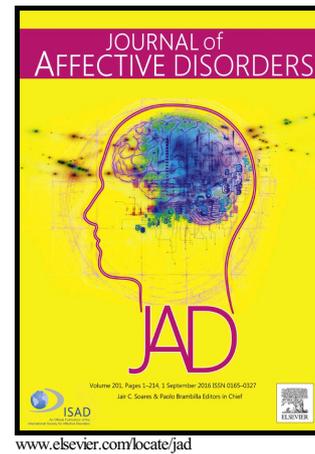


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Childhood Disadvantage, Education, and Psychological distress in Adulthood: A Three-Wave Population-based Study.

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What is already known on this subject?

- Indicators of childhood disadvantage are independently associated with low education.
- Childhood disadvantage is independently associated with a wide range of physical health outcomes.

What this study adds?

- An increase in number of childhood disadvantages was negatively associated with education.
- An increase in number of childhood disadvantages was associated with psychological distress in adulthood.
- Childhood disadvantage influences psychological distress in adulthood partly via education level.

Abstract

Background: We assessed the mediating role of education in the association between childhood disadvantage and psychological distress in adulthood using longitudinal data collected in three waves, from 1994 to 2008, in the framework of the Tromsø Study (N=4,530), a cohort that is representative of men and women from Tromsø. **Methods:** Data was analysed in 2017. Education was measured at a mean age of 54.7 years, and psychological distress in adulthood was measured at a mean age of 61.7 years. Ordinary least square regression analysis was used to assess the associations between childhood disadvantage, education, and psychological distress in adulthood. The indirect effects and the proportion (%) of indirect effects of childhood disadvantage (via education) on psychological distress in adulthood were assessed by mediation analysis. **Results:** Childhood disadvantage was associated with lower education and higher psychological distress in adulthood ($p < 0.05$). Lower education was associated with a higher psychological distress in adulthood ($p < 0.05$). A minor proportion (7.51%, $p < 0.05$) of the association between childhood disadvantage and psychological distress in adulthood was mediated by education.

Limitations: Childhood disadvantages were measured retrospectively.

Conclusion: The association between childhood disadvantages and psychological distress in adulthood is primarily independent of education.

Key words: childhood adversity; socioeconomic status; socioeconomic position; longitudinal; psychological well-being; emotional distress; social epidemiology; anxiety; depression

Introduction

Previous evidence suggests that cumulative exposure to stress over time, initiated by childhood disadvantages, has a positive effect on lifelong psychological distress via a variety of social and biological mechanisms (Sheikh, 2017b, c, 2018; Sheikh et al., 2016a). A key question in social and psychiatric epidemiology is whether education has a mediating role, i.e., whether childhood disadvantage affects education level, which in turn has an effect on psychological distress in adulthood (conceptualised as the indirect effect); or whether childhood disadvantage has an independent effect on psychological distress in adulthood, i.e., is not mediated by education level (conceptualised as the direct effect) (Muntaner et al., 2004; Sheikh et al., 2014, 2017). This question is of theoretical importance if we are to determine whether education level (reflecting socioeconomic status, economic self-sufficiency, economic outlook, and human capital accumulation) plays an etiologic role in higher psychological distress over the life course (Sheikh et al., 2014, 2017). Different approaches or theories for understanding the association between childhood disadvantage and psychological distress in adulthood have been debated (Pearlin, 1989; Ross and Mirowsky, 1999; Sheikh, 2017a, b, 2018). The ‘human capital accumulation’ explanation puts the emphasis on socioeconomic pathways (i.e., via cognitive ability, intellectual functioning, education level, self-regulation, and sense of mastery) (Currie and Almond, 2011; Duke and Macmillan, 2016; Havari and Mazzonna, 2015; Kuhlman et al., 2017; Nicolaisen et al., 2017; Opdebeeck et al., 2016; Sheikh et al., 2017).

Childhood disadvantage can affect cognitive functioning, cause neurological impairments, disrupt executive functioning (e.g., one’s ability to plan and problem solve), and cause alterations in attention (inattention) and consciousness (Stikkelbroek et al., 2016), which in turn are associated with intellectual and academic outcomes like education level (Clouston et al., 2015; D’Andrea et al., 2012; Yoshikawa et al., 2012). Indeed, cognitive

and intellectual impairments and delays in cognitive development have been proposed as consequences of childhood disadvantage (Brietzke et al., 2012; Johnson and Schoeni, 2011; Yoshikawa et al., 2012), which may confer increased vulnerability to higher psychological distress later in life (Cole et al., 2016; Opdebeeck et al., 2016; Saleh et al., 2017). Other evidence suggests that childhood disadvantage is associated with emotional reactivity, lower social competence, and lower emotional intelligence (Sheikh, 2017b, 2018; Stikkelbroek et al., 2016), which in turn are associated with poor academic performance, lower education level and psychological distress (Parker et al., 2005; Sheikh, 2017b, 2018). An alternative explanation for the association between childhood disadvantage and lower education is lack of motivation (Turner and Butler, 2003). Indeed, children exposed to socioeconomic and psychosocial disadvantages most likely do not have the ability to change or resolve their situation. This sense of impotence can lead to a generalised sense of helplessness, lower self-esteem, a weaker sense of personal control, lower mastery, pessimism, and a lack of motivation (Aglan et al., 2008; Heinonen et al., 2006; Hovens et al., 2016; Korkeila et al., 2004; Tetzner and Becker, 2015), all of which may contribute to a higher psychological distress over the life course (DeForge et al., 2008; Kuhlman et al., 2017; Zajacova et al., 2015). Other evidence has suggested that childhood disadvantage is associated with antisocial behaviour in childhood (McLeod and Shanahan, 1996; Meyer et al., 2000), which is associated with lower academic performance (McEvoy and Welker, 2000).

Childhood disadvantage may produce long-term dysregulation of stress response systems, thereby increasing reactivity to stressors encountered during adulthood (Sheikh, 2017a, b, 2018; Witek Janusek et al., 2013). Low educated individuals are more likely to face stressors such as unemployment, economic hardship, and occupations with lower income and prestige (Baum et al., 1999; Mirowsky and Ross, 2005; Sheikh et al., 2017). Other evidence suggests that stressors such as financial crisis, or an unrewarding job environment may have a

greater influence on psychological distress among those who have experienced childhood disadvantage (Sheikh et al., 2017), due to their lowered tolerance for stressors (McLaughlin et al., 2010; Sheikh, 2017b, 2018). On the contrary, a higher education fosters psychological resources such as cognitive flexibility and general coping ability (Opdebeeck et al., 2016). Previous studies have consistently shown a negative association between education level and psychological distress (Chung and Joung, 2017; Jeong and Veenstra, 2017; Sheikh et al., 2014, 2017), whereas others have shown that unemployment, aversive work conditions, and high job demands are positively associated with psychological distress (Chung and Joung, 2017; Sheikh et al., 2017; Torres et al., 2016; Ylli et al., 2016). Other evidence suggests that cognitive (e.g., comprehension) and noncognitive skills (e.g., socioemotional regulation) account for a significant proportion of the effect of education on health (Duke and Macmillan, 2016; Opdebeeck et al., 2016).

Most previous studies on the association between education level and psychological distress based their conclusions on cross-sectional data (Fryers et al., 2003; Lorant et al., 2003; Sheikh et al., 2016b). A meta-analysis (Lorant et al., 2003) of 56 studies showed that lower socioeconomic status (SES) is associated with psychological distress. Although the majority (35 out of 59) of studies included in the meta analysis measured SES with education level, most of them were cross-sectional studies (Lorant et al., 2003). The possibility of mood congruency bias and differential measurement error cannot be ruled out in cross-sectional studies (Sheikh et al., 2016b). Other evidence suggests that total effects and direct effects are vastly overestimated (biased upwards) when mediation is assessed with cross-sectional data (i.e., exposure, mediator, and outcome measured at the same time) (Sheikh et al., 2016b). Four of the studies included in the aforementioned meta-analysis (Lorant et al., 2003) assessed the longitudinal association between education level and psychological distress, and their results were also not consistent (Bracke, 2000; Eaton et al., 2001; Kaplan et al., 1987;

Sargeant et al., 1990). Only one of those studies showed a clear protective effect of education on psychological distress (Kaplan et al., 1987). On the contrary, a systematic review (Fryers et al., 2003) showed a more consistent association between low education level and high psychological distress. However, those inferences were also based on cross-sectional studies (Fryers et al., 2003). The evidence on whether lower education is associated with psychological distress in later-life, independent of parental history of psychiatric disorders, socioeconomic conditions, and psychosocial environment in childhood remains inconclusive (Park et al., 2013).

Several studies have assessed the role of education as a mediator in the association between childhood disadvantage and psychological distress in adulthood (Comijs et al., 2007; Korhonen et al., 2017; Korkeila et al., 2005; Lee et al., 2017; Markkula et al., 2017; Ni et al., 2016; Nurius et al., 2015; Nurius et al., 2012; Openshaw et al., 2015). However, the results of these studies were not consistent, and most did not report indirect effect estimates and corresponding confidence intervals (CIs). Several previous studies have either looked at childhood SES (i.e., parental SES in childhood) (Baldassari et al., 2013; Korhonen et al., 2017; Lee et al., 2017; Sheikh et al., 2014), or psychosocial adversities (Ni et al., 2016; Nurius et al., 2015; Nurius et al., 2012; Openshaw et al., 2015; Oshio et al., 2013). Since indicators of childhood adversity are often correlated, co-occur and tend to cosegregate in such a way that being exposed to one type of childhood disadvantage increases the risk of exposure to another (Jacobs et al., 2012; Lee et al., 2010), an index of both socioeconomic and psychosocial childhood disadvantages on psychological distress in adulthood is more meaningful (Baldassari et al., 2013; Markkula et al., 2017; Sheikh, 2017c, 2018). Other studies (Openshaw et al., 2015) included very small, selective samples, which makes their findings impossible to generalise. Some previous studies have focused on only one childhood disadvantage (Fuller-Thomson et al., 2012; Kessler et al., 1997), but children exposed to one

type of disadvantage are likely to be exposed to other types of disadvantages in childhood (Sheikh, 2017a; Sheikh et al., 2016b). Since different disadvantages may be correlated (Sheikh, 2017a; Sheikh et al., 2016b), we aim to address the question of whether an increase in number of childhood disadvantages is associated with lower education and psychological distress in adulthood.

Using data from the Tromsø Study, the aim of the present study were: (1) are those who experience childhood disadvantages more likely to report lower education?; (2) are those with lower education more likely to report a higher psychological distress in early old age?; (3) are those who experience childhood disadvantages more likely to report a higher psychological distress in early old age?, and; (4) what proportion of this association is mediated via education?

Data and Methods

Study population

We used data from the Tromsø Study, a longitudinal prospective cohort study of men and women. The participants of this study are considered representative of the adult population residing in the municipality of Tromsø (Jacobsen et al., 2012). Six waves of the Tromsø Study were conducted between 1974 and 2007-2008 (referred to as Tromsø I-VI) (Jacobsen et al., 2012). The present analysis includes data collected from 1994 to 2008 (Sheikh, 2017b, c, 2018). In accordance with our three-wave design, to be eligible for the present analyses, participants had to have attended Tromsø IV (1994-1995), Tromsø V (2001-2002), and Tromsø VI (2007-2008) (N=4,530).

Ethical approval

This investigation was carried out in accordance with the latest version of the Declaration of Helsinki. The Tromsø Study has been approved by the Regional Committee for Medical and Health Research Ethics, the Data Inspectorate, and the Norwegian Directorate of Health.

Written informed consent was obtained from all individual participants included in the study.

Study variables

Exposure (childhood disadvantage)

Childhood disadvantage is defined as a conglomerate of factors that have been used in a similar manner in previous studies (Sheikh, 2017c, 2018). Six indicators of childhood disadvantage (low mother's education, low father's education, low childhood financial conditions, psychological abuse, physical abuse, and substance abuse distress) were measured retrospectively in Tromsø VI and used to create an index of childhood disadvantages. Scores ranged from 0 to 6, with participants receiving 1 point for each disadvantage that was present in their childhood. The independent association between each of these six disadvantages, education and psychological distress in adulthood among Tromsø Study participants has been described previously (Sheikh, 2017b; Sheikh et al., 2014, 2016a, b).

Self-reporting of parental education is expected to be fairly reliable (Krieger et al., 1998). Mother's and father's education were measured separately on a 5-point scale: 1) primary and secondary school or similar (i.e., 7-10 years of schooling); 2) vocational school or technical school; 3) high school diploma; 4) college or university (less than 4 years) and 5) college or university (4 years or more). Consistent with previous studies from Norway, a parental education level of primary and secondary school or similar was considered a childhood disadvantage (Sheikh, 2017c, 2018; Sheikh et al., 2014). Subjective childhood financial conditions was measured by the question, "How was your family's financial situation when you were a child?" Participants replied using a 4-point scale ranging from

‘very good’ (1) to ‘very difficult’ (4). Consistent with previous studies, those who answered *difficult* or *very difficult* were considered to have this childhood disadvantage (Sheikh, 2017c, 2018; Sheikh et al., 2014). The test-retest reliability of subjective childhood financial conditions was good ($Kappa_{\text{weighted}}$: 0.61, 95% CI: 0.59, 0.63) in this sample (Sheikh, 2017b, c, 2018). Self-reported information on adverse childhood experiences was measured by the question, “Have you over a long period experienced any of the following as a child?” followed by three types of adverse experiences: (i) being tormented, or threatened with violence; (ii) being beaten, kicked, or the victim of other types of violence; and (iii) someone in your close family using alcohol or drugs in such a way that caused you worry. Respondents who reported one or more of these alternatives were classified as exposed to psychological abuse, physical abuse, and substance abuse distress, respectively (Sheikh et al., 2016a), and each of these adverse childhood experiences was considered a childhood disadvantage (Sheikh, 2017c, 2018). The internal reliability of these adverse childhood experiences was good in the Tromsø Study (Sheikh, 2017a). An index was constructed as sum of the six childhood disadvantages (mean: 2.13, standard deviation [SD]: 1.11). Cronbach alpha of these six childhood disadvantages was 0.41 (mean inter-item correlation: 0.11).

Mediator (education)

Respondent’s education was measured in Tromsø IV (mean age: 54.7 years) using the same 5-level scale described above for parental education (mean: 3.87, SD: 1.35). The test-retest reliability of this variable was very good ($Kappa$: 0.91, 95% CI: 0.91, 0.92) in Tromsø Study (Sheikh, 2017c, 2018).

Outcome (psychological distress)

The Hopkins Symptom Checklist (HSCL-10) scale is widely used in epidemiological studies, and in the Tromsø V questionnaire (mean age: 61.7 years) it was used to measure psychological distress (i.e., depressive and anxious symptomatology). Participants rated each of the 10 items in the HSCL-10 on a four-point scale, ranging from 'not at all' (1) to 'extremely' (4). The HSCL-10 had an acceptable degree of internal consistency in this sample (Cronbach's alpha: 0.86, mean inter-item correlation: 0.42, McDonald's omega coefficient for composite reliability: 0.87) (Sheikh, 2017b, c, 2018). An HSCL-10 score between 10 and 40 was calculated by summing the 10 indicators, where 40 represented the highest and 10 represented the lowest score for psychological distress (mean: 12.71, SD: 3.29, 95% CI: 12.60, 12.83).

Confounding variables (Tromsø IV)

We included the confounding variables age, gender, history of psychiatric disorders in the mother/father, social support, smoking, and alcohol intake (Sheikh, 2017a, c, 2018). Previous evidence indicates that a substantial proportion of one's risk of psychological distress is genetically determined (Boomsma et al., 2005; Sheikh, 2017c). Other evidence suggests that parental psychopathology is a risk factor for psychological distress in offspring (Koukounari et al., 2016; Meyer et al., 2000), and confounds the association between childhood disadvantage and psychological distress (Briggs-Gowan et al., 2010). Several studies have shown that education is closely associated with socially patterned differences in factors such as social support, alcohol intake, and smoking (Jorm et al., 1999; Oshio et al., 2013). A lower social support, a higher alcohol intake and smoking is likely associated with childhood disadvantage and psychological distress in adulthood (Hammen et al., 2000; Jorm et al., 1999; Oshio et al., 2013; Sheikh, 2017b, c, 2018; Sheikh et al., 2016a). Consequently, some studies have shown that social support, alcohol intake and smoking mediate the association

between certain childhood disadvantages and psychological distress (Hammen et al., 2000; Oshio et al., 2013; Sheikh, 2017b, c, 2018; Sheikh et al., 2016a). If social support, smoking and alcohol intake are not included in the models that the observed indirect effects may be due to the association between education and these factors (Sheikh, 2017c; Sheikh et al., 2016a, 2017). These reports suggest that social support, alcohol intake, and smoking are important mediator-outcome confounders that must be included in the models in order to assess the ‘independent’ and unique indirect effect of childhood disadvantage on psychological distress via education level.

Valid information on age and gender was obtained from Statistics Norway by using the unique personal identification number of each participant. The test-retest reliability of mother’s psychiatric disorders was Kappa: 0.57 (95% CI: 0.52, 0.62) and that of father’s history of psychiatric disorders was Kappa: 0.61 (95% CI: 0.53, 0.69) (Sheikh, 2017b, c, 2018). Social support (Sheikh, 2018) was measured with two indicators: number of friends and perceived social support. Number of friends was measured as, “How many good friends do you have with whom you can talk confidentially and who give you help when you need it?” Perceived social support was measured as, “Do you feel that you have enough good friends?” (yes, no). Daily smoking (Sheikh, 2017c) was measured by the question: “Do you smoke cigarettes daily?” (yes=1, no=0). The test-retest reliability of daily smoking was good (Kappa: 0.67, 95% CI: 0.63, 0.71) in this sample (Sheikh, 2017c). Alcohol intake was measured as alcohol frequency (times/month).

Statistical analysis

Data was analysed in 2017. We used Stata version 15 to conduct all analyses. Missing values were generated with multiple imputation (with chained equations) and comparisons were then made between the complete-case (excluding missing) and the imputed dataset, presented as

proportions (%) and means (standard errors, SE) (Table 1). The imputed dataset was used for all statistical analyses, and both unadjusted (crude) and adjusted estimates are presented.

The associations between childhood disadvantage, education, and psychological distress in adulthood were assessed by ordinary least square (OLS) regression analysis. OLS estimates (β) and 95% CIs are presented. No statistically significant interaction was observed between childhood disadvantage and education.

Mediation analysis with the difference-in-coefficients method was used (Sheikh et al., 2016b, 2017). Total effects (adjusted for confounding variables), direct effects (adjusted for confounding variables and education), indirect effects, and proportion mediated (%) were estimated.

The indirect effect was calculated as (Sheikh et al., 2017):

$$\beta_{\text{Indirect effect}} = \beta_{\text{Total effect}} - \beta_{\text{Direct effect}}$$

Proportion mediated (%) was calculated as (Sheikh et al., 2016b):

$$\text{Proportion mediated (\%)} = \frac{\beta_{\text{Total effect}} - \beta_{\text{Direct effect}}}{\beta_{\text{Total effect}}} * 100$$

SEs were derived with bias-corrected bootstrapping (Sheikh et al., 2017) for hypothesis testing, and 95% CIs are presented.

Results

In Tromsø IV, 56.2% of our study sample was aged 55 and over and 59.2% were female. History of mother's psychiatric disorders (5.8%) was reported more often than history of father's psychiatric disorders (2.0%). Our participants reported an average number of childhood disadvantages of over 2 (mean: 2.13, SE: 0.01), 13.8% of the participants experienced one, and only 6.4% reported none of the childhood disadvantages considered in this study. Over 21.5% of the participants were classified as having a college or university education, while almost half (45.2%) had up to 10 years of schooling (Table 1).

There was a minor attenuation ($\beta_{\text{Unadjusted}}=-0.36$ vs $\beta_{\text{Adjusted}}=-0.28$) in the estimate of education by childhood disadvantage after controlling for confounding variables, which suggests that the association between childhood disadvantage and education is quite robust (Table 2). In the fully-adjusted model, childhood disadvantage was associated ($\beta=-0.28$, 95% CI: -0.33, -0.24, $p<0.001$) with lower education in adulthood (Table 2). In turn, higher education was associated ($p<0.05$) with lower psychological distress (Table 3). The attenuation between unadjusted ($\beta=-0.21$, $p<0.001$) and adjusted ($\beta=-0.11$, $p<0.05$) estimate of education indicate that a substantial proportion of the crude association between education and psychological distress is driven by confounding variables (Table 3).

In the fully-adjusted model, childhood disadvantage was associated with higher psychological distress in adulthood ($\beta_{\text{Total Effect}}=0.40$, 95% CI: 0.30, 0.47) (Table 4). Decomposition of total effects into direct and indirect effects showed that childhood disadvantage affects psychological distress in adulthood both independent of education ($\beta_{\text{Direct Effect}}=0.36$, 95% CI: 0.30, 0.50), and via education ($\beta_{\text{Indirect Effect}}=0.03$, 95% CI: 0.01, 0.05) (Table 4). Education mediated over 7.51% (95% CI: 1.47, 15.19) of the effect of childhood disadvantage on psychological distress in adulthood (Table 4).

Discussion

Using a representative sample of 4,530 individuals, this study sought to determine whether education functions as a mechanism by which childhood disadvantage affects psychological distress in adulthood. Our findings indicate that, after adjustment for several confounding variables, childhood disadvantage was associated with lower education and both childhood disadvantage and lower education were associated with higher psychological distress in early old age. Education does not play a moderating role in the association between childhood disadvantages and psychological distress in adulthood; however, it significantly mediates

approximately 7% of the association between childhood disadvantages and psychological distress. These findings support the mediating hypotheses linking childhood disadvantage to psychological distress in adulthood via education; however, the indirect effect size is small (i.e., a small percentage of the total effect). So, while education may be a factor linking childhood disadvantage to psychological distress in adulthood, it is certainly not a major factor in this complex relationship between early experience and psychological distress in adulthood. On the other hand, the large number of confounding variables included in this study suggests that the mediating mechanism, although small, may be real. Accordingly, this study supports the assumption that a major proportion of the association between childhood disadvantage and psychological distress in adulthood is independent of education.

The findings of this study are consistent with a developmental psychopathology model of psychological distress, in which one pathway to vulnerability is through childhood disadvantage, which may function through cognitive mechanisms (Stikkelbroek et al., 2016) to affect future susceptibility to higher psychological distress (Saleh et al., 2017). Theoretically, these findings are also in line with the social causation hypothesis (Johnson et al., 1999; Mossakowski, 2014; Sheikh et al., 2017), which postulates that social conditions via childhood disadvantage and lower education have a causal effect on psychological distress (Sheikh et al., 2017). However, it must be noted that the associations we observed between childhood disadvantage, education, and psychological distress are not necessarily causative and deterministic; they are more likely inter-related and probabilistic (Sheikh et al., 2017).

Childhood disadvantages were measured retrospectively 6 years after the measurement of psychological distress. Recall of childhood disadvantage may be influenced by current mental health (Hepp et al., 2006; Reuben et al., 2016; Sheikh, 2017a; Sheikh et al.,

2016b). For instance, respondents with higher levels of psychological distress might be more prone to remember disadvantages from their childhood (Sheikh et al., 2016b). Therefore, it is plausible that the total effects and direct effects presented here are over-estimated, while the indirect effects are under-estimated (Sheikh, 2017b). On the other hand, since the reliability of education was very good in this sample, it is less likely that an association between childhood disadvantages and education would be an effect of recall bias. The study only included six childhood disadvantages, and no other indicators of scholastic or cognitive skills (achievement or IQ), parenting, or family context were measured in the Tromsø Study. The variables used in this study (except age and gender) were self-reported, thus we cannot rule out the possible presence of reporting error (Hepp et al., 2006; Jivraj et al., 2017; Sheikh, 2017a). The test-retest reliability of parental history of psychological problems was not high, which raises the concern that we were not able to fully control for genetic dispositions (Esteves et al., 2017).

Our study represents an improvement over existing research methodologically speaking, as the Tromsø Study includes a large, representative, population-based cohort of men and women without regard to their health status. Furthermore, we used a broad definition of childhood disadvantage to better reflect real-world scenarios, i.e., that different disadvantages do not occur in isolation from one another, but are correlated and coexist (Markkula et al., 2017; Sheikh et al., 2016a). By determining the exposure (childhood disadvantage), mediator (education), and outcome (psychological distress in adulthood) at different time points, spurious associations due to state of mind and mood congruency bias were avoided (Sheikh, 2017a; Sheikh et al., 2016b). Finally, missing values were imputed, which avoids the possibility that attenuations in the coefficient for childhood disadvantage were due to sample differences rather than mediation. In summary, childhood disadvantage

was associated with higher psychological distress, and a minor proportion of this association was mediated by education.

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Mashhood Ahmed Sheikh (MAS) is the sole author of this manuscript, and all aspects of this research and manuscript were performed by MAS.

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Table 1. General characteristics of the study sample (n=4,530).

Characteristics		Complete-case dataset	Imputed dataset
		n (%)	(%)
Age, years (in 1994)	Mean (standard error, SE)	54.69 (0.15)	- ^b
Gender	Male	1849 (40.8)	- ^b
	Female	2681 (59.2)	- ^b
History of psychiatric disorders, mother	Yes	262 (5.8)	- ^b
History of psychiatric disorders, father	Yes	90 (2.0)	- ^b
Alcohol frequency^a	Mean (SE)	3.00 (0.07)	2.90 (0.06)
Daily smoking^a	Yes	1312 (29.0)	30.0
Number of friends^a	Mean (SE)	5.10 (0.08)	5.13 (0.09)
Perceived social support^a	Socially isolated	669 (16.1)	16.2
	Not socially isolated	3485 (83.9)	83.8
Childhood disadvantages^a	Mean (standard error, SE)	2.14 (0.02)	2.13 (0.01)
	0	253 (6.4)	6.4
	1	543 (13.8)	13.8
	2	1849 (47.1)	47.3
	3	1051 (26.7)	26.9
	4	171 (4.4)	4.0
	5	58 (1.5)	1.4
	6	5 (0.1)	0.1
Education^a	7-10 years of schooling	2036 (45.1)	45.2
	Vocational school or technical school	1275 (28.3)	28.3
	High school diploma	228 (5.1)	5.0
	College, or university (less than 4 years)	539 (12.0)	11.9
	College, or university (4 years or more)	433 (9.6)	9.6
Psychological distress (HSCL-10)^a	Mean (SE)	12.22 (0.05)	12.71 (0.06)

^aThe numbers for some variables do not add up to 4,530 due to missing values.

^bThere were no missing values, so no imputations were made for these variables.

SE: standard error; HSCL-10: Hopkins Symptom Check List-10; scale (10–40), where 10 represents lowest psychological distress, and 40 represents highest psychological distress.

Table 2. Association between childhood disadvantages and education (n=4,530).

	Education			
	Crude		Adjusted	
	β	95% CI	β	95% CI
Childhood disadvantages	-0.36 ^a	-0.41, -0.32	-0.28 ^{a, b}	-0.33, -0.24

^a p<0.001

^b Adjusted for age, gender, mother's/father's history of psychiatric disorders, daily smoking, indicators of alcohol frequency, number of friends, and perceived social support.

CI: confidence interval.

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Table 3. Association between education and psychological distress in adulthood (n=4,530).

	Psychological distress (HSCL-10) ^a			
	Crude		Adjusted	
	β	95% CI	β	95% CI
Education^b	-0.21 ^c	-0.29, -0.12	-0.11 ^{d, e}	-0.20, -0.01

^aPsychological distress was measured in 2001-2002.

^bEducation was measured in 1994-95

^cp<0.001

^dAdjusted for childhood disadvantages, age, gender, mother's/father's history of psychiatric disorders, daily smoking, alcohol frequency, number of friends, and perceived social support.

^ep<0.05

CI: confidence interval; HSCL-10: Hopkins Symptom Check List-10; scale (10–40), where 10 represents lowest psychological distress, and 40 represents highest psychological distress.

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Table 4. Direct and indirect effect of childhood disadvantages on psychological distress in adulthood (n=4,530).

	Psychological distress (HSCL-10)			
	Total effect	Direct effect	Indirect effect	Proportion mediated
	β (95% CI)	β (95% CI)	β (95% CI)	% (95% CI)
Childhood disadvantages	0.40 (0.30, 0.47) ^a	0.36 (0.30, 0.50) ^b	0.03 (0.01, 0.05) ^a	7.51 (1.47, 15.19) ^a

^aAdjusted for age, gender, mother's/father's history of psychiatric disorders, daily smoking, alcohol frequency, number of friends, and perceived social support.

^bAdjusted for age, gender, mother's/father's history of psychiatric disorders, daily smoking, alcohol frequency, number of friends, perceived social support, and education.

CI: confidence interval; HSCL-10: Hopkins Symptom Check List-10; scale (10–40), where 10 represents lowest psychological distress, and 40 represents highest psychological distress.

Highlights

- An increase in number of childhood disadvantages was negatively associated with education.
- An increase in number of childhood disadvantages was associated with psychological distress in adulthood.
- Childhood disadvantage influences psychological distress in adulthood partly via education level.