



Original article

Do employment factors reduce the effect of low education on mental health? A causal mediation analysis using a national panel study

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Abstract

Background: Young people with low education have worse health than those with higher education. This paper examined the extent to which employment and income reduced the adverse effects of low education on mental health among people aged 20–35 years.

Methods: We used causal mediation analyses to estimate the total causal effect (TCE) of low education on mental health and to decompose the effect into the natural direct effect (NDE) and the natural indirect effect (NIE) through two mediators examined sequentially: employment (labour-force participation/occupation skill level) and income. Three waves of the Household, Income and Labour Dynamics in Australia (HILDA) survey (2012–14) were used to establish a temporal sequence between low education (not completing high school), mediators and mental health [the Mental Health Inventory (MHI-5)] among participants aged 20–35 years. Among those who were employed, we conducted further analyses examining the effect of job characteristics as a mediator of the relationship between low education and mental health.

Results: The TCE of low education on the MHI-5 was –3.61 [95% confidence interval (CI) –5.30 to –1.92]. The NIE through labour force status and occupational skill level was –1.09 (95% CI –2.29 to 0.10) and –1.49 (95% CI –2.79 to –0.19) through both labour-force status/occupational skill level and income, corresponding to a percentage mediated of 41%. Among the employed, education had a much smaller effect on the MHI-5.

Conclusions: Improving employment opportunities could reduce nearly half of the adverse effects of low education on the mental health of young people.

Key words: education, mental health, employment, causal mediation analysis

Key Messages

- Low education is a risk factor for poor mental health among young people.
- Our study suggests that obtaining employment can buffer the ill-effect of low education on mental health.
- Occupational skill level and income are important mediators of this relationship.

Background

Emerging adulthood (from adolescence up to a person is in their thirties) is increasingly recognized as a life stage of considerable individual, social and economic change, particularly as young people leave education and move into employment.^{1,2} This time period coincides with the peak age of onset for many common mental health conditions, with 75% of the first onset of mental illness occurring by age 24.³ The mental health of young people is particularly tied to the social and economic circumstances in which they grow up,^{1,2,4} particularly educational and employment circumstances.^{5,6} Because of this, there has been a recent push for greater public health attention to the social determinants of health among young people.²

Young people with lower education attainment have poorer mental health than those with higher education.^{6–9} Moreover, education, an important element of socio-economic position, has lifelong consequences.¹⁰ For example, young people with lower educational attainment may be less likely to have good employment opportunities and face greater social disadvantage,^{4,11} including being ‘Not in Employment, Education or Training’ (NEET).¹²

It is commonly assumed in social epidemiology that the causal pathway between education and health is mediated by other socio-economic factors such as employment and income, although these pathways have rarely been tested empirically.¹³ This is despite the obvious social policy implications of identifying potential points of intervention to alleviate the negative mental health consequences of low education. The relatively few studies that have been published in the area^{14–20} have not focused on the temporal relationships between low education, employment and mental health, nor have they taken a health-equity perspective on this issue by explicitly focusing on those young people with low education. We use a causal mediation approach to examine whether the effects of low education on young people’s mental health (20–35 years) could be alleviated by improving their employment circumstances.

Our primary research questions are: (i) what is the total effect of low education on mental health among young people (20–35 years) and (ii) how much of this relationship is mediated by employment and income? We have two secondary questions specifically tested among young people in the

labour force: (iv) what is the total effect of low education on mental health and (v) how much of the total effect of low education on mental health among employed young people is mediated by employment characteristics and income?

Methods

Analytic approach

We used a sequential causal mediation approach to estimate the total causal effect (TCE) of low education on mental health and to decompose the effect into the natural direct effect (NDE) and the natural indirect effect (NIE).^{21,22} Natural direct and indirect effects enable us to assess the potential pathways linking education to mental health. We use a potential outcomes approach to estimate natural direct and indirect effects. The main potential outcome we estimate is the predicted mental health of lifting employment and income of people with low education to the level that people with higher education experience.

Specifically, the NDE captures what the inequality in mental health would have been between people with high and low education if, counter to fact, the mediators (employment factors, income) for people with low education were lifted to the level observed for people with higher education levels. The NIE quantifies the amount mental health would change, for people with low education, if the mediator were changed from its observed value to the mediator distribution of people with higher education. As such, it is possible to decompose the TCE of low education on mental health into the portion of effect occurring through the mediators of interest (the NIE) and the portion of effect occurring through other pathways (the NDE).

There are four confounding structural assumptions that underpin the estimation of these effects. These are: (i) no unmeasured confounding of the exposure–outcome relationship; (ii) no unmeasured confounding of mediator–outcome relationship; (iii) no unmeasured confounding of the exposure–mediator relationship; and (iv) no unmeasured mediator–outcome confounder that is affected by the exposure.²³ Additionally, and perhaps receiving less attention, there are assumptions about the absence or negligibility of measurement error.²⁴

Data source and study eligibility

The Household, Income and Labour Dynamics in Australia (HILDA) survey is a longitudinal, nationally representative study of Australian households established in 2001. It collects detailed information annually from over 13 000 individuals within over 7000 households.²⁵ The response rates for the HILDA survey are above 90% for respondents who have continued in the survey and above 70% for new respondents being invited into the study.²⁵ In this study, we used three recent waves of HILDA, from 2012 to 2014, to establish a temporal sequence between the exposure, mediators and outcome.

Sample eligibility

The sample was restricted to young people (aged between 20 and 35 years) who had data on relevant exposure, mediators and outcomes for the periods 2012, 2013 and 2014. The process for selecting the sample can be seen in Figure 1.

Outcome variable

Mental health was assessed using the five-item Mental Health Inventory (MHI-5), a subscale from the Short

Form-36 (SF-36) general health measure. The MHI-5 assesses symptoms of depression and anxiety (nervousness, depressed affect) and positive aspects of mental health (feeling calm, happy) in the past 4 weeks. The MHI-5 is an effective screening instrument for mood disorders or severe depressive symptomatology in the general population^{26–28} and has been validated as a measure for depression using clinical interviews as the gold standard.^{26,29,30} The current analyses use the continuous MHI-5 score (scale 1 to 100), with higher scores representing better mental health. A difference of three points on the norm based scale (T-score) has been suggested to reflect a minimally important difference.³¹

Exposure variable

Our exposure variable represented a young person's education, classed as being low education (not obtaining high-school education) and high education (obtaining high-school education and above).

Mediators

For questions one and two, the mediators included:

- a combined labour force status and occupational skill variable according to the Australian and New Zealand Standard Classification of Occupations,³² coded as: employed in low-skill occupations (sales, machinery workers, and labourers); employed in medium-skill occupations (technical and trade workers, community and personal service workers, and clerical and admin workers); employed in high-skill occupations (managers and professionals); unemployed; and not in the labour force; and
- weekly household income (equivalized). This was capped at the top and the bottom (1st and 99th) percentiles of the distribution to reduce the effect of extreme values, and was mean-centred by wave.

For questions three and four (restricted to those who were in paid employment), a number of possible employment related mediators of the relationship between low education and mental health were included:

- occupational skill level (described above);
- weekly household income (described above);
- employment arrangement [permanent (1), part time/fixed term (2), casual working contracts (3) self-employed (4)];
- a multidimensional measure of psychosocial job quality assessing four main perceived job stressors: control, demands and complexity, job insecurity and unfair

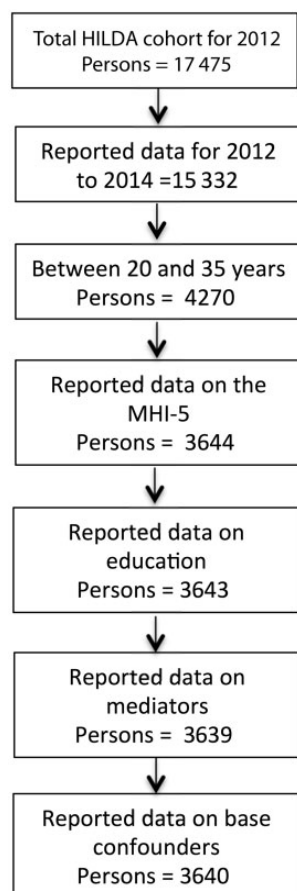


Figure 1. Sample selection.

pay.^{33–35} Full details of the construction and validation of the job quality measure are presented elsewhere^{33–35} and available in [Supplementary File 1](#), available as [Supplementary data](#) at *IJE* online. In this study, we used the overall job-quality index, scored from no psychosocial job stressors (0) to three or more stressors (3).

Confounders

We identified these potential and measurable confounders:

- mother's and father's occupation (not employed, manager, professional, technicians and trade workers, community and personal service workers, clerical and administrative workers, sales workers, machinery operators and drivers, and labourer as described above) as a proxy for childhood socio-economic status;
- long-term health condition (yes or no);
- age (measured in the groups 20–24 years, 25–29 years, 30–35 years);

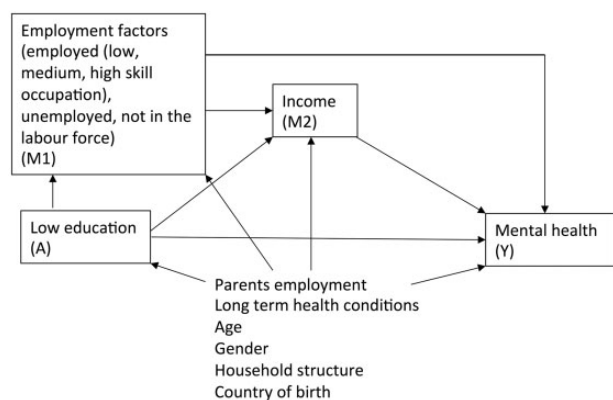


Figure 2. Directed Acyclic Graph, for research questions one and two (employed and non-employed participants).

- gender (male/female);
- household structure (couple without children, couple with children, lone parent with children, lone person, and other); and
- country of birth (Australia, English-speaking country, other country).

All confounders were measured at baseline, in the first wave of the analysis. Though there was the potential for some of these to change over time, such as household structure and long-term health conditions, we found that there was little change between waves and therefore measured them at a single time point (data not shown).

Analysis

The sequential mediation analysis approach requires specification of the structural dependencies between multiple mediators. For research questions one and two ([Figure 2](#)), we hypothesize that employment (M1) may influence mental health either independently or through income (M2). For research questions three and four, and as shown in [Figure 3](#), we hypothesize that occupational skill level and employment arrangement (considered jointly as M1) cause income (M2) which in turn cause psychosocial job stressors (M3), and each of the mediators also have an independent effect on mental health (Y). This implies that M1 is an exposure-induced mediator–outcome confounder of the association between M2 and Y, and M2 is an exposure-induced mediator–outcome confounder of the association between M3 and Y. To account for this potential confounding, we used a sequential³⁶ approach in which we estimate joint pathways between multiple mediators, thus removing this problem of confounding, estimating (i) the NIE through M1, (ii) the joint NIE through M1 and M2, and

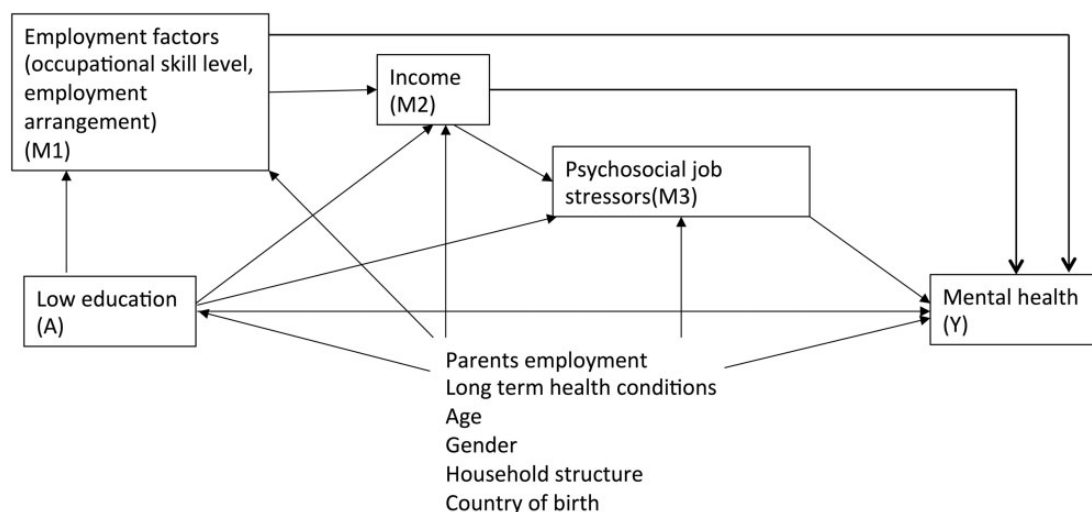


Figure 3. Directed Acyclic Graph, for research questions three and four (employed participants only).

(iii) the joint NIE through M1, M2 and M3, and the corresponding NDEs.

We conducted a sensitivity analysis excluding those young people with low levels of mental health in the wave preceding the three-wave window examined in the mediation analysis. Those excluded scored 48 or below on the MHI-5.³⁷ This recognizes that mental health problems experienced in adolescence or young adulthood may affect educational attainment, and later employment outcomes.

Analyses for all research questions used a weighting approach to estimate the marginal TCE and the marginal NIE and NDE through each of the sets of mediators.³⁶ This first creates a propensity score for the exposure to generate inverse probability weights to account for confounding to maximize exchangeability between the exposure groups. We used these weights in linear regression models for the outcome regressed on the exposure and all baseline confounders, generating predicted (counterfactual) mental health scores from a model with no mediator included, a model with M1, a model with M1 and M2, and, finally, for the third and fourth research questions only, a model with M1, M2 and M3. All predicted mental health scores were estimated for the study participants who were unexposed (high education). We compared the average (observed) weighted mental health score to the weighted mean of predicted mental health for each model (to estimate counterfactual scenarios, e.g. their predicted mental health had they experienced low education) to generate estimates of the TCE, and the NDE and NIE through each set of mediators. The proportion mediated is given by $\frac{NIE}{total\ effect}$ for effects on the absolute or additive scale. Bootstrapped standard errors (with 2000 replications) were calculated; none of the 2000 replications had a negative TCE, meaning bootstrapped confidence intervals (CIs) about the proportion mediated were valid.

Results

A description of the analytic sample can be seen in Table 1. This shows that approximately 15.8% of young people reported low levels of education. The mean level of mental health in the sample was relatively high (72.6) but had a large standard deviation (17.2). The majority of the sample were under 26 years of age at baseline and employed.

Table 1 also shows the distribution of the mediators, outcome and key confounders by low vs high education. Those with low education had (on average) MHI-5 scores that were 4 points lower than those with high education. They were also more likely to be male (53.3 vs 45.2%) and younger than those with higher levels of education (e.g. 57.4 vs 42.8% were aged 20–26 years). Those who had lower education were more likely to report unemployment

(10.8%) than those who had higher levels of education (4.8%). Those with lower levels of education were also more likely to report a long-term health condition (22.5 vs 11.3%). When they were employed, people with low levels of education were more likely to report at least one psychosocial job stressor (83.3%) than those with higher levels of education (75.8%).

The results of the mediation analysis can be seen in Table 2. For research questions one and two, the TCE of low education on the MHI-5 was estimated to be -3.61 (95% CI -5.30 to -1.92) (Table 2). The NIE through the combined labour force status and occupational skills variable was -1.09 (95% CI -2.29 to 0.10), or 30% (95% CI 0.8 to 68) of the TCE. A larger amount of the relationship between low education and mental health was mediated when income was added (-1.49 , 95% CI -2.79 to -0.19), explaining a further 11% of the effect. The total percentage mediated was 41% (95% CI 0.1 to 84) for both the labour-force status/occupational skills and income variables.

For research questions three and four (Supplementary File 2, available as Supplementary data at *IJE* online), the TCE of low education on the MHI-5 among those young people who obtained employment was -1.45 albeit with the 95% CI including the null (95% CI -3.56 to 0.57). The NIEs for occupation and employment mediation, and adding income, all had confidence intervals including the null. Thus, it is not possible to make firm conclusions. Once we excluded those persons who scored 48 or below on the MHI-5 ($n=344$), the TCE of low education on mental health attenuated to -2.95 (95% CI -4.82 to -1.10). The NIE through the combined labour force status and occupational skills variable was -0.44 (95% CI -1.58 to 0.82), representing a percentage mediated of 14% of the TCE. The NIE when also adding income was -0.95 (95% CI -2.32 to 0.44). The percentage mediated was 32%.

Discussion

The findings of this paper suggest that 40% of the effect of low education on mental health among young adults may be explained by a combination of labour-force status, occupational skill level and income. However, when we restricted our study to the employed population only, we found a suggestive (CIs including the null) association of low education with poorer mental health of smaller magnitude, and possible mediation of this association by income and psychosocial job quality (but all NIE confidence intervals included the null as well) making firm conclusions impossible.

One of the limitations of this paper was that we made an assumption about the structural temporal dependencies

Table 1. Description of the exposure, mediators, outcome and selected confounders in the analytic sample

	Whole sample		Low education		High education	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
MHI-5	72.56	17.25	68.60	19.80	73.33	16.60
Income equivalized	\$991	\$520	\$762	\$399	\$1033	\$530
	N	%	N	%	N	%
Gender						
Male	1692	46.48	305	53.32	1384	45.17
Female	1948	53.52	267	46.68	1680	54.83
Age group						
20–26 years	1641	45.08	328	57.43	1312	42.82
27–31 years	1138	31.26	154	26.92	982	32.05
32–35 years	861	23.65	90	15.73	770	25.13
Education						
High (>high school)	3066	84.23	–		–	
Low (<high school)	574	15.77	–		–	
Employment status						
Employed	2826	77.64	350	60.98	2476	80.76
Unemployed	209	5.74	62	10.80	147	4.79
NILF	605	16.62	162	28.22	443	14.45
Long-term health conditions						
No	3165	86.95	443	77.45	2719	88.74
Yes	475	13.05	129	22.55	345	11.26
Occupational skill level (among the employed)						
Low	604	23.46	121	41.58	483	21.16
Medium	1080	41.96	135	46.39	945	41.39
High	890	34.58	35	12.03	855	37.45
Employment arrangement (among the employed)						
Permanent	1670	59.77	174	52.73	1496	60.67
Causal/labour hire	673	24.07	116	35.15	557	22.59
Fixed term	276	9.87	18	5.45	258	10.46
Self-employed	177	6.33	22	6.67	155	6.29
Psychosocial job stressors (among the employed)						
0	653	23.30	55	16.67	598	24.19
1	1328	47.39	175	53.03	1153	46.64
2	584	20.84	65	19.70	519	21.00
3	237	8.46	35	10.61	202	8.17

Table 2. Estimates of direct and indirect effects (mediated through M1, M1 + M2) of association between low education and mental health among young Australians (20–35 years; $N = 3640$)

	Observed coefficient	Lower CI 95%	Upper CI 95%	Proportion mediated	Lower CI 95%	Upper CI 95%
Total effect	–3.61	–5.30	–1.92			
NIE: Mediator 1—employment	–1.09	–2.29	0.10	30%	0.8%	68%
NDE: Direct effect (not including M1)	–2.52	–4.48	–0.55			
NIE: Mediator 2—income	–1.49	–2.79	–0.19	41%	0.1%	84%
NDE: Direct effect (not including M1 or M2)	–2.11	–4.12	–0.11			

NIE, natural indirect effects; NDE, natural direct effects.

between the mediators. These decisions were made on the basis of past literature. Regardless, there may be alternate hypothesizes about the temporal relationships between the mediators. The key issue, though, was that we had

inadequate power for research questions three and four. We encourage other research groups to test these associations where comparable but larger datasets are available. We also acknowledge the possibility that poor mental

health in young adulthood could lead to low education and poor employment outcomes.³⁸ Ideally, we would have measured mental health in adolescence but this was not recorded for all participants in HILDA and therefore could not be included. However, later sensitivity analysis excluding participants with low mental health at baseline (prior to measurement of education but not necessarily prior to completion of education) found a slight attenuation of the relationship. The proportion mediated was similar to the main analysis and the main conclusion was unchanged.

There is also the possibility that the reliability of the MHI-5 alters, depending on characteristics of the population under study, e.g. by education or socio-economic position, although we would note that it has been validated as a measure for depression across the general population.^{26,29,30} We also acknowledge the possibility of unmeasured confounding and measurement error in this paper. We attempted to overcome residual confounding via careful research design, but it is possible that this remains as a problem. Regarding measurement error, non-differential measurement error of the mediators would likely lead to an under-estimation of the percentage mediated. However, the impacts of differential (and possibly dependent) measurement error of all covariates are difficult to anticipate. A strength of this study is that it is based on a large and comprehensive cohort of Australians. We applied a best-practice approach to mediation analysis in epidemiology^{36,39} and were able to use the longitudinal nature of the data to implement a design assessing carefully specified temporal relationships between a range of confounders, exposure, mediators and outcomes. Using this approach, we were able to provide evidence that employment (inclusive of occupation skill level and income) plays an important role in explaining the ill effects of low education on mental health.

The findings of our study significantly contribute to research on the relationship between low education and mental health, and more broadly to research on low socio-economic position and mental health.^{40–43} A previous paper by Chazelle, Lemogne⁴⁴ suggests a lack of material factors explains a large part of the relationship between low education and mental health (including income, housing tenure, access to health insurance). Aside from these pathways, other studies have suggested possible pathways including somatic symptoms⁸ and work factors.⁴⁵ However, it is worth noting that the majority of these mediation analyses were based on cross-sectional designs^{8,44} and were not able to implement a more rigorous time-sequenced approach as in the current paper.

The findings of the present study are important from an intervention and policy perspective. If employment characteristics can play a role in explaining the relationship

between education and mental health, then policies and practices to boost employment could improve the overall mental health of young adults. This would align with research from the broader social determinants of health, which argues that both education and employment are fundamental affectors of health.^{46,47} From a health-equity perspective, our study suggests that a particular focus on improving employment outcomes among young people with low education may yield positive mental health outcomes. The study also provides empirical support for the commonly proposed causal pathways between education, employment and occupation, income and health outcomes.

Supplementary Data

Supplementary data are available at *IJE* online.

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