Implications of Mental Health on Labor Market Outcomes: Evidence from Fixed Effects Models

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Abstract

This paper examines the influence of mental health on labor market outcomes, specifically investigating how this relationship is moderated by socioeconomic status during adolescence. A fixed effects model alongside individual- and household-level controls is used to mitigate the empirical concerns of reverse causality and unobserved individual heterogeneity. The results suggest that being at risk of having depression or being depressed decreases the probability of employment by an average of 2-5 percentage points, decreases the number of weekly hours by an average of 1.5 hours, and decreases the predicted annual earnings by $2,000. However, further research is needed to establish the direction of the interaction between socioeconomic status during adolescence and the complex relationship between mental health and labor market outcomes.

Introduction

Mental health disorders are a rising problem in the workplace. Health shocks substantially increase the probability of exiting the labor market and lower workers' hours and earnings (Jones et al., 2020). The U.S. lost an estimate of $193.2 billion in annual earnings associated with mental disorders in 2002 (Kessler et al., 2008). In addition to lowering the labor participation rate, mental illnesses also cause a loss of daily structure, sense of purpose, and opportunities for social interactions (Frijters et al., 2010). However, estimating the direct causal relationship between mental health and labor outcomes poses some problems, namely reverse causality and unobserved individual heterogeneity. Reverse causality refers to the bidirectional relationship between work and mental health; and unobserved individual heterogeneity refers to the differences between individuals not accounted for.

This paper examines the effect of mental health on labor market outcomes in the United States – particularly the effect of different measures of depression on employment, weekly work hours, and earnings. To address some of the empirical concerns, this study uses longitudinal data covering adolescence to adulthood to construct a fixed effects model to control for time-invariant individual characteristics as well as time-varying factors that affect all individuals uniformly, alongside a set of controls to account for time-varying individual- and household-level characteristics. Data come from the first five waves of the National Longitudinal Study of Adolescent to Adult Health (Add Health), a panel study that follows a nationally representative sample of adolescents in grades 7-12 during the 1994-95 school year.

Despite consistent findings that poor mental health (in the form of depression and/or anxiety) is associated with a loss of work productivity, only a few studies have used longitudinal data to address the issues named above (de Oliveira et al., 2023). The most closely related paper

is by Frijters et al. (2010), who recently conducted longitudinal analysis using seven waves of the Household, Income and Labour Dynamics in Australia (HILDA) survey. They investigate the effect of mental health on labor market participation using death of a close friend as an instrumental variable and various other models. They find that poor mental health has a substantial negative impact of the probability of labor market participation; in particular, a one standard deviation decrease in mental health decreases the probability of participation by around 17 percentage points.

Frijters et al.'s (2010) study uses an itemized questionnaire to assess mental health similar to this paper. This study extends on their results by analyzing other facets of labor market outcomes and examining heterogeneity of the effects of mental health on labor market outcomes by sex, race, and characteristics in adolescence. This paper concludes that being at risk of having depression or being diagnosed with depression decreases the probability of being employed by an average of 2-5 percentage points, decreases the number of weekly hours by an average of 1.5 hours, and decreases the predicted annual earnings by $2,000. Also, there is a difference in the effect of mental health on these labor market outcomes, though further research must be undertaken to inspect the direction of this difference.

Background

The complex impacts of mental health on labor market outcomes have been extensively explored in a wide, multi-disciplinary literature. In particular, Bartel and Taubman (1979, 1986) conduct some of the earliest investigations into this relationship and report that individuals with psychoses and neuroses have reduced earnings that can last for as long as 15 years and are more likely to have a strained marriage. Even for less severe mental disorders, the effects on

employment outcomes are still substantial. Alexandre and French (2001) find that depression decreases the probability of employment by 19 percentage points and reduces time spent at work by 7 to 8 weeks annually.

However, empirical concerns – namely reverse causality and unobservable individual heterogeneity – have made it difficult to estimate the true causal effects of mental health on labor market outcomes. Reverse causation occurs since it is possible for employment outcomes to influence mental health. Studies find that unemployment affects mental health, though not all of them agree on the direction of the association (Clark & Oswald, 1994; Salm, 2009). Additionally, unobserved individual heterogeneity that influences both mental health and work can introduce bias to the true impact of mental health on labor market outcomes. According to Frijters et al. (2010), economists have commonly used (1) controls, (2) models of fixed effects, and/or (3) instrumental variables (IV) to mitigate the previous concerns.

Amongst the 3 methods discussed above, the use of IV has been extensive within economics. In this context, the IV must have a causal effect on mental health and must only affect labor market outcomes indirectly through its effect on mental health. For instance, Chatterji et al. (2007) employ the number of childhood psychiatric disorders and religiosity in their study on employment effects of psychiatric disorders. They find that having a recent psychiatric disorder decreases the probability of being employed by 11 percentage points for males and by 22 percentage points for females for the Latino population. Another study uses number of childhood psychiatric disorders as an IV and finds that having a recent mental disorder reduces the probability of employment by 11 percentage points for both men and women (Ettner et al., 1997). However, it is often difficult to justify the validity of an instrument

under stated assumptions; hence, this paper exploits the structure of panel data to control for trends and unobserved time-constant individual characteristics.

The most closely related paper to the current study is Frijters et al. (2010). The authors examine the relationship between mental health and labor force participation in Australia using the Household Income and Labour Dynamics (HILDA) survey, which is a panel study. They construct a mental health index from items from the Short Form General Health Survey (SF-36) and standardize the variable to have a mean of 0 and standard deviation 1. Labor force participation is defined as either being employed or being unemployed but looking for work. The researchers fit simple models to more complex ones, starting from a simple linear probability model to an IV-Fixed Effects linear probability model. They conclude that a one standard deviation decrease in mental health decreases the probability of labor force participation by around 17 percentage points; also, this effect is more substantial for females and for older adults.

Similar to Frijters et al. (2010), the current study uses questions from the Center for Epidemiologic Studies Depression Scale (CES-D) to develop one of the mental health variables; however, instead of standardization, this paper utilizes a widely used threshold to classify risk of clinical depression for individuals, alongside with having a depression diagnosis, to better inspect symptomology as it relates to labor. Furthermore, this paper investigates the effects of mental health on other work outcomes, such as employment, number of weekly work hours, and earnings, to identify the nuances of different work outcomes. Finally, this study explores the extent to which sex at birth, race, and socioeconomic status (SES) during adolescence serve to influence the relationship between mental health and labor market outcomes in adulthood. Positive affects during adolescence have been shown to predict lower levels of mental distress and higher levels of job competence (Kansky et al., 2016).

Methods

Data

The data in this study comes from the public-use version of the National Longitudinal Study of Adolescent to Adult Health (Add Health). Add Health is an ongoing school-based longitudinal study of a nationally representative sample of adolescents in grades 7-12 in the United States in 1994-1995. The study explores health and health-related behaviors of adolescents and their subsequent outcomes in adulthood. The public-use data sets contain a subset of the full Add Health sample with information from the in-home interviews conducted (N=6504). A summary of respondents' profiles across the current five waves of data is presented in Table A1 in the Appendix. Further discussion of the Add Health study's design can be found in Harris (2013). Individuals are dropped if they do not have more than one wave of data available. The resulting sample consists of 6,277 individuals.

Furthermore, data on mental health and employment outcomes will come from Waves III-V. During Waves I and II, much of the sample was still attending school. Hence, changes in labor market outcomes during this period are often due to other priorities in life and not necessarily due to changes in mental health. Additionally, the Add Health study provides no solid estimates of the number of hours worked weekly or earnings. These outcomes are categorized by summer and non-summer periods, but it is unclear how they should be combined. Hence, data from Waves I and II is excluded from the research to ensure that the impacts of mental health on labor market outcomes can be captured in a more representative sample of working individuals.

Measures

The self-reported labor market outcomes of interest are (1) employment, (2) the number of hours worked in a typical week, and (3) income from earnings. Employment is a dummy variable that indicates whether the individual is currently employed or self-employed. The number of weekly work hours takes on discrete values and is calculated using the individual's current job. Earnings compile income from wages or salaries, including tips, bonuses, and overtime pay, and income from self-employment of the individual during the most recent year, conditional on current employment. Earnings are top coded at the 95^{th} percentile to ensure extreme outliers (i.e., extreme high earners) are handled. For the waves of interest, Waves III-V, if a respondent "does not know" their earnings, a subsequent question asks them for their best guess of their earnings. For these individuals, the midpoint of the range of earnings they choose for this question is imputed as their earnings. Additionally, the number of weekly work hours and earnings in Wave V are exclusively categorical, so the same method of assigning the midpoint of each category to these two variables is used.

The measures of mental health considered are diagnosis of depression, suicide attempt, and risk of depression. Diagnosis of depression is a dummy variable that indicates whether the individual has ever been diagnosed formally with depression. The Add Health study only contains information on diagnosis of depression for Waves III-V. This study also considers suicide attempt as one of the mental health variables to provide more insight into the direction of the relationship between mental health and job outcomes. Suicide attempt is a dummy variable that indicates whether the individual has attempted suicide in the past 12 months.

Risk of depression is another dummy variable to assist in the understanding of mental health. This variable is constructed from the Center for Epidemiologic Studies Depression Scale

(CES-D), a 20-item measure that assesses how often individuals have experienced symptoms of depression over the past week (Radloff, 1977). In general, studies have shown that the CES-D is an effective screening instrument for depression. For each item, there are 4 options to which respondents could rank how often they've experienced a specific symptom, ranging from "never or none of the time (0)" to "most or all of the time (4)." Items are reverse coded as necessary. Across Waves III-V, only a subset of the original 20 items is available, and these questions are presented alongside the means and standard deviations of reported scores in Table A2. The CES-D has a cutoff score of 16 over the span of its 20 items to identify high symptomatology of depression, which implies an average score of 0.8 per item. To accommodate for differences in scores between waves due to missing questions, the average score of 0.8 is used as a threshold to detect when an individual is at risk of depression. However, the original cutoff score of 16 applies to the entire CES-D questionnaire, which, in this case, this paper does not have information on. Hence, the translated threshold of 0.8 might not hold.

Time-varying controls are included as part of each of the regressions estimated. These controls are: age (and age-squared), education, marital status, household size, and self-assessment of health. Age is manually computed at each wave using information on the individual's birth year and the year of the in-home interview. Educational attainment has 4 classifications: less than high school, high school completion (including certificates of attendance/completion, GEDs, and high school diplomas), college (including bachelor's degrees), and beyond college. Household size counts the number of household members, including self. Lastly, self-assessment of health is a dummy variable that indicates when respondents claim that their general health is "excellent, very good, or good."

The two variables of interest during adolescence are socioeconomic status (SES) and risk of depression. SES during adolescence is defined by whether the resident parent(s) received public assistance. The resident parent(s) is the parent that the respondent lives with during their adolescence. An adolescent is considered to have low SES if the resident mother received public assistance during Wave I; if information on the resident mother is unavailable in Wave I, Wave II is used to supplement for missing values since these two waves are only one year apart. If no information in either wave on the resident mother is available, then the adolescent SES variable is will then be defined in terms of the resident father, following the same steps. Lastly, adolescent risk of depression is generated by Wave I using the method explained previously.

Table 1 and Table 2 report the mean and standard deviations of different measures of interests by depression diagnosis and risk of depression, respectively. From Table 1, 17% of the observations are diagnosed with depression. As expected, amongst those who are depressed, 51% of them are at risk of depression; meanwhile, amongst those who are not depressed, only 19% of them are at risk of depression. From Table 2, 25% of the observations are at risk of having depression. Similarly, 35% of people who are at risk of depression are also diagnosed, and that percentage decreases to only 11% among those who are not at risk of depression. Risk of depression captures the continuity of the behavior of mental health.

Table 1. Variable means (standard deviations) by diagnosis of depression

	Never been diagnosed (N=11,747)	Diagnosed (N=2,422)	Total (N=14,169)
Labor market outcomes			
Employed	0.80 (0.40)	0.72 (0.45)	0.79 (0.41)
Weekly working hours	32.40 (19.70)	28.32 (20.66)	31.71 (19.92)
Earnings	27,860.07 (30,699.83)	25,474.06 (30,290.69)	27,448.07 (30,641.76)
Measures of mental health			

At risk for depression	0.19 (0.40)	0.51 (0.50)	0.25 (0.43)
Attempted suicide in the past 12 months	0.01 (0.08)	0.04 (0.19)	0.01 (0.11)
Age	28.59 (6.38)	30.93 (6.39)	28.99 (6.44)
Education: Less than high school	0.08 (0.27)	0.10 (0.30)	0.08 (0.28)
Education: High school	0.28 (0.45)	0.26 (0.44)	0.28 (0.45)
Education: College	0.53 (0.50)	0.52 (0.50)	0.53 (0.50)
Education: Beyond college	0.11 (0.31)	0.12 (0.33)	0.11 (0.32)
Married	0.33 (0.47)	0.32 (0.47)	0.33 (0.47)
Household size (including self)	3.29 (1.58)	3.32 (1.63)	3.30 (1.59)
Self-assessment of health (excellent, very good, or good)	0.93 (0.26)	0.81 (0.39)	0.91 (0.29)

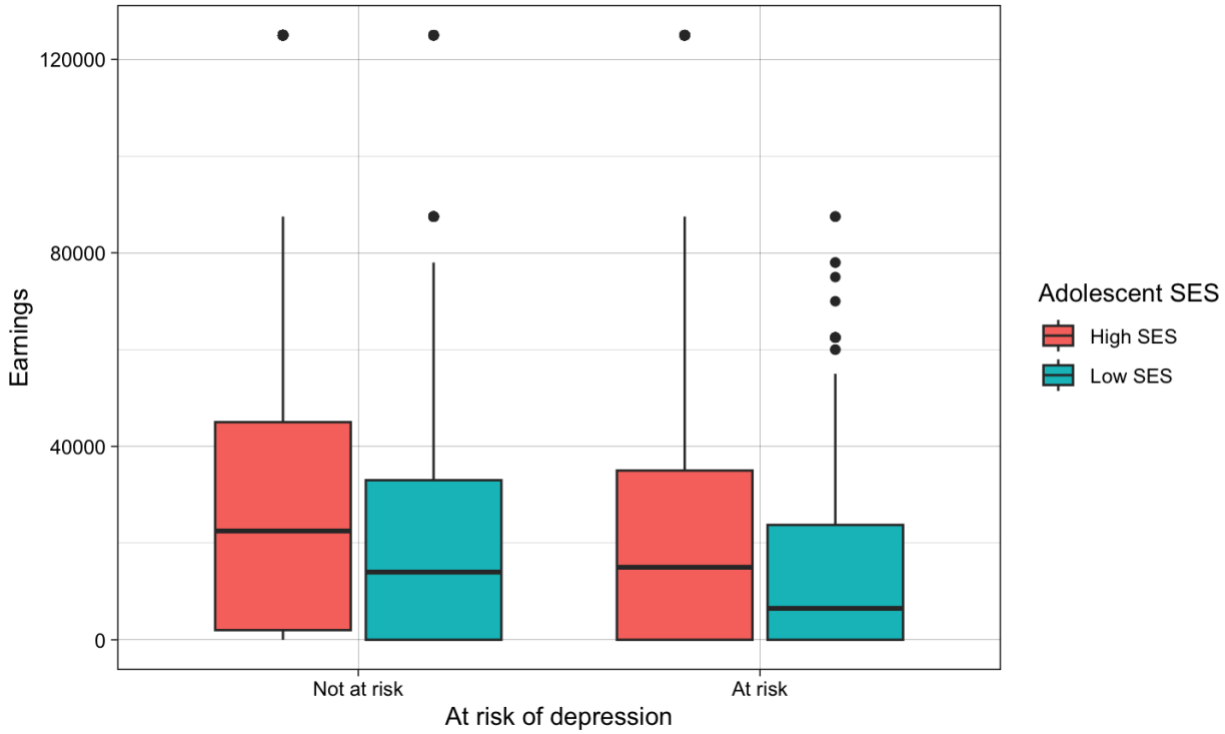
Table 2. Variable means (standard deviations) by risk of depression

	Not at risk (N=10,668)	At risk (N=3,515)	Total (N=14,183)
Labor market outcomes			
Employed	0.81 (0.40)	0.73 (0.44)	0.79 (0.41)
Weekly working hours	32.71 (19.49)	28.61 (20.91)	31.70 (19.93)
Earnings	29,275.64 (31,613.58)	21,866.18 (26,703.89)	27,437.15 (30,635.94)
Measures of mental health			
Diagnosed with depression	0.11 (0.31)	0.35 (0.48)	0.17 (0.38)
Attempted suicide in the past 12 months	0.00 (0.07)	0.03 (0.18)	0.01 (0.11)
Age	28.83 (6.57)	29.46 (6.02)	28.99 (6.44)
Education: Less than high school	0.07 (0.25)	0.13 (0.34)	0.08 (0.28)
Education: High school	0.26 (0.44)	0.32 (0.47)	0.28 (0.45)
Education: College	0.55 (0.50)	0.46 (0.50)	0.53 (0.50)
Education: Beyond college	0.12 (0.33)	0.08 (0.27)	0.11 (0.32)
Married	0.36 (0.48)	0.26 (0.44)	0.33 (0.47)
Household size (including self)	3.27 (1.55)	3.38 (1.69)	3.30 (1.59)
Self-assessment of health (excellent, very good, or good)	0.94 (0.24)	0.81 (0.39)	0.91 (0.29)

Figure 1 shows the relationship between risk of depression and earnings for groups with differences in adolescent SES. There is a slight difference in earnings between people with low adolescent SES and those with high adolescent SES. On average, being at risk of depression

decreases earnings, but there is no clear distinction in Figure 1 on whether having low SES in adolescence implies a larger decrease in earnings.

Figure 1. Earnings by risk of depression and adolescent SES



Empirical Design

The first model presented uses the nature of longitudinal data to employ individual and wave fixed effects alongside controls that are thought to be related to labor market outcomes. The following is the model's specification, with i representing an individual and w representing wave:

$$Y_{iw} = \beta_0 + \beta_1 MH_{iw} + \alpha_i + \lambda_w + \sum_{j=2}^{9} \beta_j X_{iw,j} + \varepsilon_{iw}$$

where Y_{iw} is the labor market outcome, MH_{iw} is an individual's mental health status, α_i is the individual fixed effects, λ_w is the wave fixed effects, $X_{iw,j}$ is the set of time-varying controls, and ε_{iw} is the error term. The coefficient of interest is β_1, which estimates the effect of a change towards poor mental health status on each of the 3 labor market outcomes discussed.

The equation of interest in determining how differences in sex at birth could play a role in the impact of mental health on job outcomes is as follows:

$$Y_{iw} = \beta_0 + \beta_1 MH_{iw} + \beta_2 (MH_{iw} * Male_i) + \alpha_i + \lambda_w + \sum_{j=3}^{10} \beta_j X_{iw,j} + \sum_{j=11}^{18} \beta_j \ (X_{iw,j} * Male_i) + \varepsilon_{iw}$$

where $Male_i$ indicates whether the individual is male, and the rest of the variables is defined similar to the first model. The variable $Male_i$ is excluded from the equation since it is constant across all waves for one individual, which would have been omitted by collinearity with the individual fixed effects anyway. The coefficient of interest is β_2, which explains the effect of a change towards poor mental health status on a labor market outcome for males compared to females.

The third equation examines the magnitude of the effect of mental health on labor market outcomes between Blacks/African Americans and Whites, compared to the group of non-Whites and non-Blacks/African Americans, and is as follows:

$$Y_{iw} = \beta_0 + \beta_1 MH_{iw} + \beta_2 (MH_{iw} * White_i) + \beta_3 (MH_{iw} * Black_i) + \alpha_i +$$

$$\lambda_w + \sum_{j=4}^{11} \beta_j X_{iw,j} + \sum_{j=12}^{19} \beta_j (X_{iw,j} * White_i) + \sum_{j=20}^{27} \beta_j (X_{iw} * Black_i) + \varepsilon_{iw}$$

where $White_i$ identifies whether the individual is White and $Black_i$ identifies whether the individual is Black/African American. According to the U.S. Bureau of Labor Statistics (2019), Blacks have one of the highest rates of unemployment (6.5%) and weekly earnings ($694). Thus, it is possible to observe some variation in how mental health influences labor market outcomes for Whites, Blacks/African Americans, and non-Whites/non-Blacks/multiracial people. The coefficients of interest are β_2 and β_3, in which $\beta_3 - \beta_2$ estimates the difference in the effect of mental health on labor market outcomes for Blacks/African Americans compared to Whites. Similar to the second equation, since race is a time-invariant individual characteristic, the third equation omits $White_i$ and $Black_i$ as stand-alone variables due to collinearity with the individual fixed effects.

Finally, the fourth and last equation investigates the difference in the effect of mental health on labor market outcomes for adolescent characteristics such as SES and risk of depression:

$$Y_{iw} = \beta_0 + \beta_1 MH_{iw} + \beta_2 (MH_{iw} * AdolChar_i) + \alpha_i + \lambda_w + \sum_{j=3}^{10} \beta_j X_{iw,j}$$

$$+ \sum_{j=11}^{18} \beta_j (X_{iw,j} * AdolChar_i) + \varepsilon_{iw}$$

where $AdolChar_i$ specifies the adolescent characteristic being examined and is omitted as a variable due to collinearity with the individual fixed effects. The coefficient of interest is β_2, which describes how the effect of the transition into worse mental health on labor market outcomes differs for people with contrasting characteristics during adolescence.

Results

Table 3 reports the results from the first equation. Each regression corresponds to a different labor market outcome. For both measures of mental health, the transition into worse mental health is significantly associated with worse labor market outcomes. In particular, being diagnosed with depression decreases the predicted probability of employment by 5.1 percentage points, whereas being at risk of depression decreases the same probability by 2.1 percentage points. The magnitudes of these effects are less substantial compared to previous findings by Ettner et al. (1997) and Alexandre and French (2001), who report a decrease of 11 percentage points and 19 percentage points, respectively. Moreover, being diagnosed with depression decreases the predicted number of weekly working hours by 1.7 hours, while being at risk of depression decreases weekly working hours by 1.3 hours; while being diagnosed with depression decreases predicted earnings by almost $3,000, being at risk of depression decreases predicted earnings by only around $1,500.

Table 3: Effect of depression diagnosis and risk of depression on labor market outcomes

Variables	(1) Employment	(2) Working Hours	(3) Earnings	(4) Employment	(5) Working Hours	(6) Earnings
Diagnosed with depression	-0.051***	-1.746***	-2,980.35***			

	(0.014)	(0.660)	(882.99)			
At risk for depression				-0.021*	-1.291**	-1,521.87**
				(0.011)	(0.515)	(688.23)
Mean of dependent variable	0.788	31.802	27,578.73	0.788	31.795	27,564.94
Observations	13,905	13,895	13,639	13,918	13,906	13,650
R-squared	0.069	0.134	0.459	0.068	0.133	0.458
Number of respondents	5,944	5,944	5,914	5,946	5,945	5,916

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; All models employ individual and wave fixed effects and full set of controls; Other coefficients are omitted

Estimates of the coefficient on depression are all larger than those on the risk of depression, which is reasonable. Individuals who are at risk of depression, as screened by the CES-D, may not be depressed. They might experience symptoms of depression for short periods of time when they are under mental distress due to some temporary life event. Further analysis using whether the respondent had attempted suicide in the past 12 months supports the negative association between mental health and earnings, even though estimates are not significant. These results are shown in Table A3.

Results of the second equation to determine how sex is at play in the context of mental health and labor market outcomes are presented in Table 4. On average, worse mental health is predicted to reduce employment, work hours, and earnings by a larger amount for males than it does for females. Specifically, being diagnosed with depression decreases the predicted earnings by about $3,000 more for men than it does for women, and being at risk of depression decreases the predicted probability of being employed by 4.2 percentage points more for men compared to women. Both differences are statistically significant. Research shows that women suffer more

than men from depression (Eaton et al., 2012). However, women tend to seek the help they need to alleviate symptoms of depression while men do not due to social stigma. Thus, the larger negative effects for males could stem from the difference in how both sexes view mental health and how they use the resources available to manage mental disorder(s).

Table 4: Effect of mental health on labor market outcomes by sex

Variables	(1) Employment	(2) Working Hours	(3) Earnings	(4) Employment	(5) Work Hours	(6) Earnings
Diagnosed with depression	-0.043**	-1.253	-1,234.60			
	(0.017)	(0.795)	(1,046.96)			
Diagnosed with depression * Male	-0.023	-1.236	-3,241.72*			
	(0.031)	(1.412)	(1,867.21)			
At risk for depression				-0.002	-0.585	-1,299.24
				(0.014)	(0.655)	(861.54)
At risk for depression * Male				-0.042*	-1.640	-748.04
				(0.023)	(1.047)	(1,380.27)
Mean of dependent variable	0.788	31.801	27,575.25	0.788	31.795	27,561.46
Observations	13,904	13,894	13,638	13,917	13,905	13,649
R-squared	0.077	0.145	0.481	0.076	0.145	0.480
Number of respondents	5,943	5,943	5,913	5,945	5,944	5,915

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; All models employ individual and wave fixed effects and full set of controls; Other coefficients are omitted; Controls are all interacted with Male

Results of the third equation on race is shown in Table A4. Depression decreases the predicted probability of employment by 5.2 percentage points, decreases the weekly work hours

by 1.5 hours, and reduces earnings by $735 more for Blacks/African Americans compared to Whites. Differences in effects are not significant for this equation.

Table 5 reports the estimates of the effects of labor market outcomes by adolescent SES. None of the differences in effects are statistically significant. Furthermore, refining columns (1), (2), and (3) to the same sample and columns (4), (5), and (6) to the same sample yields similar directions on the difference in effects. Being depressed decreases the predicted probability of employment by 2.1 percentage points more for those with low SES during adolescence compared to those with higher SES; similarly, being at risk of depression decreases the predicted earnings by about $300 more for those low SES during adolescence compared to those who with higher SES. The other estimates indicate the opposite relationship – the labor market outcomes of those with low SES during adolescence are not as impacted by worse mental health compared to their counterparts.

Table 5: Effect of mental health on labor market outcomes with adolescent SES

Variables	(1) Employment	(2) Working Hours	(3) Earnings	(4) Employment	(5) Working Hours	(6) Earnings
Diagnosed with depression	-0.050***	-1.873***	-3,135.81***			
	(0.015)	(0.700)	(936.51)			
Diagnosed with depression * Low adolescent SES	-0.021	1.264	1,269.74			
	(0.049)	(2.265)	(2,991.75)			
At risk for depression				-0.025**	-1.485***	-1,569.32**
				(0.012)	(0.549)	(732.22)
At risk for depression * Low adolescent SES				0.035	2.043	-319.39

				(0.037)	(1.699)	(2,271.40)
Mean of dependent variable	0.788	31.803	27,637.96	0.788	31.797	27,623.91
Observations	13,703	13,694	13,440	13,716	13,705	13,451
R-squared	0.071	0.136	0.464	0.070	0.136	0.463
Number of respondents	5,846	5,846	5,816	5,848	5,847	5,818

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; All models employ individual and wave fixed effects and full set of controls; Other coefficients are omitted; Controls are all interacted with adolescent SES

It is possible that the observed positive differences in effects in columns regressions (2), (3), (4), and (5) arise from the difference in baseline labor market outcomes that the two groups of adolescent SES started out with. Employment outcomes are most likely to be worse for adolescents who grew up in an environment with lower SES compared to those who had above average SES in adolescence. Therefore, when adolescents with low SES grow into adults and are faced with mental health struggles, their labor market outcomes are less likely to decline due to the circumstances they already overcame and are accustomed to.

On the other hand, it is possible that the observed negative differences in effects in columns (1) and (6) arise from the passage of SES. The positive effects of high levels of adolescence SES continue into adulthood, and these individuals are also well-off. Thus, they may have more access to mental health services to alleviate symptoms of depression compared to others who do not have the same access to those resources in adulthood. Further analysis is needed to better understand the intricacies of this relationship and the direction of associations. Results of the effects of mental health on labor market outcomes by risk of depression during

adolescence are presented in Table A5, and there are no statistically significant differences in effects.

Conclusion

Estimates of the effects of diagnosed depression and being at risk of depression on several labor market outcomes such as employment, weekly work hours, and earnings support previous findings in the literature. While Frijters et al. (2010) find that a one standard deviation reduction in mental health leads to a decrease in the probability of labor force participation by 19 percentage points, this paper estimates that the transition into worse mental health (in context of depression) decreases the probability of being employed by an average of 2-5 percentage points. In general, this study finds substantially smaller estimates compared to other studies on the relationship between mental health and employment status.

Shortcomings on this study include the disadvantages of using a linear probability model (LPM) to estimate the binary outcome employment, the number of missing items from the CES-D, and reverse causality. The use of a LPM to predict the effect on employment comes with 2 main problems: (1) it assumes that the relationship between mental health and employment is linear and (2) it allows the interpretation of employment to be valid outside the range of possible values 0 and 1. Though LPM might have been useful in preliminary steps to get a sense of the relationship between mental health and employment, ultimately, other models (such as the logit model) may have given a better overall estimate. In addition, from the Add Health study, there is an inconsistent number of items from the CES-D between waves and many items missing in general. Since these items make up the risk of depression variable, it is very likely that this variable failed to capture the true sample of people who were actually at risk. The average score

of 0.8 applied to non-missing values needs to be re-evaluated to ensure that it is a consistent threshold given the missing values.

While individual and wave fixed effects and time-varying individual characteristics control for factors that might confound the association between mental health and labor market outcomes, there still exists the possibility of omitted variable bias. Hence, the estimates found in this paper can only be interpreted as the association between mental health and labor market outcomes and not as a causal relationship between the two. An example of an omitted variable that this paper fails to account for is migration. Moving is a stressor to most people due to social and financial implications, so migration and mental health are likely to be negatively correlated. However, people tend to move for better job opportunities, so migration and labor market outcomes are likely to be positively correlated. Therefore, the coefficients on mental health might have suffered from a downward bias and be smaller in magnitude than in reality.

Appendix

Table A1. Overview of public-use Add Health structure

	Wave I	Wave II	Wave III	Wave IV	Wave V
Year(s) collected	1994-1995	1996	2001-2002	2008-2009	2016-2018
Grade/Age of respondents	Grades 7-12	Grades 8-12	Ages 18-26	Ages 24-32	Ages 33-43
N	6,504	4,834	4,882	5,114	4,196

Table A2. Available items of CES-D, mean (standard deviation)

	Wave III (N=4,881)	Wave IV (N=5,113)	Wave V (N=4,189)	Total (N=14,183)
I was bothered by things that usually don't bother me.	0.53 (0.69)	0.53 (0.71)	. (.)	0.53 (0.70)
I felt that I could not shake off the blues even with help from my family or friends.	0.32 (0.64)	0.32 (0.64)	0.37 (0.70)	0.33 (0.66)
I felt that I was just as good as other people.	0.68 (0.92)	0.79 (0.88)	. (.)	0.73 (0.90)
I had trouble keeping my mind on what I was doing.	0.62 (0.75)	0.82 (0.79)	. (.)	0.72 (0.78)
I felt depressed.	0.33 (0.64)	0.38 (0.67)	0.40 (0.69)	0.37 (0.67)
I felt that everything I did was an effort.	0.63 (0.73)	0.87 (0.79)	. (.)	0.75 (0.77)
I was happy.	. (.)	0.85 (0.82)	0.95 (0.82)	0.89 (0.82)
I enjoyed life.	0.61 (0.81)	0.68 (0.79)	. (.)	0.65 (0.80)
I felt sad.	0.49 (0.67)	0.56 (0.66)	0.58 (0.67)	0.54 (0.67)
I felt that people dislike me.	0.26 (0.56)	0.29 (0.58)	. (.)	0.28 (0.57)

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; All models employ individual and wave fixed effects and full set of controls; Other coefficients are omitted

Table A3: Effect of suicide attempt on labor market outcomes

Variables	(1) Employment	(2) Working Hours	(3) Earnings
Attempted suicide in the past 12 months	-0.044	-0.514	-116.03
	(0.040)	(1.857)	(2,505.25)
Observations	13,673	13,662	13,416
R-squared	0.069	0.136	0.458
Number of respondents	5,912	5,911	5,882

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; All models employ individual and wave fixed effects and full set of controls; Other coefficients are omitted

Table A4: Effect of mental health on labor market outcomes by race

Variables	(1) Employment	(2) Working Hours	(3) Earnings	(4) Employment	(5) Working Hours	(6) Earnings
Diagnosed with depression	-0.080*	-1.845	-1,899.90			
	(0.041)	(1.895)	(2,538.02)			
Diagnosed with depression * White	0.044	0.442	-1,326.24			
	(0.044)	(2.048)	(2,741.00)			
Diagnosed with depression * Black/African American	-0.008	-1.061	-2,062.69			
	(0.055)	(2.525)	(3,384.10)			
At risk for depression				-0.029	-2.007	-1,336.81
				(0.028)	(1.312)	(1,749.82)
At risk for depression * White				0.004	0.444	-559.92
				(0.032)	(1.467)	(1,954.77)
At risk for depression * Black/African American				0.026	1.895	442.62
				(0.037)	(1.687)	(2,254.06)
Mean of dependent variable	0.788	31.794	27,583.03	0.787	31.787	27,569.20
Observations	13,868	13,858	13,603	13,881	13,869	13,614
R-squared	0.074	0.139	0.465	0.073	0.139	0.464
Number of respondents	5,926	5,926	5,896	5,928	5,927	5,898

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; All models employ individual and wave fixed effects and full set of controls; Other coefficients are omitted; Controls are all interacted with White and Black separately

Table A5: Effect of mental health on labor market outcomes by risk of depression during adolescence

Variables	(1) Employment	(2) Working Hours	(3) Earnings	(4) Employment	(5) Working Hours	(6) Earnings
Diagnosed with depression	-0.044**	-1.304	-3,565.34***			
	(0.018)	(0.805)	(1,072.14)			
Diagnosed with depression * Adolescent risk of depression	-0.018	-1.327	2,123.84			
	(0.031)	(1.408)	(1,877.07)			
At risk for depression				-0.020	-1.519**	-1,550.80*
				(0.014)	(0.631)	(837.33)
At risk for depression * Adolescent risk of depression				-0.002	0.745	-605.05
				(0.024)	(1.095)	(1,457.96)
Mean of dependent variable	0.788	31.807	27,587.40	0.788	31.801	27,573.59
Observations	13,890	13,880	13,624	13,903	13,891	13,635
R-squared	0.070	0.135	0.464	0.069	0.134	0.464
Number of respondents	5,935	5,935	5,905	5,937	5,936	5,907

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; All models employ individual and wave fixed effects and full set of controls; Other coefficients are omitted; Controls are all interacted with adolescent risk of depression

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