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Early-life mental disorders and adult household income in the World Mental Health Surveys

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Abstract

Background—Better information on the human capital costs of early-onset mental disorders could increase sensitivity of policy-makers to the value of expanding initiatives for early detection-treatment. Data are presented on one important aspect of these costs: the associations of early-onset mental disorders with adult household income.

Methods—Data come from the WHO World Mental Health (WMH) Surveys in eleven high income, five upper-middle income, and six low/lower-middle income countries. Information about 15 lifetime DSM-IV mental disorders as of age of completing education, retrospectively assessed with the WHO Composite International Diagnostic Interview, was used to predict current household income among respondents ages 18-64 (n = 37,741) controlling for level of education. Gross associations were decomposed to evaluate mediating effects through major components of household income.

Results—Early-onset mental disorders are associated with significantly reduced household income in high and upper-middle income countries but not low/lower-middle income countries, with associations consistently stronger among women than men. Total associations are largely due to low personal earnings (increased unemployment, decreased earnings among the employed) and spouse earnings (decreased probabilities of marriage and, if married, spouse employment and low earnings of employed spouses). Individual-level effect sizes are equivalent to 16-33% of median within-country household income, while population-level effect sizes are in the range 1.0-1.4% of Gross Household Income.

Conclusions—Early mental disorders are associated with substantial decrements in income net of education at both individual and societal levels. Policy-makers should take these associations into consideration in making healthcare research and treatment resource allocation decisions.

Keywords

epidemiology; mental disorders; early-onset; income; cross-national; WHO World Mental Health (WMH)

INTRODUCTION

Mental disorders are highly prevalent (1) and associated with substantial impairment (2, 3). One of the most striking aspects of this impairment is that personal earnings and household income are substantially lower among people with mental disorders than others (4-9). These decrements would be important if low income-earnings were *consequences* rather than *correlates* (6, 7), but evidence is far from definitive on this point due to possible reciprocal causation (10). Causal effects of low income on mental disorders have been documented in quasi-experimental studies of job loss (11) and time series studies of associations between unemployment rates and suicide rates (12). Studies of mental disorders predicting income-earnings have not controlled for these reciprocal effects.

Large-scale long-term evaluations of the effects of mental disorder treatment interventions on income-earnings would provide definitive evidence, but no such experiments exist. Suggestive evidence exists in longitudinal surveys that document associations of childhood mental disorders with subsequent educational attainment (13). Controlled treatment effectiveness trials also document significant effects of mental disorder treatment on short-term decreases in work disability and unemployment (14, 15). But such studies are incapable of estimating the more policy-relevant long-term effects of mental disorders on income-earnings (16).

One way to sort out the temporal order between mental disorders and income-earnings would be to take advantage of the fact most common mental disorders start in childhood or adolescence (17) and use prospective epidemiological data to study long-term associations between early-onset mental disorders and subsequent income-earnings. Several such studies exist. A recent US study found retrospectively recalled emotional problems before age 17 predicted 20% reduced household income among adults aged 25-53 (18). Two prospective New Zealand studies found recurrent depression at ages 16-21 predicted low income at ages 21-25 (19) and that mental disorders at ages 18-25 predicted low workforce participation and low income at age 30 (20). A longitudinal UK study found that psychological problems by age 16 predicted a 28% reduction in household income at age 50 (21).

Such results, while compelling, are limited to a small number of high-income countries and few measures of early mental disorders. Large-scale prospective epidemiological studies with appropriate time intervals and measures do not exist in most countries. However, widely-available cross-sectional epidemiological data could provide an approximation in associations of retrospective reports about early-onset mental disorders with subsequent income. Such data are presented here from surveys carried out in 22 countries through the WHO World Mental Health (WMH) Survey Initiative (22). We examine retrospectively reported lifetime disorders as of age of completing education to establish a temporal priority of disorders before income. Disorders with later onsets are ignored because of uncertainties about temporal priority with income. Gross associations are decomposed to evaluate indirect effects through employment, marriage, spouse employment, earnings, and other income. We control level of education because We want to determine whether disorders predict subsequent income over and above previously-documented associations of childhood-adolescent disorders with educational attainment (23).

METHODS

Samples

The 22 countries include six classified by the World Bank low/lower-middle (Colombia, India, Iraq, Nigeria, Peoples' Republic of China [PRC], and Ukraine), five upper-middle (Brazil, Bulgaria, Lebanon, Mexico, and Romania), and eleven higher (Belgium, Germany, Israel, Italy, Japan, Netherlands, New Zealand, Northern Ireland, Portugal, Spain, and the United States) income countries (24). All surveys were based on probability samples of the adult household population either nationally representative (most countries), representative of urbanized areas (Colombia, Mexico), or representative of regions of the country (Brazil, India, Japan, Nigeria, PRC). More details about sampling are provided elsewhere (25). The weighted (by sample size) average response rate across surveys was 72.5%.

All WMH interviews were administered face-to-face by lay interviewers trained and supervised using standardized procedures described elsewhere (26). Informed consent was obtained using procedures approved by local Institutional Review Boards. Interviews had two parts. Part I, administered to all respondents, assessed core mental disorders. All Part I respondents with any core mental disorder plus a probability sub-sample of other Part I

respondents were administered Part II, which assessed correlates and disorders of secondary interest. The income questions were in Part II. Part II data were weighted to adjust for under-sampling of Part II non-cases and residual discrepancies between sample and population distributions on socio-demographic/geographic variables. There were 57,929 Part II respondents across surveys. Analysis was limited to non-student non-retired respondents ages 18-64.

Measures

Mental disorders—Mental disorders were assessed with the WHO Composite International Diagnostic Interview (CIDI) Version 3.0 (27), a fully-structured interview that generates research diagnoses of common mental disorders according to both DSM-IV (used here) and ICD-10 criteria. The 15 disorders considered here include anxiety disorders (panic, generalized anxiety [GAD], social phobia, specific phobia, agoraphobia without panic, posttraumatic stress [PTSD], and separation anxiety), mood disorders (major depression/dysthymia and bipolar), disruptive behavior disorders (oppositional defiant, conduct, attention-deficit/hyperactivity, and intermittent explosive), and substance disorders (alcohol and illicit drug abuse). Methodological studies found CIDI diagnoses to have generally good concordance with blinded clinical diagnoses based on the Structured Clinical Interview for DSM-IV (28).

Alcohol and drug abuse were sub-typed into cases with and without dependence, resulting in 17 rather than 15 measures of disorder. However, alcohol and drug dependence among respondents without a history of abuse were not assessed in most surveys, making it impossible to generate total-sample dependence diagnoses. Abuse, not dependence, is consequently the focus of our analysis of substance use disorders. However, five WMH surveys assessed dependence without abuse (DWOA; Iraq, Northern Ireland, Portugal, Romania, Sao Paulo Brazil). DWOA made up relatively small proportions of all lifetime dependence (16.6% of alcohol dependence and 17.4% of drug dependence) and even smaller proportions of lifetime dependence as of age of completing education (2.2% of all lifetime alcohol dependence and 1.3% of all lifetime drug dependence). Given that DWOA was not assessed in the other WMH countries, these cases were excluded from the analyses in the five countries where it was assessed.

Income-earnings—Household income, personal earnings, and spouse earnings were assessed for the 12 months before interview. Earnings were defined as wages/stipends from employment excluding pensions, investments, financial assistance, and other sources of income. As in most community surveys, item-level non-response rate for income-earning questions was non-trivial (range 0.8–18.3%; inter-quartile range 2.2–7.0%) (7). Regression-based imputation was used to impute these missing values. Mental disorders were not strongly related to missing income-earning data.

Employment status—Respondents were asked if they were currently employed or self-employed, unemployed, disabled, homemakers, students, or retired. Students and retired were excluded from analysis.

Socio-demographic variables—Socio-demographics considered here include sex, education, and time since completing education. In addition to continuous years of education, categories were defined for no education, less than secondary education, completing secondary education, some post-secondary school, completed junior college or associate degree, completed some college beyond junior/associate college, and completed a college/university degree.

Analysis methods

Income-earnings reports were divided by median within-country values. These transformed scores were outcomes in regression analyses estimated simultaneously across all countries for associations of lifetime mental disorders as of respondent's age of completing education (henceforth referred to as *early-onset* disorders) with income-earnings, controlling sex, education, time since completing education, and country. Mental disorders with later onsets might also influence subsequent income, but we wanted to err on the side of caution in establishing temporal priorities of disorders with later income, leading to conservative estimates of predictive associations between mental disorders and subsequent income-earnings.

A major statistical problem was that income-earnings distributions were highly skewed, making ordinary-least-squares (OLS) regression analysis both biased and inefficient. Two statistical procedures address this problem. (*i*) Using two-part models, a first logistic regression model to predict any income-earnings and a second linear regression model to predict amount of income-earnings among those with any, and multiplies coefficients from these two models to create a composite estimate (29). (*ii*) Using one-part Generalized Linear Models (GLMs) with nonlinear link functions and complex error structures (30). Preliminary analyses using both procedures and standard fit comparisons (31) showed that one-part models with either log (total and other household income) or linear (personal and spouse earnings) link functions provided the best fit. (Detailed results of model comparisons are available on request.) Logistic regression models were estimated to predict dichotomous (yes-no) measures of work disability, employment among those not disabled, marriage, and spouse employment among the married.

As substantial comorbidity exists among mental disorders (32), we evaluated a number of non-additive model specifications among comorbid disorders. After determining a best-fitting model, the Population Attributable Risk Proportion (PARP) was calculated to represent proportional reduction in total income if early-onset mental disorders were eliminated based on the assumption that the regression coefficients represent causal effects (33). This was done using simulation methods described elsewhere (7). Briefly, though, coefficients in the regression equations predicted individual-level income twice for each respondent: once using actual predictor values and the second time assuming that none of the early-onset mental disorders existed. The ratio of the mean of these two income estimates defined PARP. Finally, effects of component outcomes (e.g., employment, earnings among the employed, marriage, spouse earnings, other income) on PARP were examined by repeating PARP calculations after controlling each component separately.

The design-based jack-knife repeated replications method (34) was used to estimate standard errors due to weighting and clustering of data in a series of SAS (35) macros. Statistical significance was consistently evaluated using .05-level, two-sided design-based tests.

RESULTS

Prevalence of early-onset mental disorders

Previous WMH reports presented DSM-IV/CIDI disorder lifetime prevalence estimates (17, 36). As in those earlier reports, preliminary analyses found that lifetime prevalence of any early-onset DSM-IV/CIDI disorder is highest in high income countries (21.5%), lowest in low/lower-middle income countries (11.7%), and intermediate in upper-middle income countries (17.1%). Disorder-specific prevalence estimates generally follow this same cross-national pattern. (Detailed prevalence estimates of individual early-onset disorders are available on request.)

Association of early-onset mental disorders with subsequent income-earnings

The best-fitting model for total household income is an additive model with a separate coefficient for each of the 15 mental disorders and 2 disorder subtypes (i.e., the subset of alcohol and drug abuse cases that also meet criteria for dependence). We also considered non-additive models including a model for number of disorders (henceforth referred to as the *number-of-disorders model*) and a series of more complex non-additive models with interactions between number and types of disorders. (Details of model fitting are available on request.) Although the additive model was the best-fitting model overall, the number-of-disorders model was the best-fitting model in most of the subgroups described below. As a result, the coefficients for both models are shown below.

While the additive model is significant overall in predicting total household income (χ^2_{17} = 60.5, p < .001), only two disorders (specific phobia and agoraphobia) are individually significant. (Table 1, Part I). These significant coefficients are both negative, a fairly consistent sign pattern across disorders (13 of 17 coefficients). As the model for total income is based on a log link function, exponentiated coefficients can be interpreted as ratios of expected incomes among respondents with versus without predictor disorders. Negative coefficients represent ratios less than 1.0. The -.04 coefficient for specific phobia and -.17 for agoraphobia represent income ratios of .96 and .84, respectively. The coefficients in the number-of-disorders model have a significant monotonic pattern where high comorbidity (four or more disorders) is associated with household income approximately 16% (1 – the antilog of the regression coefficient of -.18) lower than the national median. (Table 1, Part II)

Decomposition shows that early-onset mental disorders also significantly predict five of the seven components of income considered here. Two of these are continuous outcomes (Table 1): low personal earnings among the employed (χ^2_{17} = 67.4, p < .001) and, in the number-of-disorders model, low spouse earnings among married people with employed spouses (χ^2_5 = 15.1, p = .010). The other three are dichotomous outcomes (Table 2): increased probability of work disability (χ^2_{17} = 558.6, p < .001), decreased probability of employment if not disabled (χ^2_{17} = 102.0, p < .001), and decreased probability of being married (χ^2_{17} = 103.2, p < .001). The association with work disability is by far the strongest of these five, with 12 significant coefficients for individual disorders. The sign pattern shows that most early-onset mental disorders predict most components of low household income and that high comorbidity consistently has especially strong associations with these outcomes.

Early-onset mental disorders are associated in quite different ways with the other two components of household income -- other household income and probability of spouse employment. The model for other income is complex in that, although significant overall (χ^2_{17} = 27.8, p = .048), the sign pattern is weak (10 of 17 coefficients negative) and there is only one significant negative coefficient (alcohol abuse) along with two significant positive coefficients (major depression/dysthymia, oppositional-defiant disorder). The model to predict spouse employment is also significant (χ^2_{17} = 30.0, p = .026), but distinct from models for all other outcomes in that early-onset mental disorders are associated with a higher, not lower, probability of the outcome.

No single early-onset disorder stands out as accounting for most components of income. Fifteen of the 17 predictors of disorders or disorder subtypes have at least one significant coefficient across the seven outcomes and none has more than four significant coefficients across these outcomes. The two disorders with the highest number (four) of significant coefficients are major depression/dysthymia and social phobia. The four disorders that have three significant coefficients across outcomes are bipolar, specific phobia, agoraphobia with

or without panic disorder and alcohol abuse. All other significant disorders have only one or two significant coefficients.

Subgroup associations

We replicated the above analyses by sex and country income level. The best-fitting model in most cases was the number-of-disorders model. Based on this model, early-onset mental disorders significantly predict total household income separately among men and women in high income countries (χ^2_5 = 29.9-41.3, p < .001), only among women (χ^2_5 = 11.6, p = .041) in upper-middle income countries, and among neither men nor women in low/low-middle income countries (χ^2_5 = 5.5-6.2, p = .29-.36). (Table 3) As in the total sample, the sign pattern is largely negative in each significant sub-sample. High comorbidity is generally associated with the largest decrements in income, with household incomes in the range 16% (1 – the antilog of the regression coefficient of -.17) to 33% (1 – the antilog of the regression coefficient -.40) lower than the national medians among respondents with a history of highly comorbid early-onset disorders.

We also estimated models for income components in the same sub-samples. (Detailed results are available on request.) Considering each of these seven components separately among men and women and for men and women combined we have 21 equations for each set of countries. Early-onset mental disorders predict only two of these 21 significantly in low/lower-middle income countries (other income among men and in the total sample; χ^2_5 = 18.0-22.9, p = .003 - < .001), seven of 21 in upper-middle income countries (other income, disability, and spouse employment in the total sample; employed and being married among women and in the total sample; χ^2_5 =.11.1-20.5, p = .001-.049), and 20 of 21 in high income countries (all outcomes except personal earnings among men; χ^2_5 =.16.4-66.3, p = .006 - < .001). These significant sub-sample associations are consistently stronger than those in the total sample.

Population Attributable Risk Proportions (PARPs)

As noted above, PARP can be interpreted as the proportional reduction in total income that would be prevented if early-onset mental disorders were eliminated (either prevented or effectively treated) based on the assumption that the regression coefficients represent causal effects. PARP estimates show that early-onset mental disorders are associated with 1.1% of Gross Household Income (GHI) in the total sample, 1.4% in high income countries, 1.0% in upper-middle income countries, and 0.5% in low/lower-middle income countries. (Table 4) Percentages are consistently higher among women than men (1.2% vs. 0.8% in all countries combined; 0.6-1.6% vs. 0.4-1.2% in sub-sets of countries defined by income level). These are nontrivial proportions of GHI. To put them into perspective, we note that 1% of GHI in the US is equal to roughly $79 billion and that the latter is roughly equivalent to the entire annual budget of the US Department of Health and Human Services ($78 billion).

Estimates of decomposition percentages were obtained by recalculating PARP from Table 4 seven times, each time including in the prediction equation a control for one of the seven components of total family income, and comparing adjusted PARP estimates to total PARP estimates in Table 4 to calculate proportions of total PARP due to the controlled components. (See the footnote to Table 5 for a more detailed description.) As these components are interrelated and the decomposition controls separately for each one, the sum of percentage estimates across components adds to much more than 100%. (Table 5) Indeed, percentages of a few components exceed 100% due to sign reversals in residual associations. Data patterns should consequently be interpreted only in general terms. With this in mind, five broad observations can be made about the data patterns in the decomposition.

First, while decomposition percentages do not vary greatly across country income levels, they differ by sex, with PARP among men more than explained by personal earnings and PARP among women due roughly equally to spouse earnings and personal earnings. Second, consistent with these sex differences, PARP percentages associated with marriage and spouse employment are consistently higher among women than men, while PARP percentages due to personal disability and employment are consistently larger among men than women. Third, PARP percentages due to personal earnings are consistently larger than those due to employment. This means that early-onset disorders are associated not only with being employed but also with amount earned among the employed. Fourth, the ratio of PARP percentages associated with amount earned vs. being employed is higher for women (2.6-3.2) than men (1.4-1.6), meaning that amount earned by the employed is relatively more important than employment among women than men, presumably reflecting the fact that unemployment is more indicative of preexisting emotional problems among men than women. Fifth, other household income is of very little importance either for men or women in any country sub-sample.

DISCUSSION

The above results show that common early-onset mental disorders are strongly associated with low current household income after adjusting education, but that this association is considerably stronger in high income than upper-middle income countries and not significant at all in low/lower-middle income countries. It considering these differences, it is important to remember that “early-onset” is defined as onset prior to completing education. Given that level of educational attainment varies with country income level, the average age-of-onset of early-onset disorders is inversely related to country income level, which means that some part of the cross-national variation in strength of associations could be due to differences in age-of-onset. Further analyses in subsamples with a constant level of educational attainment could be carried out to compare effect sizes across countries, but this would also raise the issues of historical-cohort changes in levels of educational attainment within and across countries and differences in effects of early-onset disorders across different parts of the life course. Serious consideration of these issues exceeds the scope of a single paper.

We also found that association of early-onset mental disorders with current income varies by sex, that a wide variety of early-onset mental disorders are involved in these associations, and that the overall associations are mediated by a number of components. The relative importance of the components differs for men compared to women due to stronger associations with personal employment and earnings among men and of spouse employment and spouse earnings among women. In keeping with the fact that no single disorder has a dominant effect in accounting for these associations, significant individual-level coefficients were stronger for high comorbidity than for individual disorders.

Estimates of PARP were in the range 1.0-1.4% of total GHI in upper-middle and high income countries. These percentages might seem small, but are actually quite large in substantive terms. For example, 1% of GHI is more than twice the amount spent on all federal health research in the US. Importantly, these are *annual* costs averaged over the entire life course up through age 65 among people who had early-onset mental disorders with ages-of-onset typically in childhood or early-middle adolescence.

Results as dramatic as these naturally raise the question how much these losses could be averted through child-adolescent interventions to prevent and treat early-onset mental disorders. We don’t know. No large-scale, long-term interventions have ever been carried out to evaluate the long-term effects of broad-based interventions for early-onset mental

disorders on adult income-earnings. Diverse relevant interventions have been carried out that could be the subject of pooled long-term follow-ups to carry out such an evaluation (37-40) but this has never been done. The results presented here might provide a rationale for a pooled study of this sort. Even in the absence of such a study, though, the results make a strong inferential case that early-onset mental disorders are, if not important *causal* risk factors, at least important early risk *markers* (41) that should be the subject of greater focus as potentially valuable targets of early intervention to increase societal human capital. Prior WMH findings that early-onset mental disorders predict low educational attainment are also relevant in this regard (23).

The current results are limited by the WMH surveys not assessing psychosis, which has been found to be significantly related to income-earnings (42), alcohol and drug dependence without a history of abuse, or a number of other disorders that could be significant predictors of income-earnings. In addition, DSM categories might not capture the full relevant range of psychopathology in all countries studied. An additional measurement limitation is that mental disorders were assessed retrospectively with fully-structured interviews. Retrospective recall bias might have distorted prevalence estimates, while use of fully-structured rather than semi-structured clinical interviews might have introduced imprecision into estimates. While these measurement errors likely led prevalence estimates to be conservative, they could have introduced anti-conservative estimates of effects of these disorders on adult household income to the extent that people with low household income have less downward bias in disorder reports than other respondents. By ignoring disorders with later onsets we also ignored information about the chronicity of disorders. These decisions presumably make the PARP estimates more conservative than they would otherwise have been.

The measures of income-earnings are also limited in two ways. First, item-level missing data rates were high for these questions. Although we used a sophisticated imputation method to address this problem and found that mental disorders were not strongly related to missing income-earning data, this missing data problem raises concerns about the external validity of findings. Second, we did not assess either *informal* economic activity (i.e., barter) or production by household members for their own final use (e.g., subsistence agricultural). Although conceptual and operational challenges exist in expanding the assessment of economic activity to include these components, progress has been made in developing international standards for doing so that should be used to expand the outcomes in future studies (43). This expansion might be especially important in low income countries, where our analysis failed to find significant economic effects of early-onset mental disorders.

Another potentially important anti-conservative limitation involving measurement is that unmeasured common causes were not controlled. The only way to correct this problem definitively would be through analysis of long-term effects of child-adolescent experimental interventions, adding additional support for pooled long-term follow-ups of previously conducted child-adolescent interventions. It would also be valuable to carry out long-term prospective naturalistic studies in countries at different developmental stages and with different cultures both to confirm the present findings longitudinally and to trace out developmental pathways linking early-onset mental disorders with the components of total household income examined here.

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Table 1

Regressions of total family income and continuous income component measures on type and number of early-onset mental disorders among WMH respondents who were 18-64 years old at the time of interview[1]

	Total household income	Personal earnings among the employed	Spouse earnings among those with an employed spouse	Other Household income
	Est (SE)	Est (SE)	Est (SE)	Est (SE)
I. Mental disorders [2]				
Mood disorders				
Major depression or dysthymia	−.02 (.02)	−.06* (.02)	.01 (.04)	.11* (.04)
Broad spectrum bipolar disorder	−.08 (.05)	−.02 (.06)	−.03 (.08)	.09 (.09)
Anxiety disorders				
Panic disorder	−.02 (.05)	−.07 (.07)	−.08 (.07)	.11 (.08)
Generalized anxiety disorder	−.04 (.05)	−.02 (.05)	.04 (.10)	−.03 (.08)
Social phobia	−.02 (.02)	−.01 (.03)	−.00 (.04)	−.07 (.04)
Specific phobia	−.04* (.02)	−.05 (.03)	−.09* (.04)	.02 (.04)
Agoraphobia without panic	−.17* (.06)	−.25* (.06)	−.22 (.13)	−.01 (.09)
Post-traumatic stress disorder	−.07 (.04)	.00 (.05)	.01 (.06)	−.13 (.09)
Separation anxiety disorder	−.03 (.03)	−.02 (.04)	−.02 (.05)	.05 (.06)
Disruptive behavior disorders				
Oppositional-defiant disorder	.05 (.03)	.04 (.05)	−.04 (.07)	.16* (.07)
Conduct disorder	−.02 (.04)	−.03 (.04)	.07 (.08)	−.03 (.07)
Attention/deficit-hyperactivity disorder	.03 (.03)	.03 (.04)	−.03 (.09)	−.02 (.09)
Intermittent explosive disorder	.04 (.03)	.05 (.03)	.00 (.06)	−.03 (.06)
Substance disorders				
Alcohol abuse[3]	−.04 (.03)	.01 (.04)	−.03 (.06)	−.14* (.07)
Alcohol abuse with dependence	−.08 (.06)	−.08 (.06)	−.08 (.11)	−.04 (.12)
Drug abuse[3]	−.03 (.04)	−.08 (.05)	−.10 (.09)	.10 (.09)
Drug abuse with dependence	.01 (.07)	.01 (.08)	.03 (.13)	−.04 (.13)
χ^2_{17} [4]	60.5*	67.4*	21.9	27.8*
χ^2_{16} [5]	29.6*	44.4*	11.2	26.5*
II. Number of disorders [2]				
Exactly 1 disorder	−.02 (.02)	−.02 (.02)	−.03 (.03)	.00 (.03)
Exactly 2 disorders	−.02 (.02)	−.01 (.03)	.01 (.04)	−.03 (.04)
Exactly 3 disorders	−.08* (.03)	−.10* (.03)	−.11 (.07)	.06 (.06)
Exactly 4 disorders	−.18* (.04)	−.09 (.06)	−.18 (.10)	−.01 (.08)
5+ disorders	−.18* (.04)	−.17* (.05)	−.26* (.07)	.07 (.07)
χ^2_5 [4]	40.0*	22.4*	15.1*	2.7
(n)	(37,741)	(25,460)	(18,213)	(37,741)

*Significant at the 0.05 level, two-sided test

[1]Based on GLM multiple regression models with controls for country, sex, level of education, and time since completing education estimated in all countries other than New Zealand and Ukraine. The latter countries were excluded because the surveys in these countries did not assess components of family income. The equations for total household income and other income use a log link function and Poisson error variance structure, while the equations for personal earnings among the employed and spouse earnings among those with an employed spouse use a linear link function and normally distributed error structure. Exponentiated values of the log link function coefficients can be interpreted as the ratio of expected incomes among respondents with versus without the predictor disorder. For example, coefficients of −.05, −.10, − .15, and −.20 represent mean income ratios of .95, .90, .86, and .82 among respondents with versus without the predictor disorder. The linear link function coefficients, in comparison, can be interpreted as the mean income difference between respondents with versus without the predictor disorder.

[2]The results in Parts I and II are for two different models. The first model has a separate dummy predictor variable for each mental disorder assessed in the surveys. The second model includes a set of dummy predictor variables for the number of disorders the respondent had without distinguishing types of disorders. We also investigated models that included predictors for both type and number of disorders as well as models that included interactions between type and number of disorders, but the less complex models shown here out-performed those other models.

[3]With or without dependence

[4]Joint significance of the coefficients associated with the disorders assessed in the model

[5]Significance of differences among the coefficients associated with the disorders assessed in the model

Table 2

Logistic regressions of dichotomous income component measures on type and number of early-onset mental disorders among WMH respondents who were are 18-64 years old at the time of interview[1]

	Disabled	Employed	Married	Spouse employed among the married
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
I. **Mental disorders**[2]				
Mood disorders				
Major depression or dysthymia	2.0* (1.7-2.3)	0.9 (0.8-1.0)	0.7* (0.6-0.8)	1.1 (0.9-1.3)
Broad spectrum bipolar disorder	2.5* (1.8-3.5)	0.7* (0.5-0.9)	0.7* (0.5-0.9)	0.8 (0.5-1.4)
Anxiety disorders				
Panic disorder	1.5* (1.1-2.0)	0.7* (0.6-1.0)	0.8 (0.6-1.1)	1.0 (0.6-1.6)
Generalized anxiety disorder	1.9* (1.4-2.4)	0.6* (0.5-0.8)	0.9 (0.7-1.2)	1.0 (0.7-1.6)
Social phobia	1.4* (1.2-1.7)	0.9* (0.8-1.0)	0.8* (0.7-1.0)	1.3* (1.1-1.6)
Specific phobia	1.6* (1.4-1.8)	0.9* (0.8-1.0)	0.9 (0.8-1.1)	1.1 (1.0-1.3)
Agoraphobia without panic	2.1* (1.5-3.0)	0.7 (0.5-1.0)	0.6* (0.5-0.9)	0.6 (0.4-1.0)
Post-traumatic stress disorder	2.0* (1.6-2.5)	0.8 (0.7-1.1)	1.0 (0.8-1.4)	0.8 (0.6-1.2)
Separation anxiety disorder	1.3* (1.0-1.6)	1.0 (0.8-1.1)	1.0 (0.8-1.1)	1.0 (0.8-1.4)
Disruptive behavior disorders				
Oppositional-defiant disorder	1.1 (0.7-1.5)	0.9 (0.7-1.2)	1.0 (0.8-1.2)	1.4 (0.9-2.0)
Conduct disorder	1.7* (1.1-2.6)	0.8 (0.6-1.1)	1.2 (0.9-1.5)	1.1 (0.8-1.7)
Attention-deficit/hyperactivity disorder	1.9* (1.2-3.0)	1.3 (1.0-1.7)	1.1 (0.9-1.3)	1.0 (0.7-1.5)
Intermittent explosive disorder	1.0 (0.8-1.3)	1.0 (0.8-1.3)	1.3* (1.1-1.5)	1.3 (1.0-1.7)
Substance disorders				
Alcohol abuse[3]	1.0 (0.8-1.3)	0.8* (0.6-1.0)	0.8 (0.7-1.0)	1.5* (1.1-2.0)
Alcohol abuse with dependence	1.6* (1.1-2.3)	0.7 (0.4-1.1)	0.8 (0.6-1.2)	0.6* (0.4-0.9)
Drug abuse[3]	1.2 (0.9-1.7)	0.9 (0.7-1.3)	1.0 (0.7-1.2)	1.1 (0.7-1.5)
Drug abuse with dependence	0.8 (0.5-1.4)	1.6 (0.9-2.8)	0.9 (0.6-1.4)	1.0 (0.5-2.2)
χ^2_{17}[4]	558.6*	102.0*	103.2*	30.0*
χ^2_{16}[5]	87.1*	34.3*	58.7*	30.4*
II. Number of disorders[2]				
Exactly 1 disorder	2.1* (1.9-2.4)	0.8* (0.8-0.9)	0.9* (0.8-1.0)	1.1 (1.0-1.3)
Exactly 2 disorders	3.1* (2.6-3.7)	0.7* (0.6-0.8)	0.8* (0.7-0.9)	1.3* (1.1-1.6)
Exactly 3 disorders	4.4* (3.5-5.5)	0.7* (0.5-0.9)	0.7* (0.6-0.9)	1.4 (1.0-1.8)
Exactly 4 disorders	5.9* (4.5-7.8)	0.5* (0.4-0.7)	0.6* (0.5-0.8)	1.5 (0.9-2.4)
5+ disorders	7.1* (5.5-9.2)	0.5* (0.4-0.6)	0.7* (0.5-0.8)	1.5 (1.0-2.2)
χ^2_{5}[4]	466.4*	74.5*	32.9*	16.0*
(n)	(44,527)	(37,741)	(37,741)	(26,103)

*Significant at the 0.05 level, two-sided test

1Based on a multiple logistic regression model with controls for country, sex, level of education, and time since completing education estimated in all countries. Unlike the analyses in Table 1, New Zealand and Ukraine were included in the analyses reported in this table. This accounts for the larger total sample size here (n = 44,527) than in Table 1 (n = 37,741).

2The results in Parts I and II are for two different models. The first model has a separate dummy predictor variable for each mental disorder assessed in the surveys. The second model includes a set of dummy predictor variables for the number of disorders the respondent had without distinguishing types of disorders. We also investigated models that included predictors for both type and number of disorders as well as models that included interactions between type and number of disorders, but the less complex models shown here out-performed those other models.

3With or without dependence

4Joint significance of the coefficients associated with the disorders assessed in the model

5Significance of differences among the coefficients associated with the disorders assessed in the model

Table 3

Associations of number of early-onset mental disorders predicting total household income in sub-samples defined by sex and country income level[1]

	Number of disorders						
	Exactly 1 disorder	Exactly 2 disorders	Exactly 3 disorders	Exactly 4 disorders	5+ disorders	χ^2_5[2]	(n)
	Est (SE)	Est (SE)	Est (SE)	Est (SE)	Est (SE)		
I. Low/lower-middle income countries							
Men	.02 (.05)	.18*(.08)	.04 (.16)	−.15 (.18)	−.38 (.41)	6.2	(5,654)
Women	.00 (.04)	.06 (.10)	−.24*(.12)	−.10 (.12)	−.20 (.42)	5.5	(6,508)
Total	.01 (.03)	.11 (.07)	−.08 (.12)	−.13 (.10)	−.32 (.30)	6.9	(12,162)
II. Upper-middle income countries							
Men	.00 (.06)	.17*(.07)	−.07 (.12)	.17 (.14)	−.17 (.13)	10.2	(3,310)
Women	−.03 (.15)	.07 (.06)	−.09 (.09)	−.04 (.16)	−.40*(.17)	11.6*	(4,745)
Total	−.02 (.04)	.11*(.04)	−.09 (.07)	.10 (.09)	−.26*(.10)	21.0*	(8,055)
III. High income countries							
Men	−.04 (.03)	−.16*(.03)	−.13*(.04)	−.21*(.08)	−.10 (.05)	41.3*	(7,600)
Women	−.04 (.02)	−.07 (.04)	−.03 (.05)	−.29*(.07)	−.30*(.07)	29.9*	(9,924)
Total	−.04*(.02)	−.11*(.03)	−.08*(.03)	−.25*(.04)	−.17*(.04)	57.7*	(17,524)
IV. All countries							
Men	−.02 (.02)	−.03 (.03)	−.10*(.04)	−.11 (.06)	−.11*(.05)	10.9	(16,564)
Women	−.03 (.02)	−.01 (.03)	−.06 (.04)	−.23*(.06)	−.30*(.07)	28.9*	(21,177)
Total	−.02 (.02)	−.02 (.02)	−.08*(.03)	−.18*(.04)	−.18*(.04)	40.0*	(37,741)

*Significant at the 0.05 level, two-sided test

[1]Based on GLM multiple regression models with controls for country, level of education, time since completing education, and sex (in the models that combine men and women) estimated in all countries other than New Zealand and Ukraine. See Footnote 1 in Table 1 for the rationale for excluding these two countries. The equations all use a log link function and Poisson error variance structure. Exponentiated values of the coefficients can be interpreted as the ratio of expected incomes among respondents with versus without the predictor disorder. For example, coefficients of −.05, −.10, −.20, and −.30 represent mean income ratios of .95, .90, .82, and .74 among respondents with versus without the predictor disorder.

[2]Joint significance of the coefficients associated with the disorders assessed in the model

Table 4

Population Attributable Risk Proportions (PARPs) of early-onset mental disorders predicting total household income in sub-samples defined by sex and country income level[1]

	PARP		
Countries	**Men**	**Women**	**Total**
Low/lower-middle income	0.4	0.6	0.5
Upper-middle income	0.7	1.1	1.0
High income	1.2	1.6	1.4
All	0.8	1.2	1.1

[1]The entries in this table are based on simulations using parameters from the models described in Footnotes 1-2 of Table 1. The outcome is total household income. See the text for a description of the simulation methods.

Table 5

Percentage of PARP estimates associated with each of seven components of total household income[1]

Country income level	Components of total household income							
	Disability	Employment	Marriage	Spouse employment	Personal earnings	Spouse earnings	Other household income	(n)
I. Men								
Low/lower-middle	63.9	86.4	19.8	0.5	122.3	−0.5	23.2	(5,654)
Upper-middle	58.4	83.7	19.9	3.8	119.0	4.6	18.2	(3,310)
High	51.8	76.0	18.8	7.4	118.3	11.7	6.1	(7,600)
All countries	54.9	78.9	19.2	5.8	119.0	8.7	10.3	(16,564)
II. Women								
Low/lower-middle	46.0	24.3	33.0	39.1	76.8	65.8	−8.8	(6,508)
Upper-middle	44.9	22.9	30.4	36.9	65.3	64.8	−2.8	(4,745)
High	39.1	20.4	26.0	31.9	53.2	56.9	5.3	(9,924)
All countries	41.2	21.4	28.0	34.2	58.6	60.0	1.3	(21,177)
III. Men and women combined								
Low/lower-middle	50.8	52.5	26.1	11.8	103.3	26.7	4.7	(12,162)
Upper-middle	48.0	49.0	25.0	13.7	94.9	28.4	6.4	(8,055)
High	43.2	43.0	22.8	15.4	85.7	31.0	4.9	(17,524)
All countries	45.2	45.5	23.9	14.8	90.0	30.2	4.7	(37,741)

[1]The simulations in Table 4 were rerun seven times, each time with a control for one of the seven components of total household income. The entries here are equal to 100% minus the ratio of the simulation with the additional control over the corresponding simulation from Table 4 (i.e. without the additional control). These numbers represent the percent of PARP explained by the additional control. For example, if disorders no longer predicted total household income at all after controlling for a given component, the entry would be 100%, indicating that the control fully accounts for the PARP. If the addition of a control reverses the sign of disorders predicting total household income, the entry in Table 5 will be greater than 100%. If the addition of the control makes the association between disorders and household income stronger (i.e. more negative), the entry on Table 5 will be negative.