



## King's Research Portal

DOI:

[10.1186/s12939-019-1020-4](https://doi.org/10.1186/s12939-019-1020-4)

*Document Version*

Publisher's PDF, also known as Version of record

[Link to publication record in King's Research Portal](#)

*Citation for published version (APA):*

Hailemichael, Y., Hanlon, C., Tirfessa, K., Docrat, S., Alem, A., Medhin, G., Fekadu, A., Lund, C., Chisholm, D., & Hailemariam, D. (2019). Mental health problems and socioeconomic disadvantage: a controlled household study in rural Ethiopia. *International journal for equity in health*, 18(1), Article 121. <https://doi.org/10.1186/s12939-019-1020-4>

### **Citing this paper**

Please note that where the full-text provided on King's Research Portal is the Author Accepted Manuscript or Post-Print version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version for pagination, volume/issue, and date of publication details. And where the final published version is provided on the Research Portal, if citing you are again advised to check the publisher's website for any subsequent corrections.

### **General rights**

Copyright and moral rights for the publications made accessible in the Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the Research Portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the Research Portal

### **Take down policy**

If you believe that this document breaches copyright please contact [librarypure@kcl.ac.uk](mailto:librarypure@kcl.ac.uk) providing details, and we will remove access to the work immediately and investigate your claim.

RESEARCH

Open Access



# Mental health problems and socioeconomic disadvantage: a controlled household study in rural Ethiopia

Yohannes Hailemichael<sup>1,2\*</sup>, Charlotte Hanlon<sup>3,4,9</sup>, Kebede Tirfessa<sup>3</sup>, Sumaiyah Docrat<sup>5</sup>, Atalay Alem<sup>3</sup>, Girmay Medhin<sup>6</sup>, Abebaw Fekadu<sup>3,8,9,10</sup>, Crick Lund<sup>4,5</sup>, Dan Chisholm<sup>7</sup> and Damen Hailemariam<sup>1</sup>

## Abstract

**Background:** There is a lack of high quality population-based studies from low- and middle-income countries examining the relative economic status of households with and without a member with a mental health problem. The aim of the study was to explore the socio-economic status of households with a person with severe mental disorder (SMD; psychosis or bipolar disorder) or depression compared to households without an affected person.

**Methods:** A population-based, comparative, cross-sectional household survey was conducted in Sodo district, south Ethiopia, between January and November 2015. Two samples were recruited, each with its own comparison group. Sample (1): households of 290 community-ascertained persons with a clinician-confirmed diagnosis of SMD and a comparison group of 289 households without a person with SMD. Sample (2): households of 128 people who attended the primary health care centre and who were identified by primary care staff as having a probable diagnosis of depressive disorder; and comparison households of 129 patients who attended for other reasons and who did not receive a diagnosis of depression. Household socioeconomic status (household income, consumption and asset-based wealth) was assessed using a contextualized version of the World Health Organization (WHO) Study on global Ageing and adult health (SAGE) questionnaire. Each disorder group (SMD and depression) was further divided into higher and lower disability groups on the basis of median score on the WHO Disability Assessment Schedule.

**Results:** Households of a person with SMD who had higher disability were more likely to have a poorer living standard (no toilet facility;  $p < 0.001$ ). Having a reliable source of regular income was significantly lower in households of a person with SMD ( $p = 0.008$ ) or depression ( $p = 0.046$ ) with higher disability than the comparison group. Households of persons with SMD with higher disability earned less ( $p = 0.005$ ) and owned significantly fewer assets ( $p < 0.001$ ) than households without SMD. Households including persons with depression who had higher disability had lower income ( $p = 0.042$ ) and reduced consumption ( $p = 0.048$ ).

**Conclusions:** Households with a member who had either SMD or depression were socioeconomically disadvantaged compared to the general population. Moreover, higher disability was associated with worse socio-economic disadvantage. Prospective studies are needed to determine the direction of association. This study indicates a need to consider households of people with SMD or depression as a vulnerable group requiring economic support alongside access to evidence-based mental healthcare.

**Keywords:** Socio-economic status, Severe mental disorder, Depression

\* Correspondence: [yohannes.h.michael@gmail.com](mailto:yohannes.h.michael@gmail.com)

<sup>1</sup>Department of Reproductive Health and Health Services Management, School of Public Health, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia

<sup>2</sup>Department of Health Economics, Policy and Management, College of Health Sciences, Jimma University, Jimma, Ethiopia

Full list of author information is available at the end of the article



## Introduction

In the seminal paper of Faris and Dunham in 1939 [1], an inverse relationship between socioeconomic status and rates of schizophrenia was identified. It has been argued that mental health problems make an important contribution to inequality in socioeconomic status across populations [2–4]. People living with severe mental disorders (SMD), including psychotic disorders, such as schizophrenia and bipolar disorder, are thought to drift into poverty as a consequence of factors such as reduced income, increased medical and transport costs, and lost productivity [5]. The economic effects of SMD extend beyond the individual with a mental health problem to adversely impact household income [6]. Household members may devote time to provide care and support, diminishing their own opportunities to work [7], in turn affecting their income, and thus further increasing the risk of household poverty [6]. Depression, on the other hand, is perceived to be less associated with enduring disability compared to SMD, although has been associated with increased health care expenditure and reduced work productivity [8–10]. However, in several population-based studies conducted in high-income countries, there was weak and inconsistent evidence of an association between common mental disorders (including depression) and low socio-economic status [11–13].

There is inadequate information on the household socioeconomic status of people with SMD or depression in low-income countries due to methodological limitations of the studies to date. The few studies that have been conducted globally have linked SMD and depression to low socioeconomic status or poverty [2, 14, 15]. People with mental disorders have a lower income when compared to those without mental disorder [16], are more likely to live in rented and poor-quality housing [17], have lower educational status [18, 19], suffer from greater indebtedness [20, 21], have greater food insecurity [22, 23], be less likely to have any savings [24] and more likely to live in poverty [15]. The effect of poor mental health can extend to reduced consumption of food, and lower expenditure on clothes and durable goods at the household level [25]. The limitation of most existing studies is that they are facility-based (in settings where most people with mental health problems do not access care), have been conducted in middle-income rather than low-income country settings and do not examine the relative impact of depression vs. SMD in the same study.

Sustainable Development Goals one and 10 give strong emphasis to the importance of equitable development, equal rights to economic resources and the inclusion of marginalized and vulnerable groups within the population [26]. The inconsistent and limited evidence base regarding poverty and mental health in low-income country

population samples limits advocacy efforts to ensure households with persons with mental health problems are given due attention. There is, therefore, a pressing need for high quality population-based studies using contextualized and comprehensive evaluations of socioeconomic status of households of persons with mental health problems living in low-income countries.

The study reported in this paper is part of the cross-country Emerald programme (Emerging mental health systems in low- and middle-income countries) which sought to provide rigorous, population-based evidence about the adequacy and fairness of mental healthcare financing [27]. This study was conducted at the baseline of the PRogramme for Improving Mental health care (PRIME), when no mental health care was available in the district; but mental health care was about to be integrated into primary care using a task-sharing model [28]. The objective was to compare the socio-economic status of households with persons with SMD or depression to households without these disorders in a rural Ethiopian setting.

## Methods

### Study design

A population-based, comparative, cross-sectional household survey was conducted in Sodo district, south Ethiopia, between January and August 2015 for the SMD cohort and March to November 2015 for the depression cohort.

### Setting

Sodo district is one of 15 districts in the Gurage Zone of Ethiopia. Administratively, the district is structured into 58 sub-districts (*kebeles*), with an estimated total population of 161,952, of whom around 90% reside in rural areas [29]. The economically active population is estimated to be 67.3%; 70.6% in the rural areas and 41.5% in urban areas [30]. The livelihoods of the population depend on agriculture, primarily farming and livestock rearing. During the data collection period, health services in the district were being delivered through eight health centers and 58 community health posts. The health post is staffed by community health extension workers and the health center by health officers, nurses, midwives, environmental officers and pharmacy technicians [31]. Sodo district was selected by PRIME and Emerald projects because it was mostly rural (in keeping with the rest of Ethiopia), included both highland and lowland topography, was accessible from Addis Ababa and neighbored a district where a psychiatric nurse-led out-patient unit was available [31].

### Sample size and participants

The sample size for the case cohorts were determined to address different objectives set within the PRIME and Emerald studies [23]. For the household cohorts, the

sample was powered to detect a difference in household income. Comparison groups for the SMD study and the depression study were recruited with a ratio of 1:1 to the corresponding case groups.

See Additional file 1: Figures S1 and S2 for the detailed recruitment procedure. For sample 1 (SMD study), community health extension workers, leaders, and lay data collectors who resided in the area were trained for half a day in typical presentations of SMD in this setting and then asked to identify people with possible SMD and refer them to the local primary care health centre. This approach to case ascertainment for SMD was used previously in the neighboring district and found to be sensitive [32]. The sample for the SMD study comprised community-ascertained people with possible SMD who attended the local health centre for treatment and were confirmed to have SMD (schizophrenia or other primary psychotic disorder, bipolar disorder or major depressive disorder with psychotic features) by psychiatric nurses using a semi-structured clinical interview (Operational Criteria for Research, OPCRIT) [33]. A comparison group of households was selected randomly from a sampling frame of a census of all households in the district which was carried out by PRIME [34]. The comparison household was matched to the household of the person with SMD on the basis of respondent characteristics (household head vs. other position in household), age ( $\pm 5$  years), gender, *gott* (lowest level of residential area) and household size.

Sample two (depression study) comprised households of people attending the health centre who were identified by primary care staff as either having a probable diagnosis of depressive disorder or who screened positive on the Patient Health Questionnaire, nine item version (PHQ-9) and were thought to require treatment. The PHQ-9 was developed originally to identify probable depression in primary care samples in the US [35]. The PHQ-9 has been validated in Ethiopia in an urban teaching hospital out-patient clinic [36] and in primary care attendees in health centres in a district neighboring the location of the current study [37]. The comparison sample for the depression study comprised households of people who attended the health centre on the same day as the person with depression but who did not have a primary care worker diagnosis of depression and who had a PHQ score  $< 5$ , matched by gender, age ( $\pm 5$  years) and *gott*. The justification for selecting the comparison group from the facility rather than the community was so that the comparison sample was drawn from the base population that gave rise to the cases in order to minimize selection bias.

People attending the health centre with SMD, depression or no depression (facility comparison) were asked to give consent to visit their home. In the event that the person lacked capacity to consent, the caregiver was asked

to give consent for the home visit. For the household interviews, the primary respondent was the household head, aged 18 years and above, who was willing to participate and provide consent. When the household head was absent for interview after three visits, a spouse or adult member of the household who was knowledgeable about the household economic status was interviewed.

## Measurements

### Data collection and definitions

Outcome data were collected using an adapted and abbreviated version of the World Health Organization ERC-approved SAGE (Study of global AGEing and adult health) survey instrument. SAGE was used previously in a study on health and ageing in six LMICs [38].

Data on income and consumption expenditure were systematically collected for different time periods (weekly, monthly and annually) as applicable, and converted into standardized comparable time periods. Modifications were made to ensure contextual validity. For example, locally and culturally valued assets were identified for both urban and rural settings with the goal of distinguishing poor, middle and wealthier households.

Data collection from the case and the comparison households was conducted as close in time as possible, and not longer than 4 weeks apart.

### Outcome variables (dependent variables)

Household socio-economic status was the primary outcome (income, consumption and asset possession). Socio-economic status refers to the social and economic factors that influence what position individuals or groups hold within the structure of a society [39]. Therefore, no single measure of socio-economic status will be ideal for all studies and contexts [39, 40]. Hence, in this study we aimed to examine multi-dimensional aspects of socio-economic status, based on household income, consumption and asset-based wealth.

Household income and consumption were estimated in terms of Ethiopian Birr and converted to US dollars (US\$). The average 2015 exchange rate of 20.69 Ethiopian Birr (ETB) to US\$1 was used [41]. In order to account for differences in household size and composition, total household income and consumption were made equivalent ('equivalised') using the OECD-modified scale [42, 43]. Using the household headcount, the scale assigns a value of 1 to the household head, of 0.5 to each additional adult member and of 0.3 to each child [42, 43]. By dividing household income and consumption by the OECD scale, these equivalised values can be expressed and compared based on income and consumption per adult equivalent.

The multi-dimensional measures of socioeconomic status used in this study were estimated as follows:

- I. Household income from a range of sources (i.e., income from wages, rental property, trade, farming, savings and grants, transfers from families, community groups, and government and from other sources) were summed and adjusted for household size and composition using the OECD-modified scale [42, 43]. The resulting household income was categorized into five quintiles.
- II. Household consumption (i.e., consumption of food produced by the household or purchased in the market place or given in kind to the household, consumption of non-food items for daily use, consumption of consumer durables, consumption of health care goods, consumption related to transfers out to household or community) were summed for each household and adjusted for household size and age using the OECD-modified scale. The resulting household consumption was then classified into five consumption quintiles.
- III. An asset-based index was constructed on the basis of multiple correspondence analyses (MCA) using 35 items that included housing characteristics and sanitation facilities, access to basic services, ownership of a range of durable assets, household amenities and livestock. MCA is used to analyze a set of observations described by a set of nominal and quantitative variables and imposes fewer constraints on the data compared to principal component analysis [44].

#### Primary exposure variable

The primary exposure was whether a household included a person with a mental health problem (SMD or depression) or not (comparison households).

#### Covariates

Demographic variables included: household size, age, sex, marital status of the household head, and *gott*. Education was measured in terms of literacy, completed years of formal education and qualifications attained. Household size was measured by the total number of people who lived in the household (defined as those people who usually stay in the household, share meals (eat out of the same cooking pot), spends more than 4 months a year living there, or who usually stay there but are away currently for a short time).

Household composition reflects the number of children < 15 years and the number of adults in the household. This information used to make each member equivalent by weighting each according to their age, using the so-called modified OECD equivalence scale [42, 43].

The head of a household is a person who economically supports or manages the household or, for reasons of

age or respect, is considered as a head by members of the household or declares themselves to be head of a household. The head of a household could be male or female.

#### SMD and depression severity measures

##### WHODAS-ii

Disability was assessed using the 36-item fully structured interviewer administered version of the World Health Organization Disability Assessment Schedule second version (WHODAS-II) [45]. WHODAS-II assesses the level of disability and the number of days lost from work in the past 30 days due to health conditions. The WHODAS-II consists of six domains: mobility, self-care, life activities, understanding and communicating, interpersonal interactions, and participation in society. Total WHODAS-II scores range from zero to 100, with higher numbers indicating greater impairment of day-to-day functioning [45]. The Amharic version of this instrument was validated for people with SMD in Ethiopia previously [46–48]. For this study, people enrolled in the SMD or depression cohorts were classified into two groups based on the median of the WHODAS-II polytomous summary score, with the hypothesis that greater disability would be associated with greater socioeconomic disadvantage: Hence, for SMD cohort (A) higher disability (WHODAS-II score  $\geq 52.7$ ); (B) lower disability (WHODAS-II score  $< 52.7$ ). For the depression cohort (A) Depression with higher disability (WHODAS-II score  $\geq 33.3$ ); (B) Depression with lower disability (WHODAS-II score  $< 33.3$ ).

#### Data collection and training

The household socioeconomic interview was administered by lay interviewers who had completed secondary school education and were experienced in data collection. The lay interviewers received 2 weeks of practical and theoretical training. The data collection was closely supervised and directly observed in the field by trained supervisors.

#### Statistical analysis

The pre-coded responses were double entered by trained personnel using Epidata version 3.1 [49]. Analyses of variance (with the Scheffe' test), Kruskal-Wallis and Pearson chi-squared test statistics were used, as appropriate, for testing unadjusted differences of mean, median and proportions to compare economic status between case and comparison households.

In multivariate regression, all estimates of household income and consumption expenditures (the dependent variables) were based on ordinal least squares regression of difference in outcome variables controlling for covariates. For asset-based wealth (the third dependent variable),

estimates were based on an ordered logit regression model which adjusted for confounders. A negative coefficient represents lower income, consumption expenditure and asset-based wealth in relation to the comparison sample.

Both income and consumption data are highly skewed and so were log-transformed. The transformation ensures that errors are approximately homoscedastic. A Spearman rank correlation coefficient for the quintiles of consumption expenditure with asset-based wealth and with income was calculated. 0.36 and 0.35 for SMD, respectively. For the depression study, the corresponding values were 0.25 and 0.43, respectively. The proportion of households classified in the same quintile by the three measures (consumption, income and asset quintiles) in the SMD study and depression study were 30.9 and 27.1%, respectively. Nevertheless, these measures are not equivalent and might represent different concepts of economic status in the study settings.

An exploratory examination of data for missing cases, outliers, and fulfillment of test assumptions was conducted as follows:

In the model of log income, the Breusch-Pagan test for heteroscedasticity was carried out. In case of the presence of heteroscedasticity, Stock and Watson 2003, recommend use of heteroscedasticity-robust standard errors [50]. An important assumption for the multiple regression models is that independent variables are not perfectly multicollinear. Hence, the VIF (Variance Inflation Factor) was calculated.

Testing for omitted variable bias is important for our model since it is related to the assumption that the error term and the independent variables in the model are not correlated ( $E(e|X) = 0$ ). Therefore, Ramsey RESET test using powers of the fitted values of the three economic outcomes was tested. Cameron and Trivedi's [51] decomposition of information matrix (IM) for heteroscedasticity, skewness and kurtosis were also calculated. Data analysis was performed using STATA 13.1 (Stata-Corp LP, College Station, TX, USA) [52].

## Results

### Sample characteristics

The survey covered a total of 836 households: 290 households of persons with SMD (148 with higher disability and 142 with lower disability) and 289 comparison households without SMD, and 128 households of persons with depression (65 with higher disability, 63 with lower disability) and 129 comparison households without depression.

### General descriptive statistics

Table 1 presents descriptive results of households and clinical characteristics disaggregated by case, comparison and level of disability.

### Clinical characteristics of the sampled population

The median (and interquartile range; IQR) of WHODAS-II complex score for households of persons with SMD with higher disability (69.4; 61.1, 80.5) and lower disability (30.5; 19.4, 41.6) were considerably higher than households without a person with SMD (median WHODAS-II 5.5; IQR 0.0, 19.4); ( $\chi^2(2)$  test-for-trend = 386.726;  $p < 0.001$ ). In the depression study, the median (IQR) WHO-DAS-II score for depression with higher disability was 47.2 (38.9, 61.1) and for lower disability was 16.6 (11.1, 25.0); Pearson ( $\chi^2(1) = 102.7938$ ;  $p < 0.001$ ).

The median (IQR) depression symptom scores (PHQ-9 total) in the households of persons with higher and lower- disability depression were 12.0 (9.0, 15.0) and 9.0 (6.0, 11.0), respectively.

### Household characteristics

The probability of having an average household size was similar for all groups, ranging between 4.9 and 5.2. Respondents from households of persons with SMD with higher disability were less likely to be married or to have attended formal education than comparison households.

### Housing, water and sanitation facilities

A lower percentage of households of a person with SMD with lower disability owned their home (82.3%;  $p = 0.039$ ) compared to households without a person with SMD (88.6%). See Additional file 2: Table S1. Households with a member with depression with higher disability were more likely to obtain drinking water from an unprotected source (38.5%;  $p = 0.045$ ) compared with households without depression (28.7%). In 23% ( $p < 0.001$ ) of households with persons with SMD with higher disability there was no toilet facility compared to 11.0% for households without a person with SMD.

### Household income -based measures

The results shown in Table 2 present the reliability and source of household income. Higher proportions [6.8% (95% CI, 3.7,12.3)] of households with SMD with higher disability reported not to have any income ( $p = 0.011$ ). Relying on regular income was significantly lower for households with SMD with higher disability ( $p = 0.008$ ) or depression with higher disability ( $p = 0.046$ ) than households without a person with a mental health problem.

The median equalised annual income earned by households of persons with SMD with lower disability was about 1070 Birr (51.7 USD) lower ( $p < 0.001$ ) compared with households without a person with SMD. In the depression study, equalized annual income was significantly lower ( $p = 0.047$ ) by 1086 Birr (52.5 USD) for households with persons with depression with higher

**Table 1** Background characteristics of the Study Participants (Households) by Mental Health Conditions and Severity

Household Characteristics	Severe mental disorder (SMD) study			Depression study		
	Households of persons with SMD (N = 290)		Comparison households without persons with SMD (N = 289)	Households of person with depression (N = 128)		Comparison households for depression (N = 129)
	SMD with higher disability (N = 148)	SMD with lower disability (N = 142)		Depression with higher disability (N = 65)	Depression with lower disability (N = 63)	
Clinical Characteristics						
Functioning measured using						
WHODAS complex score Median (IQR)	69.4 (61.1, 80.5)***	30.5 (19.4, 41.6)***	5.5 (0.0, 19.4)	47.2 (38.9, 61.1)	16.6 (11.1, 25.0)	–
WHODAS simple score, Median (IQR)	32.0 (28.0, 36.5)***	13.5 (8.0, 18.0)***	2.0 (0.0,7.0)	20.0 (9.0, 26.0)	7.0 (6.0, 10.0)	–
Symptom scores						
BPRS-E, median (IQR)	48.0 (37.0, 59.0)	45.0 (34.5, 57.0)	–	–	–	–
PHQ-9, median (IQR)	–	–	–	12.0 (9.0, 15.0)	9.0 (6.0, 11.0)	–
Socio-demographic variables						
Household size, mean (SD)	5.1 (2.1)	5.2 (2.3)	5.2 (2.0)	5.2 (2.1)	4.9 (1.9)	5.0 (2.0)
Household composition, †† Mean (SD)	2.6 (0.8)	2.7 (0.9)	2.7 (0.8)	2.7 (0.9)	2.6 (0.8)	2.6 (0.8)
Rural residence, n (%)	118 (79.7)	117 (82.3)	236 (81.6)	46 (70.8)	57 (90.5)*	103 (79.8)
Gender of household head, n (%) Male	104 (70.7)	106 (74.6)	223 (77.9)	52 (80.0)	49 (80.3)	96 (75.0)
Age (years) of household head, mean (SD)	50.1(14.8)	48.8 (13.6)	49.9 (13.9)	48.7 (11.8)	44.1 (12.9)	44.2 (13.8)
Marital status of household head, n (%) married	101 (68.7)*	104 (73.2)	223 (77.7)	52 (80.0)	50 (83.3)	98 (76.6)
Educational level of household -head, n (%) no formal education	98 (66.2)*	87(61.2)	179 (61.9)	44 (67.6)	38 (60.3)	67 (52.3)

\*  $P < 0.05$ , \*\*\*  $P < 0.001$ ; †† adult equivalent

WHODAS (World Health Organization Disability Assessment Scale); IQR (Inter-Quartile Range); SD (Standard Deviation); BPRS-E (Brief Psychiatric Rating Scale, Expanded version); PHQ-9 (Patient Health Questionnaire item-9)

disability compared to control households without a person with depression.

After adjusting for household level socio-demographic characteristics, there was a clear association between levels of disability and household income (Table 3). The mean difference in income level of households of persons with SMD with higher disability and lower disability were  $\beta = -0.325$  ( $p = 0.005$ ) and  $\beta = -0.180$  ( $p = 0.010$ ), respectively, compared to the mean income level of households without persons with SMD. The mean annual income of households of persons with depression with higher disability was lower ( $\beta = -0.133$ ;  $p = 0.042$ ), compared to households without a person with depression.

In the model of log income, the Breusch-Pagan test for heteroscedasticity indicated possible heteroscedasticity in both the SMD and depression models ( $p = 0.1$  and  $0.3$ ). The mean Variance Inflation Factor was 1.57 for the SMD regression model and 1.50 for the depression model, indicating no effect of multicollinearity.

The Ramsey RESET test indicated that the model has no omitted variables ( $p = 0.68$  for SMD model and  $0.27$  for depression). Cameron and Trivedi's [51] decomposition of information matrix for heteroscedasticity, skewness and kurtosis was 0.5, 0.5 and 0.01 for the SMD model and 0.9, 0.1 and 0.04 for the depression model, respectively.

#### Household consumption-based measures

Table 2 shows that there were differences in median consumption expenditure in case vs. comparison households and with respect to levels of disability. Households of persons with SMD with higher disability and households of persons with depression with higher disability had lower consumption expenditure by Birr 292 (14.1 USD) and Birr 2604 (125.8 USD), respectively, compared to households without a person with a mental health problem. Table 4 shows the estimated ordinary least square (OLS) coefficients for the effect of SMD,

**Table 2** Household's income and consumption-based Welfare Measures by Mental Health Conditions and Severity

Household's economic variables	Severe mental disorder (SMD) study			Depression study		Comparison households for depression (N = 129)
	Households of persons with SMD (N = 290)		Comparison households without persons with SMD (N = 289)	Households of persons with depression (N = 128)		
	SMD with higher disability (N = 148)	SMD with lower disability (N = 142)		Depression with higher- disability (N = 65)	Depression with lower disability (N = 63)	
Reliability of income, % (95% CI)						
Regular income	54.4** (46.2, 62.4)	57.7 (49.4, 65.6)	66.2 (60.5, 71.4)	44.6* (32.9, 56.9)	71.4 (58.9, 81.3)	63.2 (54.5, 71.2)
Seasonal income	38.6 (31.0, 46.8)	38.7 (31.0, 47.0)	32.8 (27.5, 38.4)	52.3 (40.1, 64.2)	28.6 (18.6, 41.0)	34.3 (26.6, 43.0)
No income	6.8* (3.7, 12.3)	3.5 (1.4, 8.2)	1.0 (0.3, 3.2)	3.0 (0.7, 11.6)	0.0 (0.0)	2.3 (0.7, 7.0)
Sources of income, % (95% CI)						
Wages	27.8 (21.2, 35.7)	19.1 (13.4, 26.5)	21.8 (17.4, 27.0)	27.6 (18.0, 39.8)	12.7* (6.4, 23.5)	27.9 (20.7, 36.3)
Trading	73.4** (65.7, 80.0)	79.5* (72.1, 85.4)	87.5 (83.1, 90.8)	78.4 (66.6, 86.8)	90.4 (80.2, 95.7)	85.2 (80.2, 95.7)
Rental properties	12.8* (8.3, 19.2)	13.3* (8.6, 20.0)	6.2 (3.9, 9.6)	9.2 (4.1, 19.2)	3.1 (0.7, 12.0)	6.2 (3.1, 11.9)
Annual income HC, median (IQR) ‡	2584.4** (1316.0, 4651.5)	2888.8 (1666.6, 5313.2)	3654.7 (2000.0, 5776.5)	3130.4* (2476.1, 4761.9)	4193.5 (2400.0, 6086.9)	4216.2 (2333.3, 8333.3)
Annual consumption HC, median (IQR) ‡	8235.2 (4957.6, 12507.7)	8352.2 (5220.7, 12492.4)	8527.4 (5855.3, 13160.0)	7650.0** (5251.0, 10737.5)	10054.1 (6628.9, 16460.6)	10254.2 (7026.6, 16104.0)

‡ = Birr; US\$1 = Birr 20.69 (2015); \*  $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ ; IQR (inter-quartile range); HC (headcount)

depression and covariates, on household's consumption expenditures. Households of a person with SMD with higher disability had 10.6 percentage points lower in consumption expenditures compared to households without SMD ( $\beta = -0.106$ ,  $p > 0.05$ ). In contrast, households of a person with depression with higher disability had 12.2% lower consumption expenditures compared to households without a person with depression ( $\beta = -0.122$ ,  $p < 0.05$ ). In the model of log-consumption heteroscedasticity, skewness, Kurtosis, VIF and Ramsey RESET test were (0.4 vs.0.5), (0.5 vs.0.6), (0.2 vs.0.1), (1.5 vs.1.8) and (0.3 vs.0.4) for SMD and depression models respectively.

#### Asset ownership and asset-based wealth

A significantly lower percentage of households of persons with SMD with higher disability owned a mobile phone (41.2% vs. 57%;  $p = 0.006$ ), radio (35.8% vs. 53.2%;  $p = 0.001$ ), television (4.7% vs. 11.7%;  $p = 0.043$ ), livestock (76.5% vs. 88.5%;  $p = 0.002$ ), Table (23.4% vs. 36.3%;  $p = 0.008$ ) or cassette recorder (13.4% vs. 23.1%;  $p = 0.018$ ). See Additional file 2: Table S2. In the depression study, households of persons with depression with higher disability had significantly lower assets compared to households without a person with depression in terms of ownership of a television ( $p = 0.043$ ), livestock ( $p = 0.026$ ) and land ( $p = 0.035$ ).

There was a difference between households in relation to asset-based wealth quintiles. Greater numbers of

households of persons with SMD with higher disability were found in the lowest quintile (24.8% vs. 14.5%), compared to comparison households. In sharp contrast, a smaller percentage (17%;  $p = 0.007$  and 15%;  $p = 0.003$ ) of households of persons with SMD with higher disability or lower disability, respectively, were in the highest quintiles, compared to 26.3% in households without a person with a mental health problem. In the depression study we found similar differences across groups. The percentage of households of persons with depression with lower disability in the lowest quintile was 9.0% ( $p = 0.019$ ) higher compared to comparison households without depression.

The results of the regression of asset-based wealth for SMD and depression cohorts are presented in Table 5. Households of persons with SMD with higher disability or lower disability owned significantly fewer assets, with mean differences of  $\beta = -0.630$  ( $p = 0.001$ ) and  $\beta = -0.542$  ( $p = 0.005$ ) compared to households without a person with SMD.

There was no evidence of an interaction between SMD or depression and educational status, gender of the household head or residential area in relation to household income and consumption.

#### Discussion

Consistent with theoretical expectations, the findings from this study demonstrate that households of persons with SMD or depression are economically disadvantaged in



**Table 3** Regression coefficient estimate of log of income by mental health conditions, severity and covariates

(a). Severe mental disorder (SMD) study			
Characteristics	N(%), or mean (SD)	Household log of income	
		<i>unadjusted model</i>	<i>adjusted model</i>
Mental health conditions (%)		$\beta$ (95% CI)	$\beta$ (95% CI)
Households of SMD with higher disability	148 (25.7)	-0.295* (-0.519, 0.071)	-0.325** (-0.547, 0.102)
Households of SMD with lower disability	141 (24.4)	-0.155* (-0.377, 0.066)	-0.180* (-0.406, 0.045)
Households without SMD	288 (49.9)	1.00	1.00
Household characteristics <sup>†</sup>			
Male household head	431(75.4)	0.320** (0.093, 0.546)	0.271*(0.037, 0.506)
Age (years) of household head, mean(SD)	49.1(14.1)	-0.009**(-0.015, 0.003)	-0.009 **(-0.015, 0.002)
Urban residence	108 (18.7)	0.192 (-0.075, 0.459)	0.212 (-0.073, 0.497)
Household head with no formal education	363 (63.1)	-0.182 (-0.453, 0.089)	-0.183 (-0.446, 0.078)
Total adults <sup>††</sup> , mean (SD)	3.4 (1.4)	0.052 (-0.025, 0.131)	0.076*(0.001, 0.155)
(b). Depression study			
Characteristics	N(%), mean (SD)	Household log of income	
		<i>unadjusted model</i>	<i>adjusted model</i>
Mental health conditions, n (%)		$\beta$ (95% CI)	$\beta$ (95% CI)
Depression with higher disability	65 (25.3)	-0.384* (-0.675, 0.092)	-0.133* (-0.604, 0.020)
Depression with lower disability	63 (24.5)	-0.126 (-0.414, 0.161)	-0.053 (-0.412, 0.179)
Comparison households for depression	129 (50.2)	1.00	1.00
Household characteristics <sup>†</sup>			
Male household head	197 (77.6)	0.147(-0.134, 0.430)	0.013 (-0.258, 0.322)
Age (years) of household head, mean (SD)	45.3(13.2)	-0.013**(-0.022, 0.003)	-0.047(-0.013, 0.006)
Urban residence	51 (19.8)	0.074 (-0.235, 0.384)	0.010 (-0.309, 0.360)
Household head with no formal education	149 (58.2)	-0.634**(-1.013, 0.255)	-0.253* (-0.924, 0.84)
Total adults <sup>††</sup> , mean (SD)	3.1(1.4)	-0.058 (-0.152, 0.035)	-0.004 (-0.098, 0.092)

\*  $P < 0.05$ , \*\*  $P < 0.01$ ; SD (standard deviation); <sup>††</sup> (headcount); <sup>†</sup> CI, confidence interval; Reference group for household characteristics (female household head, rural residence, and more than primary education). All estimates are based on OLS regression of change in outcome variables, controlling for covariates. Coefficient of a specific disorder (SMDs or depression) is from a separate OLS regression

terms of income, consumption and possession of assets. Furthermore, in terms of living conditions and access to basic facilities, households with SMD or depression were significantly less likely to have a regular source of income, access to a toilet facility or access to water from a protected source. Households with persons with SMD or depression are, therefore, unable to meet essential requirements for their basic living and livelihoods.

After controlling for economic and demographic related variables, SMD and depression were associated with significantly lower household income. Moreover, there was a clear association between level of disability and household income, with a dose response seen between level of disability and level of socio-economic disadvantage compared to the households without a person with a mental health problem. Although this relationship is complex, higher disability is associated with impaired day-to-day functioning and reduced productivity [47, 53] which would be expected to have a downward effect on income.

The other possible reason for the lower income by households of persons with SMD or depression with higher or lower disability is the caregiver opportunity costs and perhaps an overall effect of stigma/social exclusion which may impede households' income generation opportunities or their ability to draw on social networks for support. Previous research has shown that earnings and long-term work incapacity are both much more strongly associated with SMD compared with absence of SMD [54].

Our study result is consistent with a previous study from rural Ethiopia which found that severe mental disorder was associated with substantially lower income among households with a person with bipolar disorder when compared with control households with a person with a chronic physical disorder [7]. Furthermore, our findings are similar to other studies from LMICs. For example, the World Mental Health Survey that included bipolar disorder and depression [9] and SMD from South Africa [16] indicated an association between SMD or depression and reduced earnings. In a study from a high-income country, SMD was associated with the highest level of income-related inequality compared to the general population [4]. Jenkins et al. (2008) found that people with mental disorder had significantly less income, and more debt and financial hardship, than those without this disorder [21].

Equivalised household consumption in households with SMD with higher disability was lower than comparison households, but the difference was not significant. One explanation for this finding could be that consumption was already at the minimum level for survival [55] and so there was little scope for consumption to decrease significantly. It appears that depletion of assets occurred to maintain consumption in the face of reduced income.

**Table 4** Regression coefficient of log of consumption by mental health conditions, severity and covariates

(a) Severe mental disorder (SMD) study			
Characteristics	N (%), mean (SD)	Household log of consumption	
		<i>unadjusted model</i>	<i>adjusted model</i>
		$\beta$ (95% CI)	$\beta$ (95% CI)
Mental health conditions, n (%)			
Households of SMD with higher disability	148 (25.6)	-0.058 (-0.200, 0.085)	-0.106 (-0.509, 0.273)
Households of SMD with lower disability	141 (24.4)	-0.033 (-0.184, 0.116)	-0.010 (-0.152, 0.172)
Households without SMD	289 (50.0)	1.00	1.00
Household characteristics <sup>†</sup>			
Household Composition <sup>††</sup> , mean (SD)	2.7 (0.9)	0.091*(0.021, 0.162)	0.030 (-0.051, 0.112)
Male household head	433(75.4)	0.108 (-0.027, 0.244)	0.063 (-0.061, 0.188)
Urban residence	108(18.7)	0.322*** (0.168, 0.476)	0.083 (-0.300, 0.184)
Household head with no formal education	363(62.7)	-0.155 (-0.340, 0.029)	-0.198 (-0.387, 0.010)
Log of income		0.248 *** (0.186, 0.309)	0.227 *** (0.145, 0.309)
Total debt <sup>††</sup>	341.2(974.5) ‡	0.0001*** (0.000, 0.00014)	0.0007* (0.00001, 0.00010)
Lowest Wealth	109(18.9)	-0.771***(-0.946, -0.595)	-0.684 ***(-0.923, -0.445)
Log of annual health expenditure		0.011 (-0.060, 0.083)	-0.013 (-0.157, 0.047)
(b) Depression study			
Characteristics	N(%), or mean (SD)	Household log of consumption	
		<i>unadjusted model</i>	<i>adjusted model</i>
		$\beta$ (95% CI)	$\beta$ (95% CI)
Mental health conditions (%)			
Depression with higher disability	65 (25.3)	-0.288** (-0.491, -0.085)	-0.122* (-0.349, -0.104)
Depression with lower disability	63 (24.5)	-0.023 (-0.257, 0.209)	-0.016 (-0.157, 0.245)
Comparison households for depression	129 (50.2)	1.00 <sup>†</sup>	1.00 <sup>†</sup>
Household characteristics <sup>†</sup>			
Household Composition <sup>††</sup> , mean (SD)	2.6 (0.8)	-0.225***(-0.339, 0.110)	-0.150 ***(-0.292, -0.081)
Male household head	197 (77.6)	0.082 (-0.138, 0.303)	0.018 (-0.236, 0.273)
Urban residence	51(19.8)	0.322*** (0.168, 0.476)	0.064 (-0.317, 0.189)
Household head with no formal education	149 (58.2)	-0.565***(-0.827, -0.302)	-0.256 (-0.565, 0.052)

**Table 4** Regression coefficient of log of consumption by mental health conditions, severity and covariates (Continued)

Log of income		0.323*** (0.217, 0.429)	0.201 ** (0.088, 0.314)
Total debt <sup>††</sup>	536.2 (1396.5) ‡	0.00008* (0.00001, 0.00014)	0.00007* (0.00002, 0.00012)
Lowest Wealth		-0.577***(-0.862, -0.292)	-0.311**(-0.684, 0.061)
Log of annual health expenditure		0.251*** (0.159, 0.342)	0.209*** (0.123, 0.294)

\*  $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ ; ‡ = Birr; US\$1 = Birr 20.69 (2015); CI, confidence interval; All estimates are based on OLS regression of change in outcome variables, controlling for covariate. Coefficient of a specific disorder (SMDs or depression) is from a separate OLS regression. †† HC (headcount); † Reference group for household characteristics (female household head, rural residence, and more than primary education)

In the depression study, similar to the work of Dahal et al. (2013) and Tampubolon and Hanandita (2014), we found lower consumption in households of persons with depression with higher disability [56, 57]. This could be through the pathway that depression induced reductions in income and labor supply that resulted in reduced consumption.

SMD and depression tend to be chronic or recurrent conditions that have the potential to impose high- and long-term economic burdens on households through asset depletion. As reflected in the asset index, we detected wealth difference in terms of position of households. A higher proportion of households of persons with SMD with higher disability were in the lowest asset-based wealth quintile. Similarly, a lower proportion of households of a person with depression with higher or lower disability were found in the highest asset quintile compared with households without depression.

Controlling for other variables, households of a person with SMD with higher or lower disability owned statistically significant fewer assets compared with their counterparts ( $p = 0.001$ ) and ( $p = 0.005$ ), respectively. However, households with a person with depression did not have significantly fewer assets than households without a person with depression. A possible explanation for this difference might be that SMD and depression affect household assets differently. Lower asset-based wealth in SMD may reflect chronicity of the financial impact of the illness, due to more difficulty with recovery and regaining capacity to produce assets. Although households with depression are disadvantaged economically, they may find it easier to regain their socio-economic status once the index person recovers so that the impact on asset depletion might be minimal.

Our results for SMD are in line with the findings by Yilma et al. (2014) on general illness that conclude illness is associated with asset depletion [58]. In a previous study from Ethiopia on maternal depression, higher disability

**Table 5** Regression coefficient of asset based wealth by mental health conditions, severity and covariates

(a) Severe mental disorder (SMD) study			
Characteristics	N (%), or mean (SD)	Household asset based wealth	
		<i>unadjusted model</i>	<i>adjusted model</i>
		$\beta$ (95% CI)	$\beta$ (95% CI)
Mental health conditions (%)			
Households of SMD with higher disability	148 (25.6)	-0.536** (-0.891, -0.181)	-0.630 **(-1.000, -0.252)
Households of SMD with lower disability	142(24.5)	-0.499** (-0.853, -0.145)	-0.542** (-0.916, -0.167)
Households without SMD	289 (49.9)	1.00	1.00
Household characteristics <sup>†</sup>			
Male household head	433 (75.3)	-0.204 (-0.536, 0.128)	-0.148 (-0.506, 0.209)
Urban residence	108 (18.7)	2.936*** (2.465, 3.407)	2.990*** (2.501, 3.480)
Household head with no formal education	364 (62.9)	-0.047 (-0.443, 0.538)	-0.059 (-0.464, 0.584)
Log of income		0.449*** (0.306, 0.592)	0.451*** (0.300, 0.602)
Total debt <sup>‡‡</sup>	341.2(974.5)‡	0.00005(-0.00009, 0.00020)	-0.0004 (-0.002, 0.0011)
(b) Depression study			
Characteristics	N %, or mean (SD)	Household asset based wealth	
		<i>unadjusted model</i>	<i>adjusted model</i>
		$\beta$ (95% CI)	$\beta$ (95% CI)
Mental health conditions			
Depression with higher disability	65 (25.3)	-0.643* (-1.173, -0.112)	-0.227 (-0.793, 0.338)
Depression with lower disability	63 (24.5)	-0.003 (-0.522, 0.529)	-0.020(-0.606, 0.565)
Comparison households for depression	129 (50.2)	1.00	1.00
Household characteristics <sup>†</sup>			
Male household head	197 (77.6)	0.284(-0.234, 0.802)	0.205 (-0.355, 0.767)
Urban residence	51 (19.8)	3.171*** (2.463, 3.879)	3.159*** (2.468, 3.850)
Household head with no formal education	149 (58.2)	-1.523*** (-2.172, -0.874)	-1.170 **(-1.871, -0.469)
Log of income		0.548*** (0.303, 0.793)	0.215*** (0.111, 0.320)
Total debt <sup>‡‡</sup>	536.2(1396.5) ‡	-0.00008(-0.00021, 0.00005)	-0.00009 (-0.00021, 0.00003)

\*  $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\* $P < 0.001$ ; ‡ = *Birr*; US\$1 = *Birr* 20.69 (2015); †† HC (headcount); † CI, confidence interval; Reference group; SD (standard deviation); † Reference group for household characteristics (female household head, rural residence, and more than primary education). All estimates are based on ordered logit regression of change in outcome variables. Coefficient of a specific disorder (SMD or depression) is from a separate ordered logit regression models

scores were significantly associated with possessing fewer assets and self-rated lower wealth [53]. In general, the findings of lower income, lower consumption and possession of fewer assets by households of persons with SMD in our study are similar to the findings of Trani et al. (2015) in India that reported multidimensional poverty is linked to severe mental illness [15].

In line with expectations, the reported annual income was lower than consumption. This may be a true finding, reflecting that households use other means to maintain consumption levels in the face of financial stress or income shortfall, for example, borrowing money or using savings. The discrepancy may also reflect reporting bias for income, given the sensitive nature of the question. We argue that our study overcomes the limitations of previous studies. First, the study sample was community based and based on households that are representative of a sample population. Secondly, we used comprehensive measures of socio-economic context. However, our study has several limitations: our analyses cannot show the causal effect of SMD or depression on economic status of households or vice versa. The cross-sectional study design does not allow us to elucidate the mechanisms behind the associations we have observed. Thus, prospective studies are needed. Furthermore, the existence of endogeneity cannot be ruled out although we have controlled for various demographic and economic variables. Respondents might not be comfortable about revealing information on income although confidentiality was assured. One other limitation of the study is that we do not know whether the comparison households for depression included persons with depression as we were not able to screen all household members.

## Conclusions

Households with a member who had a severe mental disorder or depression were socioeconomically disadvantaged compared to the general population. Therefore, we argue that mental disorders should be an important concern for development strategies and this vulnerable group should be prioritized with development assistance and access to evidence-based mental healthcare implemented by the government. Our study findings also indicate the need to further explore the economic impacts of different types of mental disorders at the household level across different African and LMIC settings.

## Additional files

**Additional file 1:** Figure S1. Patient recruitment flow for SMD study.

**Figure S2.** Patient recruitment flow for depression study (DOC 38 kb)

**Additional file 2:** Table S1. Housing, Water and Sanitation Characteristics by Mental Health Conditions and Severity. **Table S2.** Household Asset Ownership and Asset Based Wealth Distribution by Mental Health Disorder and Severity (DOC 107 kb)

### Abbreviations

BPRS-E: Brief psychiatric rating scale, Expanded version; Emerald: Emerging mental health systems in low- and middle-income countries; GDP: Gross domestic product; LMICs: Low- and middle-income countries; MCA: multiple correspondence analyses; OCRPIT: Operational criteria checklist for psychotic illness and affective illness; OECD: Organization of economic co-operation and development; OLS: ordinary least squares; PHQ-9: Patient health questionnaire – 9 item; PRIME: Programme for improving mental health care; SAGE: Study on global Ageing and adult health; SMD: Severe mental disorder; VIF: variance inflation factor; WHO: World Health Organization; WHODAS: WHO disability assessment schedule

### Acknowledgments

We appreciate all participants in the study for their time and effort.

### Disclaimer

DC is a staff member of the World Health Organization. The authors alone are responsible for the views expressed in this publication and they do not necessarily represent the decisions, policy or views of the World Health Organization.

### Authors' contributions

YH, CH, CL, SD, DC and DH designed the study. YH, SD analyzed the data. YH drafted the manuscript and received critical feedback from CH, KT, AF, AA, GM, CL, SD, DC and DH. All co-authors (CH, KT, AF, AA, GM, CL, SD, DC and DH) read and approved the final version of the manuscript.

### Funding

The research leading to these results was funded by Addis Ababa University and the Emerald project through a grant from European Union's Seventh Framework Programme (FP7/2007–2013) under grant agreement no 30598. This study was also partly funded by the PRIME, through a grant from the UK Department for International Development [201446]. The views expressed do not necessarily reflect the UK Government's official policies. The funders had no role in study design, data collection, analysis, decision to publish and preparation of the manuscript. YH (AAU and Jimma University) was funded by Postgraduate Academic Mobility for African Physician-Scientists (PAMAPS), CH (King's College London and AAU), CL (King's College London and UCT) and AA (Addis Ababa University) are funded by the National Institute of Health Research (NIHR) Global Health Research Unit on Health System Strengthening in Sub-Saharan Africa, King's College London (GHRU 16/136/54) using UK aid from the UK Government. The views expressed in this publication are those of the authors and not necessarily those of the NIHR or the Department of Health and Social Care. CH additionally receives support from the Africa Mental Health Research Initiative (AMARI) as part of the DELTAS Africa Initiative (DEL-15-01).

### Availability of data and materials

The data are being used for a PhD student (YH) for his thesis and are not, therefore, available at the present time to the general public. The data may be requested from the corresponding author for verification of the analyses in this paper on a reasonable request.

### Ethics approval and consent to participate

Ethical approval was obtained from the Institutional Review Board of the College of Health Sciences, Addis Ababa University (Reference number 074/13/Psy), King's College London (KCL), and the Ethics Review Committee of the World Health Organization (RPC 619). Voluntary informed consent was obtained from all study participants prior to their inclusion in the study. Participants diagnosed as having SMD and depression received health centre-based mental healthcare through PRIME.

### Consent for publication

Not applicable

### Competing interests

The authors declare that they have no competing interests.

### Author details

<sup>1</sup>Department of Reproductive Health and Health Services Management, School of Public Health, College of Health Sciences, Addis Ababa University,

Addis Ababa, Ethiopia. <sup>2</sup>Department of Health Economics, Policy and Management, College of Health Sciences, Jimma University, Jimma, Ethiopia. <sup>3</sup>Department of Psychiatry, School of Medicine, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia. <sup>4</sup>Centre for Global Mental Health, Health Service and Population Research Department, Institute of Psychiatry, Psychology and Neuroscience, King's College, London, UK. <sup>5</sup>Alan J. Fisher Centre for Public Mental Health, Department of Psychiatry and Mental Health, University of Cape Town, Cape Town, South Africa. <sup>6</sup>Akilu-Lemma Institute of Pathobiology, Addis Ababa University, Addis Ababa, Ethiopia. <sup>7</sup>Department of Mental Health and Substance Abuse, World Health Organization, Geneva, Switzerland. <sup>8</sup>Department of Global Health & Infection, Brighton and Sussex Medical School, Brighton, UK. <sup>9</sup>Centre for Innovative Drug Development and Therapeutic Trials for Africa (CDT-Africa), College of Health Sciences, Ababa University, Addis Ababa, Ethiopia. <sup>10</sup>Centre for Affective Disorders, Department of Psychological Medicine, Institute of Psychiatry, Psychology and Neuroscience, King's College, London, UK.

Received: 12 October 2018 Accepted: 21 July 2019

Published online: 31 July 2019

### References

1. Faris RE, Dunham HW. Mental disorders in urban areas: an ecological study of schizophrenia and other psychoses. Chicago: University of Chicago Press; 1939.
2. Lorant V, Deliège D, Eaton W, Robert A, Philippot P, Ansseau M. Socioeconomic inequalities in depression. A meta-analysis. *Am J Epidemiol*. 2003;157:98–112.
3. World Health Organization. Mental Health and Development. Targeting people with mental health conditions as a vulnerable group. Geneva: World Health Organization and Mental Health and Poverty Project. World Health Organization; 2010.
4. Mangalore R, Knapp M. Income-related inequalities in common mental disorders among ethnic minorities in England. *Soc Psychiatry Psychiatr Epidemiol*. 2012;47:351–9.
5. Saraceno B, Levav I, Kohn R. The public mental health significance of research on socio-economic factors in schizophrenia and major depression. *World Psychiatry*. 2005;4:181–5.
6. Magliano L, Mcdaid D, Kirkwood S, Berzins K. Carers and families of people with mental health problems. In: Knapp M, Mcdaid D, Mossialos E, Thornicroft G. (eds) Mental health policy and practice across Europe. The future direction of mental health care. Maidenhead: Open University Press; 2007.
7. Zergaw A, Hailemariam D, Alem A, Kebede D. A longitudinal comparative analysis of economic and family caregiver burden due to bipolar disorder. *Afr J Psychiatry*. 2008;11(3):191–8.
8. Chisholm D, Diehr P, Knapp M, Patrick D, Treglia M, Simon G. Depression status, medical comorbidity and resource costs. Evidence from an international study of major depression in primary care (LIDO). *Br J Psychiatry*. 2003;183:121–31.
9. Levinson D, Lakoma MD, Petukhova M, Schoenbaum M, Zaslavsky AM, Angermeyer M, et al. Associations of serious mental illness with earnings: results from the WHO world mental health surveys. *Br J Psychiatry*. 2010; 197(2):114–21.
10. Patel V, Kleinman A. Poverty and common mental disorders in developing countries. *Bull World Health Organ*. 2003;81(8):609–15.
11. Andrade L, Caraveo-Anduaga JJ, Berglund P, Bijl RV, De Graaf R, Vollebergh W, Dragomirecka E, Kohn R, Keller M, Kessler RC, Kawakami N, Kilic C, Offord D, Utsun TB, Wittchen H-U. The epidemiology of major depressive episodes: results from the international consortium of psychiatric epidemiology (ICPE) surveys. *Int J Methods Psychiatr Res*. 2003;12(1):3–21.
12. Eaton W, Muntaner C, Bovasso G, Smith C. Socioeconomic status and depressive syndrome: the role of inter- and intra-generational mobility, government assistance, and work environment. *J Health Soc Behav*. 2001;42(3):277–94.
13. Skapinakis P, Weich S, Lewis G, Singelton N, Araya R. Socio-economic position and common mental disorders longitudinal study in the general population in the UK. *Br J Psychiatry*. 2006;189:109–17.
14. Bauer M, Glenn T, Rasgon N, Marsh W, Sagduyu K, Munoz R, Schmid R, Haack S, Whybrow PC. Association between median family income and self-reported mood symptoms in bipolar disorder. *Compr Psychiatry*. 2011;52:17–25.
15. Trani J-F, Bakhshi P, Kuhlberg J, Narayanan SS, Venkataraman N, Mishra NN, Groce NE, Jadhav S, Deshpande S. Mental illness, poverty and stigma in

- India: a case-control study. *BMJ Open*. 2015;5:e006355. <https://doi.org/10.1136/bmjopen-2014-006355>.
16. Lund C, Myer L, Stein DJ, Williams DR, Flisher AJ. Mental illness and lost income among adult south Africans. *Soc Psychiatry Psychiatr Epidemiol*. 2013;48(5):845–51.
  17. Lewis G, Bebbington P, Brugha T, Farrell M, Gill B, Jenkins R, Meltzer H. Socio-economic status, standard of living, and neurotic disorder. *Int Rev Psychiatry*. 2003;15(1–2):91–6.
  18. Araya R, Rojas G, Fritsch R, Acuna J, Lewis G. Common mental disorders in Santiago, Chile: prevalence and socio-demographic correlates. *Br J Psychiatry*. 2001;178:228–33.
  19. Kebede D, Alem A. Major mental disorders in Addis Ababa, Ethiopia. *Schizophrenia, schizoaffective and cognitive disorders. Acta Psychiatr Scand*. 1999;100:11–7.
  20. Mahal A, Karan A, Engelgu M. The economic implication of non-communicable disease for India. HNP discussion paper. Washington DC: The World Bank; 2010.
  21. Jenkins R, Bhugra D, Bebbington P, Brugha T, Farrell M, Coid J, Fryers T, Weich S, Singleton N, Meltzer H. Debt, income and mental disorder in the general population. *Psychol Med*. 2008;38(10):1485–93.
  22. Patel V, Chisholm D, Kirkwood BR, Mabey D. Prioritizing health problems in women in developing countries: comparing the financial burden of reproductive tract infections, anaemia and depressive disorders in a community survey in India. *Tropical Med Int Health*. 2007;12(1):130–9.
  23. Tirfessa K, Lund C, Medhin G, Hailemichael Y, Fekadu A, Hanlon C. Food insecurity among people with severe mental disorder in a rural Ethiopian setting: a comparative, population based study. *Epidemiol and Psychiatr Sci*. 2017;1–11. <https://doi.org/10.1017/S2045796017000701>.
  24. Gresenz CR, Sturm R. New dimensions of economic well-being among people with mental illness: evidence from health care for communities. *Health Serv Res*. 2000;35(5 Pt 3):32–42.
  25. World Health Organization. Disease and injury regional estimates for 2004. Geneva: World Health Organization; 2009.
  26. United Nations. Transforming our world: the 2030 agenda for sustainable development. New York: United Nations; 2015.
  27. Semrau M, Evans-Lacko S, Alem A, Ayuso-Mateos JL, Chisholm D, Gureje O, Hanlon C, Jordans M, Kigozi F, Lempp H, Lund C, Petersen I, Shidhaye R, Thornicroft G. Strengthening mental health systems in low- and middle-income countries: the emerald programme. *BMC Med*. 2015;13:79.
  28. Lund C, Tomlinson M, De Silva M, Fekadu A, Shidhaye R, Jordans M, Petersen I, Bhana A, Kigozi F, Prince M, Thornicroft G, Hanlon C, Kakuma R, McDaid D, Saxena S, Chisholm D, Raja S, Kippen-Wood S, Honikman S, Fairall L, Patel V. PRIME: A Programme to reduce the treatment gap for mental disorders in five low- and middle-income countries. *PLoS Med* 2012; 9:e1001359.
  29. Hanlon C, Luitel N, Kathree T, Murhar V, Shrivastava S, Medhin G, Ssebunnya J, Fekadu A, Petersen I, Jordans M, Kigozi F, Thornicroft G, Patel V, Tomlinson M, Lund C, Breuer E, De Silva M, Prince M. Challenges and opportunities for implementing mental health in primary care in the PRIME study: comparison of the baseline situation in five LAMIC settings. *PLoS One*. 2014;9:e88437.
  30. Central Statistics Agency. The 2007 National Population and housing census of Ethiopia. Addis Ababa: Central Statistic Agency; 2008.
  31. Fekadu A, Hanlon C, Medhin G, Alem A, Selamu M, W.Giorgis T, Shibre T, Teferra S, Tegegn T, Breuer E, Patel V, Tomlinson M, Thornicroft G, Prince M, Lund C. Development of a scalable mental healthcare plan for a rural district in Ethiopia. *Br J Psychiatry*. 2016;208:s4–s12. <https://doi.org/10.1192/bjp.bp.114.153676>.
  32. Shibre T, Kebede D, Alem A, Negash A, Kibreab S, Fekadu A, Fekadu D, Jacobsson L, Kullgren G. An evaluation of two screening methods to identify cases with schizophrenia and affective disorders in a community survey in rural Ethiopia. *Int J Soc Psychiatry*. 2002;48(3):200–8.
  33. Brittain PJ, Stahl D, Rucker J, Kawadler J, Schumann G. A review of the reliability and validity of OPCRIT in relation to its use for the routine clinical assessment of mental health patients. *Int J Methods Psychiatr Res*. 2013;22(2):110–37.
  34. Fekadu A, Medhin G, Selamu M, Hailemariam M, Alem A, Giorgis TW, Breuer E, Lund C, Prince M, Hanlon C. Population level mental distress in rural Ethiopia. *BMC Psychiatry*. 2014;14:194.
  35. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med*. 2001;16(9):606–13.
  36. Gelaye B, Williams MA, Lemma S, Deyessa N, Bahretibeb Y, Shibre T, Wondimagegn D, Lemenhe A, Fann JR, Van der Stoep A, Zhou X-HA. Validity of the patient health questionnaire-9 for depression screening and diagnosis in East Africa. *Psychiatry Res*. 2013;210:653–61.
  37. Hanlon C, Medhin G, Selamu M, Breuer E, Worku B, Hailemariam M. Validity of brief screening questionnaires to detect depression in primary care in Ethiopia. *J Affect Disord*. 2015;186:32–9.
  38. World Health Organization. World Health Organization study on global ageing and adult health (SAGE). Geneva: World Health Organization; 2013. Available from: <http://www.who.int/healthinfo/systems/sage/en/index.html>. Accessed 20 Feb 2014
  39. Galobardes B, Shaw M, Lawlor AD, Lynch JW, Smith GD. Indicators of socioeconomic position. *J Epidemiol Community Health*. 2006;60:7–12. <https://doi.org/10.1136/jech.2004.023531>.
  40. Howe LD, Galobardes B, Matijasevich A, Gordon D, Johnston D, Onwujekwe O, Patel R, Webb EA, Lawlor DA, Hargreaves JR. Measuring socio-economic position for epidemiological studies in low- and middle-income countries: a methods of measurement in epidemiology paper. *Int J Epidemiol*. 2012;1–16. <https://doi.org/10.1093/ije/dys037>.
  41. National Bank of Ethiopia. Annual report 2015/2016. <http://www.nbe.gov.et/pdf/annualbulletin/Annual%20Report%202015-16%20N.pdf>. Accessed 3 June 2017.
  42. Hagenaars A, de Vos K, Zaidi MA. Poverty Statistics in the Late 1980s: Research based on micro-data. Office for Official Publications of the European Communities. Luxembourg: European Community; 1994.
  43. EUROSTAT. Glossary: Equivalised disposable income. [http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Equivalised\\_disposable\\_income&oldid=171112](http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Equivalised_disposable_income&oldid=171112)
  44. Booysen F, van der Berg S, Burger R, von Maltitz M, du Rand G. Using an asset index to assess trends in poverty in seven Sub-Saharan African countries. *World Dev*. 2008;36(6):1113–30.
  45. World Health Organization. Measuring Health and Disability: Manual for WHO Disability Assessment Schedule (WHODAS 2.0). Geneva: World Health Organization; 2010.
  46. Habtamu K, Alem A, Medhin G, Fekadu A, Prince M, Hanlon C. Development and validation of a contextual measure of functioning for people living with severe mental disorders in rural Africa. *BMC Psychiatry*. 2016;16:311.
  47. Mogga S, Prince M, Alem A, Kebede D, Stewart R, Glozier N, Hotopf M. Outcome of major depression in Ethiopia: population-based study. *Br J Psychiatry*. 2006;189:241–6.
  48. Habtamu K, Alem A, Medhin G, Fekadu A, Dewey D, Prince M, Hanlon C. Validation of the World Health Organization disability assessment schedule in people with severe mental disorders in rural Ethiopia. *Health Qual Life Outcomes*. 2017;15:64. <https://doi.org/10.1186/s12955-017-0647-3>.
  49. Lauritsen JM, Bruus M. EpiData (version 3.1). A comprehensive tool for validated entry and documentation of data. The EpiData Association: Odense, Denmark; 2004.
  50. Stock JH, Watson MW. Introduction to econometrics: students solutions manual. Berkeley: University of California; 2003.
  51. Cameron C, Trivedi PVK. Microeconomics using stata: Stata press; 2009.
  52. StataCorp.L.P. Stata/SE Version 13.1. Texas: USA; 2014.
  53. Senturk V, Hanlon C, Medhin G, Dewey M, Araya M, Alem A, Prince M, Stewart R. Impact of perinatal somatic and common mental disorder symptoms on functioning in Ethiopian women: The P-MaMIE population-based cohort study. *J Affect Disord*. 2011. <https://doi.org/10.1016/j.jad.2011.11.028>.
  54. Kessler RC, Heeringa S, Lakoma MD, Petukhova M, RUPP AE, Schoenbaum M, Wang PS, Zaslavsky AM. Individual and societal effects of mental disorders on earnings in the United States: results from the National comorbidity Survey Replication. *Am J Psychiatry*. 2008;165:703–11.
  55. Central Statistics Agency. Household Consumption and Expenditure (HCE) Survey 2010/11. Addis Ababa: The Federal Democratic Republic of Ethiopia, central Statistics Agency; 2012.
  56. Dahal A, Fertig A. An econometric assessment of the effect of mental illness on household spending behavior. *J Econ Psychol*. 2013;37:18–33.
  57. Tampubolon G, Hanandita W. Poverty and mental health in Indonesia. *Soc Sci Med*. 2014;106:20–7.
  58. Yilma Z, Mebratie A, Sparrow R, Abebaw D, Dekker M, Alemu G. Coping with shocks in rural Ethiopia. *J Dev Stud*. 2014;50(7):1009–24.

## Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.