalence of migraine in adulthood. Females reported more on migraine in adulthood than men (16% vs 7.1%). For the total sample, the prevalence of migraine at age 42 was 11.5%. Chi-square test showed that the sex differences on migraine were statistically significant (χ^2 (1), N = 5627) = 111.72, $p < .001$).

There were no significant sex differences in childhood migraine (3.1% for boys and 3.5% for girls).

Correlational analysis

Table 2 shows the point biserial correlation matrices and the means and SDs of all variables examined in the study. Migraine in adulthood was significantly associated with gender, parental social class, childhood migraine, childhood locus of control and self-esteem and psychological distress ($p < .05$ to $p < .001$). Thus, hypotheses 1–5 were supported, though the correlations indicated low effect sizes.

Regression analysis

Table 3 shows the results of binary logistic regression analyses using migraine in adulthood as the criterion variable. For the total sample in Model 1, it shows that childhood migraine (OR = 3.50, CI: 2.34–5.26, p < .001), gender (OR = 2.55, CI: 2.02–3.22, p < .001) and adult psychological distress (OR = 1.62, CI: 1.23–2.11, p < .001) were significant and independent predictors of the prevalence of migraine in adulthood. For the male sample

Table 1. Social and demographic characteristics of the study participants and the prevalence of migraine at 42 years.

	n	%	Prevalence of migraine %
Sex			
Male	2870	53.5	7.1
Female	2758	46.5	16.1
Parental social class at birth			
Unskilled (V)	258	4.6	14.7
Partly skilled (IV)	780	13.9	11.7
Skilled manual (III)	2560	45.5	12.3
Skilled non-manual (III)	880	15.6	10.0
Managerial/ technician (II)	806	14.3	9.6
Professional (I)	344	6.1	11.0
Educational qualifications			
No qualifications	333	5.9	12.3
CSE 2–5/ equivalent NVQ1	830	14.7	10.7
O Level/ equivalent NVQ2	1890	33.6	11.7
A level/ equivalent NVQ 3	534	9.5	11.2
Higher qualification/ equivalent NVQ4	1642	29.2	11.8
University Degree/ equivalent NVQ 5, 6	399	7.1	10.5
Own current social class			
Unskilled (V)	106	1.9	9.4
Partly skilled (IV)	635	11.3	11.7
Skilled manual (III)	944	16.8	8.5
Skilled non-manual (III)	996	17.7	14.2
Managerial/ technician (II)	2580	45.8	11.7
Professional (I)	367	6.5	11.2

in Model 2, it shows the similar results, that childhood migraine and psychological distress measured 8 years earlier were significant and independent predictors of the outcome variable. For the female sample, apart from childhood migraine and psychological distress shown in Models 1 and 2, childhood locus of control was also a significant and independent predictor of the outcome variable (OR = 0.85, CI: 0.73–0.98, p < .05). Thus, hypotheses 2 and 5 were further supported, and hypothesis 6 was partially

Table 2. Correlations (point biserial) of adulthood migraine, gender, parental social class, childhood migraine, childhood intelligence, locus of control and self-esteem, adulthood psychological distress, education and occupation.

	Variables	Mean (SD)	1	2	3	4	5	6	7	8	9	10
1.	Migraine	.11 (.32)	—									
2.	Sex	.49 (.50)	**.14***	—								
3.	Parental social class	3.39 (1.20)	**-.03***	-.02	—							
4.	Childhood migraine	.03 (.18)	**-.10***	.01	-.01	—						
5.	Childhood intelligence	103.0 (13.9)	**-.01**	-.03*	.29***	-.01	—					
6.	Childhood locus of control	10.30 (3.04)	**-.05****	-.02	.20***	.01	-.44***	—				
7.	Childhood self-esteem	8.81 (2.62)	**-.06***	.11***	.13***	-.01	.21***	.45***	—			
8.	Psychological distress	1.51 (1.76)	**.11***	.14***	-.05***	.02	-.08***	-.12***	-.13***	—		
9.	Educational qualifications	2.62 (1.38)	**.01**	.04**	.31***	.01	.43***	.34***	.18***	-.08***	—	
10.	Current occupation	4.14 (1.22)	**.02**	.01	.22***	.01	.30***	.25***	.15***	-.05***	.45***	—

$***p < .001 \quad **p < .01 \quad *p < .05$

Note. Variables were scored such that a higher score indicated being female, a higher score on the prevalence of migraine, a more professional occupation for parents and cohort members, higher scores on childhood intelligence, locus of control and self-esteem, higher scores on psychological distress and a highest educational qualification. Correlations between the outcome variable and a set of other variables examined are in bold.

supported (parental social class and childhood self-esteem were not independent predictors of the outcome variable, and childhood locus of control was a significant and independent predictor only for female sample).

Discussion

This study confirms and extends the literature in the area (Buse et al., 2012, Buse et al., 2020; Gale et al., 2008; Steiner et al., 2013; Woldeamanuel & Cowan, 2016). The correlation matrix shows six significant correlates of migraine in adulthood: parental social class, gender, childhood migraine, childhood locus of control and self-esteem, and adult psychological distress. The regression models showed that three factors, childhood migraine, gender and psychological distress, were the independent predictors of migraine in adulthood. In addition, for females, childhood locus of control was also a significant and independent predictor of the outcome variable.

The current study, to the best of our knowledge, is the first that has explored the association between childhood locus of control and migraine in adulthood. Locus of control appears to be particularly important for females in the development of migraines in adulthood. It seems that the exercise of internal locus of control at age 10 years had protective effect on the prevalence of migraine 32 years later at age 42 years. However, the reason for the sex differences of the association between childhood locus of control and adulthood migraine is unclear. On the other hand, the association between migraine in childhood and migraine in adulthood seems to be stronger among men than among women. The regression models showed that for men, the negative effect of childhood migraine on the same health condition in adulthood was more than 5 times greater than those who did not have such health condition in childhood (for women, the odds ratio was less than 3 times greater for those who had migraine in childhood), suggesting that for men, migraine suffered in childhood may make them more susceptible to the recurrence of this health condition in adulthood than for women. On the other hand, it may be that females have an increased chance of developing migraines after the age of 10 years.

Schroeder et al. (2018) have reviewed the growing evidence which supports the roles of sex and gender in migraine risk, pathophysiology, presentation, diagnosis, treatment and management. It remains an area of great interest and debate which calls for sensitive longitudinal data to unpack causal patterns.

The significant association between childhood migraine and migraine in adulthood is understandable, due to evidence that demonstrates the biological and aetiological determinants of illness. It is less clear, though, why this association is stronger among men than among women.

Psychological distress seems to be a trait-like variable, which is relatively stable over time and related to minor psychiatric morbidity (Furnham & Cheng, 2015). In the current study, psychological distress was a significant and independent predictor for both men and women, indicating that individual who scored higher on this factor at age 34 tends to be more likely (twice more likely for men and 47% more likely for women) to

Table 3. Odds ratios (95% CI) for migraine at age 42 years, according to parental social class, childhood intelligence, locus of control and self-esteem, psychological distress, education and occupation in the total sample and by gender.

Measures	All		Males		Females	
	Unadjusted Odds Ratio (95% CI)	p-value	Unadjusted Odds Ratio (95% CI)	p-value	Unadjusted Odds Ratio (95% CI)	p-value
Sex	2.55 (2.02, 3.22)***	<.001				
Parental social class at birth (*unskilled as reference group*)						
Partly skilled	0.64 (0.37, 1.09)	0.101	0.33 (0.13, 1.01)	0.107	0.81 (0.43, 1.55)	0.538
Skilled manual	0.74 (0.46, 1.18)	0.215	0.67 (0.32, 1.37)	0.274	0.77 (0.42, 1.38)	0.387
Skilled non-manual	0.63 (0.38, 1.08)	0.102	0.58 (0.26, 1.31)	0.192	0.67 (0.35, 1.29)	0.231
Managerial/tech	0.52 (0.30, 0.90)	0.130	0.48 (0.20, 1.16)	0.113	0.52 (0.27, 1.01)	0.085
Professional	0.62 (0.33, 1.20)	0.159	0.57 (021, 1.63)	0.298	0.61 (0.27, 1.36)	0.223
Childhood migraine at age 10	3.50 (2.34, 5.26)***	<.001	5.49 (2.96, 9.22)***	<.001	2.69 (2.34, 5.26)***	<.001
Childhood intelligence at age 10	1.03 (0.91, 1.07)	0.561	0.85 (0.87, 1.03)	0.101	1.04 (0.99, 1.31)	0.060
Childhood locus of control at age 10	0.94 (0.83, 1.07)	0.374	1.01 (0.83, 1.07)	0.505	0.85 (0.73, 0.98)*	0.042
Childhood self-esteem at age 10	0.94 (0.83, 1.05)	0.252	0.86 (0.70, 1.06)	0.158	0.97 (0.85, 1.12)	0.672
Adult psychological distress at age 34	1.62 (1.23, 2.11)***	<.000	2.11 (1.21, 3.38)**	0.002	1.47 (1.07, 2.03)*	0.017
Educational qualifications at age 34 (*no qualification as reference group*)						
CSE 2–5/ equivalent NVQ1	0.85 (0.51, 1.41)	0.514	0.81 (0.37, 1.79)	0.611	0.77 (0.40, 1.47)	0.425
O Level/ equivalent NVQ2	0.85 (0.53, 1.36)	0.502	0.96 (0.47, 1.96)	0.907	0.75 (0.41, 1.38)	0.357
A level/ equivalent NVQ 3	0.67 (0.38, 1.18)	0.166	0.99 (0.42, 2.39)	0.983	0.54 (0.26, 1.13)	0.201
Higher qualification/ equivalent NVQ4	0.83 (0.13, 1.38)	0.487	0.81 (0.37, 1.77)	0.593	0.82 (0.43, 1.56)	0.546
University degree/ equivalent NVQ 5, 6	0.65 (0.34, 1.25)	0.196	0.52 (0.17, 1.59)	0.251	073 (0.34, 1.62)	0.455

(*Continued*)

Table 3. (Continued).

	All			Males			Females		
Measures	Unadjusted Odds Ratio (95% CI)		p-value	Unadjusted Odds Ratio (95% CI)		p-value	Unadjusted Odds Ratio (95% CI)		p-value
Current occupation at age 42 (unskilled as reference group)									
Partly skilled	1.24 (0.50, 3.13)		0.642	1.27 (0.26, 6.29)		0.772	1.07 (0.38, 2.99)		0.897
Skilled manual	1.44 (0.58, 3.60)		0.432	1.33 (0.29, 5.97)		0.709	1.17 (0.39, 3.52)		0.785
Skilled non-manual	1.71 (0.70, 4.21)		0.237	1.22 (0.24, 6.02)		0.806	1.59 (0.58, 4.32)		0.361
Managerial/tech	1.78 (0.73, 4.32)		0.136	1.80 (0.40, 8.11)		0.221	1.44 (0.53, 3.89)		0.476
Professional	1.90 (0.79, 5.58)		0.785	1.87 (0.55, 9.73)		0.507	1.33 (0.42, 4.19)		0.627

Note. *$p < .05$; **$p < .01$***$p < .001$. †Adjusted for gestational age and birthweight in all three models.

suffer from migraine 8 years later. It is not clear whether those with higher distress scores are likely to experience migraines or whether those who have migraines are likely to have more psychological distress, or indeed there is bi-directional causality. Amiri et al., (2018), however, reviewed the evidence showing that migraines clearly lead to depression which is hardly unsurprising. Interventions and treatment, such as cognitive behavioural therapy, may help to reduce the symptoms of psychological distress, whence the prevalence of migraine in subsequent years might be reduced. This also indicates that the outcome of treatment of migraine might be improved if psychological distress is taken into account.

Childhood self-esteem was significantly associated with migraine in adulthood, but it was not an independent predictor of the outcome variable. There was a considerable overlapping between self-esteem and locus of control ($r = .45$, $p < .001$) indicating the covariance between these two constructs.

Gender was a significant and independent predictor of migraine in adulthood. This is in line with previous findings showing that women tend to score higher than men on this health condition (Stovner et al., 2018; Woldeamanuel & Cowan, 2016). However, the reason for this finding is not clear. One of the explanations could be the hormonal fluctuations among women around menstruation. Another explanation is that women tend to score higher on depression (Beck, 1979; Cheng & Furnham, 2003), and psychological distress contains features such as depression and anxiety; thus, women tend to score higher on psychological distress as well (in the current study, the correlation between females and psychological distress was $r = .14$, $p < .001$).

Further, this study shows that among social factors, parental social class was the only factor that significantly ($p < .05$) associated with migraine in adulthood, which is in line with the previous finding of the link between health in general and socio-economic conditions (Marmot, 2007). Nevertheless, this association appears to be modest, and it ceased to be significant in the regression models. One of the explanations could be that this study is based on a normal population sample and the symptoms of migraine may be less severe compared with clinical samples.

Limitations

Like all studies using cohort datasets, the present study is based on available variables in the dataset rather than being based on the study designed for the purpose, which invariably has its restricted scope. Another limitation is the attrition of respondents over time. Sample attrition is greatest among individuals in more deprived circumstances, and our results may thus be a conservative estimate of the long-term effects of early experience. Also, two psychological measures, locus of control and self-esteem, were less used measures in the area, which made the results less comparable, though the psychometric properties of these two measures are reasonably sound in the present study. Furthermore, both measures used a Yes/No response format which is less sensitive than a linear scale. It would have been desirable to know the frequency and severity of the migraine as well as the disability caused by the migraine.

Disclosure statement

Funding

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