Poverty and mental health in Indonesia

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ABSTRACT

Community and facility studies in developing countries have generally demonstrated an inverse relationship between poverty and mental health. However, recent population-based studies contradict this. In India and Indonesia the poor and non-poor show no difference in mental health. We revisit the relationship between poverty and mental health using a validated measure of depressive symptoms (CES-D) and a new national sample from Indonesia — a country where widespread poverty and deep inequality meet with a neglected mental health service sector. Results from three-level overdispersed Poisson models show that a 1% decrease in per capita household expenditure was associated with a 0.05% increase in CES-D score (depressive symptoms), while using a different indicator (living on less than $2 a day) it was estimated that the poor had a 5% higher CES-D score than the better off. Individual social capital and religiosity were found to be positively associated with mental health while adverse events were negatively associated. These findings provide support for the established view regarding the deleterious association between poverty and mental health in developed and developing countries.

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Introduction

Mental disorders are becoming a major burden for developing countries (WHO, 2001), where approximately 7% of the total burden of disease in 2010 is accounted for by various forms of mental and behavioural disorder (5% in 2000, 4% in 1990; IHME, 2013). It is estimated that the prevalence of common mental disorders in developing countries is as high as 20–50% in community and out-patient samples (Patel, Araya, de Lima, Ludermir, & Todd, 1999) or approximately 6–7% among the general population (Rai, Zitko, Jones, Lynch, & Araya, 2013). Yet among diagnosed cases, only 15–25% receive proper treatment (WHO, 2004) and the average amount of public investment in the mental health sector is just under 1% of the total health expenditure of many developing countries (Patel, 2007).

The increasing burden of mental illness in developing countries is far from inconsequential. The World Health Organization (WHO, 2012) warns that mental disorders reduce an individual's ability to function and often lead to disability and suicide. Mental illness also inflicts economic costs on society through loss of productivity (Bir & Frank, 2001) and income (Lund, Myer, Stein, Williams, & Flisher, 2013), which in turn could undermine the very effort to tackle communicable diseases. Ignoring common mental disorders in an attempt to address communicable diseases may prove to be a false economy.

The relationship between poverty and mental health has been the subject of recent publications for several reasons. First, poverty eradication has always been at the heart of development policy-making. If poverty is associated with more mental illness, then this will serve as further motivation towards poverty eradication. Secondly, although the inverse relationship between poverty and mental health has long been established in industrialised countries, evidence from developing countries remains relatively scarce. If a consistent pattern is also found among the latter, this will indicate the universality of poverty as an important risk factor for poor mental health (Patel et al., 1999, p.1462), and thus a global development agenda can be set. Indeed, Lund et al. (2010) in reviewing 115 community and facility-based studies in developing countries strongly suggested that poor people have poorer mental health.

This however is contradicted by Das, Do, Friedman, McKenzie, and Scott (2007). When poverty was measured using per capita household expenditure, and physical health status was also controlled for in a multivariate model, these authors found no consistent association between poverty and mental health among their four nationally representative samples. Mental health was slightly worse for individuals in low consumption households in Bosnia, better in Mexico, and there was no statistically significant association in India and Indonesia. The authors then concluded that "poverty, *per se*, is not a strong determinant of poor mental health"

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(p.476) and further stated that the rationale for public investment in mental health is undermined by the more serious threat of communicable diseases.

Nonetheless, the study is not without shortcomings. Although nationally representative samples were used and many potential confounders were controlled for, the psychometric properties of the 'General Health Questionnaire-derived' instrument used to measure depressive symptomatology in Indonesia and Mexico are unclear (Goldberg, 1972). Moreover the studies also ignored the well-known skewed distribution of mental illness scores. The inconsistent findings might simply be an artefact of these problems.

Using a nationally representative sample from Indonesia, we revisited the relationship between consumption poverty and mental illness using a common measure, namely the 10-item Center for Epidemiological Studies Depression scale (CES-D; Radloff, 1977). Second, in addition to a poverty variable, this paper considers three factors that have long been considered important determinants of mental health among industrialised societies, namely social capital, religiosity and experience of adverse events. Lastly, we analysed the data using a multilevel overdispersed Poisson regression analysis that accommodates skewed data.

Poverty and mental health: conflicting evidence?

Poverty has long been associated with a myriad of suffering. While factors such as genetics and environment unquestionably play a role, in public health research it is generally conceded that socio-economic status strongly correlates with an individual's physical and mental health.

Studies conducted in developing countries have so far largely confirmed the negative association between poverty and mental health. Analysing both community and facility samples in Zimbabwe, India, Brazil and Chile, Patel et al. (1999) found that the prevalence of common mental disorders ranged from 23% to a staggering 52%, with lower prevalence in community than facility samples. Furthermore, the odds of having depressive symptoms was significantly higher for income-poor individuals than income-rich individuals in all four countries (see also Mumford, Saeed, Ahmad, Latif, and Latif (1997) on Pakistan, Dzator (2012) on Ghana, Roberts, Ocaka, Browne, Oyok, and Sondorp (2009) on Uganda, and Myer, Stein, Grimsrud, Seedat, and Williams (2008) and Hamad, Fernald, Karlan, and Zinman (2008) on South Africa). Measures of poverty varied and included illiteracy (Mumford, Nazir, Jilani, & Baig, 1996), lack of tap water or electricity (Bahar, Henderson, & Mackinnon, 1992), number of electrical appliances (Mumford et al., 1997) and housing difficulty (Hussain, Creed, & Tomenson, 2000).

Using a consistent measure of poverty, namely per capita household expenditure, Das et al. (2007), Das, Do, Friedman, and McKenzie (2009) reported the association of poverty and mental distress in nationally representative samples from Bosnia (2001), India (2003), Indonesia (2000) and Mexico (2002). The study concluded that poor mental health has no strong relationship with poverty.

Other major determinants of mental health

Apart from highlighting the role of poverty, studies over the last three decades have demonstrated that other factors strongly determine an individual's mental health. These include gender, marital status, experience of adverse event, religiosity and social capital.

Gender

Gender is probably the most extensively researched and the most widely accepted determinant of mental health. Regardless of the economic development level of the country in question, literature suggests that depression is two to three times more prevalent among women than men (Das et al., 2007, 2009; Mumford, Minhas, Akhter, Akhter, & Mubbashar, 2000; Mumford et al., 1996, 1997; Noorbala, Yazdi, Yasamy, & Mohammad, 2004; Patel et al., 1999), albeit a few studies in Africa not showing this inequality (Dzator, 2012; Jenkins et al., 2012; WHO, 2012). Explanations offered for greater depression among women than men include more reproductive problems, lower social empowerment, and more work/family stresses.

Marital status

Evidence from industrialised countries so far suggests that married individuals tend to have fewer mental disorders compared to their non-married (never married, separated, divorced, or widowed) peers (Afifi, Cox, & Enns, 2006; Bromet et al., 2011; Wade & Pevalin, 2004), although there is new evidence from an Australian study suggesting that this association is moderated by relationship quality (Leach, Butterworth, Olesen, & Mackinnon, 2013, p.417). In developing countries evidence remains scarce, perhaps due to the limited availability of nationally representative longitudinal data. A negative effect of being widowed on mental health was found in an urban poor community in Pakistan (Mumford et al., 2000), although the effect did not achieve statistical significance in a more elaborate multivariate model. Patel et al. (1999) also found a negative bivariate effect among community samples in Zimbabwe, Brazil, India and Chile, although this also failed to achieve statistical significance in a multivariate model. Other studies found a consistent negative effect of being widowed in Tonga, India, Mexico, Bosnia, Indonesia (Das et al., 2007, 2009), South Africa and Ukraine (Bromet et al., 2011), while another new study from high sex ratio rural areas of China showed that unmarried men have lower self-esteem, a higher risk of depression, elevated suicidal thoughts and aggressive tendencies compared to married men (Zhou, Yan, & Therese, 2012).

Adverse events

Experience of adverse events is intuitively related to poor mental health. The corpus of mental health literature documents the prevalence of mental disorders to be higher among individuals who have experienced disaster than among those who have not, irrespective of whether it was natural or man-made (Galea, Nandi, & Vlahov, 2005; Satcher, Friel, & Bell, 2007) and whether a one-time occurrence or recurrent disaster (Wind, Joshi, Kleber, & Komproe, 2013). Crime victims (Kilpatrick & Acierno, 2003) along with their immediate relatives (Amick-Mcmullan, Kilpatrick, & Resnick, 1991) and those who are in fear of crime (Stafford, Chandola, & Marmot, 2007) often experience greater psychological distress and mental disorders.

Religiosity

Research into the relationship between religiosity and mental health over the past two decades suggests that religious individuals — measured in terms of both self-rated religiousness and religious attendance — are, in general, mentally more robust than their secular counterparts (Dein, Cook, & Koenig, 2012; Koenig, King, & Carson, 2012). Compared to those who are not religious, religious individuals report less psychological distress (Ellison, Boardman,

Williams, & Jackson, 2001) and greater life satisfaction (Lim & Putnam, 2010), and have lower odds of having depressive disorders or substance abuse (National Center on Addiction and Substance Abuse at Columbia University, 2001). However, longitudinal studies provide evidence inconsistent with these conclusions (Vaillant, Templeton, Ardelt, & Meyer, 2008).

It is important to note, however, that nearly all studies on religiosity and mental health were conducted in the context of industrialised, white Christian cultures. Few have examined the association between religiosity and mental health in the context of developing non-Western or non-Christian cultures.

Social capital

A growing body of literature over the last decade has suggested that the prevalence of mental disorders is inversely associated with social capital (Tampubolon, 2012). Social capital, sometimes regarded as the glue that binds different elements of society together, has been defined as consisting of two components: the *structural* and the *functional*. The structural component denotes quantitative aspects of social life and civic participation, whereas the functional component relates to trust, social cohesion and perceived support (Kawachi & Berkman, 2000). Despite the importance of both components, however, studies have generally found that the relationship of mental health with trust is more significant than with participation.

Studies conducted in developing countries seem to largely confirm the evidence for a positive association between social capital and mental health. Data from Indonesia, based on a nationally representative sample from 1993 to 1997, supported this conclusion (Miller, Scheffler, Lam, Rosenberg, & Rupp, 2006). When social capital was operationalised as the number of available community organisations, it was positively associated with good mental and physical health, and there was weak evidence for the interactive effect of social capital and education. Note, however, that this Indonesian study did not use a validated measure of mental health.

Thus the objective of the current study was to examine the association between poverty and mental health after controlling for gender, marital status, experience of adverse events, religiosity, social capital and other socio-demographic variables.

Setting

Indonesia provides an interesting case to test the relationship between poverty and mental health in developing countries. It is a sprawling archipelago where widespread poverty and deep inequality meet with a minimal mental health service. With relatively stable 5—6% year-on-year economic growth (World Bank, 2013) and a growing population of 247 million (68% of whom are aged 15—64 years), Indonesia is one of the twenty largest world economies. However, with its USD 3557 per capita Gross Domestic Product (current dollar; World Bank, 2013) it has a Human Development Index of 0.629. Nearly half of Indonesians (43.3%) live below the $2 a day poverty line and more than one-third have no access to electricity (35.5%; World Bank, 2013), while at the same time a disproportionate share of income (46%) is found in the top two richest deciles alone, leading to a highly unequal 38.1 Gini index (World Bank, 2013). The Indonesian government only spends 5.3% of its total expenditure on health, which is about one half of the average of its East Asian and Pacific neighbours (World Bank, 2013). Out-of-pocket health expenditure in Indonesia remains enormously high at 76% of the total private expenditure spent on health (10% higher than the regional average), whereas per capita health expenditure is only USD 95 (less than half of the regional

average; World Bank, 2013). It is estimated that mental illness contributed to a loss of 20 trillion Indonesian Rupiahs (USD 2 billion; 0.5% of GDP) in 2007 (Kemenkes, 2011). With only 29 mental health workers per million population, Indonesia is less equipped than its neighbours in South-East Asia to manage mental illness of its population (WHO, 2005).

Data: the Indonesia Family Life Survey (IFLS)

The IFLS is a multi-purpose longitudinal household survey that collects data from more than 30,000 individuals from 12,000 households, and is representative of about 83% of the entire Indonesian population. In collaboration with several Indonesian universities, the IFLS was first started by RAND Corporation in 1993, and since then three waves of follow-up data collection have been fielded, in 1997, 2000 and 2007. Prior to the interview, respondents were informed about why it is important for them to participate in the study and were provided with "examples of policies that have been affected by the study" (Thomas et al., 2012, p.110). Confidentiality and anonymity were ensured (RAND, 2011). The dataset is in the public domain and is accessible via the RAND Labor and Population website (http://www.rand.org/labor/FLS/IFLS.html).

This analysis used only the 2007 wave, as it was the first time a validated mental health instrument was used. The sample was restricted to respondents aged 14 years and older, for whom there was complete information on the mental health measure and complete household expenditure information. The sample included 25,101 individuals from 11,553 households living in 258 districts, which corresponds to approximately 86% of the IFLS 2007 sample included in the mental health module. On average, there were 5.4 individuals within each household and 44.7 households within each district.

Measure of mental health

Mental health status was measured using the 10-item Center for Epidemiologic Studies Depression scale (CES-D; Andresen, Malmgren, Carter, & Patrick, 1994), which assesses depressive symptoms (hereafter called depression) in the general population (Radloff, 1977). Although originally developed in the United States, the CES-D instrument is found to perform satisfactorily in various non-Western settings including in Indonesia, North Korea, Myanmar, Sri Lanka and Thailand (Mackinnon, McCallum, Andrews, & Anderson, 1998) with factor structure comparable to those obtained in North America and Europe. It has also been shown that there is little loss of sensitivity or specificity when using the shortened version (Kohout, Berkman, Evans, & Cornoni-Huntley, 1993; Shrout & Yager, 1989).

Each respondent is asked to report how often in the past week they experienced the listed 10 depressive symptoms. Responses are recorded using a four-category ordinal scale which ranges from 0 to 3 (0 = rarely or none of the time or 0—1 day in a week; 1 = some or little of the time or 1—2 days in a week; 2 = moderately or much of the time or 3—4 days in a week; 3 = most or almost all the time or 5—7 days in a week). After the positively phrased items were reverse-coded, scores were calculated as the sum of these responses (theoretical range 0—30). Data commonly have a positive or right-skewed distribution (Radloff, 1977), thus groups with higher means also tend to have higher variances. Sometimes a cut-off point of 10 (Andresen et al., 1994) is applied, but the continuous score is used here because no cross-validation study has ever been conducted with an Indonesian sample.

Other measures (see online Appendix A)

The per capita household expenditure variable was entered alternatively as: (1) a log-transformed continuous variable, (2) a less than $2 a day dummy variable, and (3) tertile dummy variables. The log-transformation makes the distribution more symmetric and reduces the effect of outliers, whereas the two categorical alternatives are meant to facilitate intuitive interpretations of the coefficients. The less than $2 a day dummy variable is calculated using the 2007 historical exchange rate of IDR 9182 to USD 1 (Bank Indonesia, 2013).

Age was treated as a continuous covariate. Gender was entered a dummy variable (1: female; 0: male). Marital status was entered using two dummies: for never married and for separated/divorced/ widowed; the reference is married. Adverse events are measured using two dummies for household having been affected by disaster within the last five years, and for any household member having been a victim of crime during the past year; the reference is no adverse event. The type of disaster and crime asked of respondents includes flood, volcano, earthquake and fire for disasters and theft and assault for crime (see online Appendix A for measures). Religiosity is measured with the question, "How religious are you?", with ordered choices comprising not religious (0), somewhat religious (1), and very religious (2), treated as a continuous variable. Social capital was measured using two continuous variables: trust and participation. The trust variable was calculated as the average response to seven neighbourhood trust questions, while the participation variable was calculated as the percentage of community activities known to the respondent in which they also participated within the past year out of a list of 12. Education was entered using two dummy variables: for high school and for college; the reference is secondary school or less. Physical health is based on a self-assessed general health question ("In general, how is your health?") with an ordinal response format comprising very poor, poor, fairly healthy and very healthy. A dummy variable is created indicating poor or very poor health; the reference is fair or very healthy. Household size was measured as the total number of household members. Residential location is a dummy variable indicating residence in urban areas; the reference is rural areas.

Statistical method

An individual's depressive symptoms status was examined as a function of individual-level variables and household-level variables where individual-level variables included age, sex, marital status, education, physical health, religiosity, trust, participation and per capita household expenditure, and where household-level variables included household size, rural–urban residential location, experience of disaster and experience of crime.

A multilevel modelling approach was applied in order to take full advantage of household and district clustering information available from the IFLS. Then, as the outcome variable (CES-D score) is a non-negative right-skewed discrete variable, we began with specifying an overdispersed three-level Poisson model although later we also consider linear models and Poisson models with heteroscedasticity-robust standard error.

Admittedly, the CES-D score is not a natural count, but it shares the non-negative, integer-valued, right-skewed and heteroscedastic features of count variables. Advocates for the use of Poisson regression model in this situation includes Santos Silva and Tenreyro (2006), Nichols (2010) and Gould (2011) who suggest relaxing the equidispersion assumption using the heteroscedasticity-robust variance–covariance estimator instead of a dispersion parameter. This alternative parameterisation is explored in robustness analysis, although in practice the two

Table 1
Sample characteristics and bivariate analysis.

Variable	Mean ± SD or %	Association with CES-D	% Missing
Individual characteristics (N = 29,029)			
CES-D score	4.08 ± 3.55		0.03
Age	36.88 ± 15.62	0.001*	0.01
Gender:			0.01
Male	47.61%	0.000	
Female	52.39%	0.034*	
Marital status:			0.01
Married	69.54%	0.000	
Never married	22.14%	0.151*	
Separated, divorced, or widowed	8.32%	0.263*	
Education:			7.36
Secondary school or less	57.26%	0.000	
High school	31.22%	−0.018*	
College or more	11.52%	−0.138*	
Physical health status:			0.00
Healthy	85.90%	0.000	
Poor health	14.10%	0.506*	
Religiosity	2.82 ± 0.56	−0.107*	0.24
Trust	2.72 ± 0.19	−0.169*	0.02
Participation	37.92 ± 33.82	−0.001*	4.56
Household characteristics (N = 12,683)			
Household size	5.37 ± 2.98	0.011*	0.00
Residential location:			0.00
Rural	45.94%	0.000	
Urban	54.06%	0.006	
Disaster:			0.02
Non-victim	93.68%	0.000	
Victim	6.32%	0.015	
Crime:			0.08
Non-victim	94.23%	0.000	
Victim	5.77%	0.183*	
Poverty status:			2.21
More than $2 a day	32.89%	0.000	
Less than $2 a day	67.11%	0.014*	
Per capita household exp., USD	60.87 ± 58.57	−0.021*	2.21

Percent missing is calculated from the total number of individual-level observation (N = 29,029).
Poverty status and per capita household expenditure are summarised as individual-level variables.
Reported associations are the coefficients of simple bivariate Poisson regression analysis.
The effect of per capita household expenditure is calculated from its log-transformation.
*p < .05.

approaches rarely give different results (Cameron & Trivedi, 1998, p.70).

A positive β coefficient indicates an increase in the log expected CES-D score (more depression). To enable a more intuitive interpretation of this essentially non-linear model, it is common to take the exponent of β coefficient so that difference in the log expected CES-D score can be expressed in terms of percentage change in the expected CES-D score for a one unit change in a predictor variable (Long & Freese, 2006, p.360). If the predictor variable enters the equation logarithmically, then β can be interpreted as an elasticity coefficient, indicating the percentage change in the expected CES-D score for a 1% change in the predictor (Cameron & Trivedi, 1998, p.81). This multilevel model allows the mean of the CES-D score to vary between households and districts, while the estimated effects of the covariates are held constant across households and districts. In short, this is a three-level *random-intercepts* overdispersed Poisson regression model.

Alternatively, in robustness analysis available in the online Appendix A, we fit linear multilevel models with a square-root transformed CES-D score. This linear model with a variance-stabilising square-root transformation often succeeds in handling a right-skewed outcome variable and has the advantage of being easier to interpret compared to the Poisson model. However, the

weakness of this modelling technique is that it is prone to the violation of important residual normality and homoscedasticity assumptions (Santos Silva & Tenreyro, 2006). Not needing to assume these, the Poisson model is more robust than the linear model.

Results

The mean CES-D score was 4.08 (SD = 3.55), measured on a 0 (not depressed) to 30 (very depressed) scale. Socio-demographic variables are shown in Table 1.

Bivariate Poisson regression analysis (third column of Table 1) shows that all but two predictors were statistically significantly associated with the CES-D score at the 5% level. Age, being female, being unmarried, poor physical health, household size and being a victim of crime correlated positively with the CES-D score, whereas education, religiosity, social capital and household expenditure exhibited an inverse relationship. Urban living and disaster variables failed to achieve statistical significance, but they both correlated with a higher CES-D score. The extent of missing data for each variable is given in the right-most column of Table 1. Only a small number of observations were missing. With this relatively small amount of missing data, it is expected that bias and efficiency loss in the estimation of the following multivariate models were be minimal.

Multivariate analysis (Table 2) was carried out in a step-by-step manner. First, an intercept-only or null multilevel model was fitted. Next, all individual-level covariates (except the measure of poverty) were entered, followed by household-level variables in the third step. Finally, per capita household expenditure was entered. This method allowed an estimation of net poverty coefficient, independent of the influence of potential confounders.

Results of the null model (Poisson 0) showed that the unconditional mean of the CES-D score was 3.59. This figure is allowed to vary across households and districts, but it is apparent that variation across households ($\sigma_u^2 = 0.52 = 0.27$, SD = 0.52) was greater than that attributed to districts ($\sigma_v^2 = 0.04$, SD = 0.02). The dispersion coefficient $\varphi = 2.17$ indicates that the variance is approximately twice the expected value, suggesting the presence of

a right-skewed discrete distribution whose tail is longer than the theoretical Poisson distribution. The magnitude of overdispersion seems to be constant at about $\varphi = 2$ for the remaining models (Poisson 1 to Poisson 3C).

In the second step (Poisson 1), a number of individual-level covariates were entered into the model. The inclusion of 10 additional parameters reduces the Deviance Information Criterion (DIC) by 18,602 points, suggesting a highly improved model fit. Marital status, education level, physical health status, religiosity, trust and participation were all statistically significant at the 5% level, though participation is too small to be of practical significance. Those who were unmarried, poorly-educated, or physically poor had a higher CES-D depression score than their counterparts. Unexpectedly, females did not have higher depression scores. Among these 10 individual-level covariates, poor physical health was most strongly related to depression.

In the third step (Poisson 2), household characteristics were entered. This inclusion of four variables decreases DIC by 135 points, suggesting an improvement in model fit. Urban living, disaster and crime variables were all statistically significant at the 5% level. Individuals who lived in urban areas were estimated to have a roughly 4% lower CES-D score (better mental health) than those living in rural areas, although the statistical significance diminished after household expenditure was included in the models. Individuals whose household was affected by disaster or crime had an approximately 12% higher CES-D score (worse mental health) than their counterparts.

Per capita household expenditure – the key variable of interest in this analysis – was entered into the model in the final three specifications, since it is parameterised in three forms: as a log-transformed continuous variable (Poisson 3A), as a less than $2 a day dummy variable (Poisson 3B), and as tertile dummy variables (Poisson 3C). The inclusion of per capita household expenditure alone reduces DIC by roughly 2755 points, indicating a huge improvement in model fit. All three parameterisations returned statistically significant estimates at the 5% level. Holding all other covariates constant, a 1% increase in per capita household expenditure reduced the depression score by 0.05% (Poisson 3A), while

Table 2
Multilevel Poisson regression models predicting CES-D score.

Predictors	Poisson 0	Poisson 1	Poisson 2	Poisson 3A	Poisson 3B	Poisson 3C
Intercept	1.28 ± 0.02*	1.88 ± 0.06*	1.86 ± 0.06*	2.49 ± 0.14*	1.84 ± 0.06*	1.83 ± 0.06*
Age		−0.00 ± 0.00	−0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Female		−0.01 ± 0.01	−0.01 ± 0.01	−0.00 ± 0.01	−0.00 ± 0.01	−0.00 ± 0.01
Never married		0.15 ± 0.01*	0.15 ± 0.01*	0.15 ± 0.01*	0.15 ± 0.01*	0.15 ± 0.01*
Divorced or other		0.17 ± 0.02*	0.17 ± 0.02*	0.18 ± 0.02*	0.18 ± 0.02*	0.18 ± 0.02*
High school		−0.02 ± 0.01*	−0.02 ± 0.01	−0.01 ± 0.01	−0.01 ± 0.01	−0.01 ± 0.01
College or more		−0.10 ± 0.02*	−0.09 ± 0.02*	−0.07 ± 0.02*	−0.08 ± 0.02*	−0.07 ± 0.02*
Poor physical health		0.38 ± 0.01*	0.38 ± 0.01*	0.38 ± 0.01*	0.38 ± 0.01*	0.38 ± 0.01*
Religiosity		−0.08 ± 0.01*	−0.08 ± 0.01*	−0.09 ± 0.01*	−0.09 ± 0.01*	−0.08 ± 0.01*
Trust		−0.17 ± 0.02*	−0.16 ± 0.02*	−0.17 ± 0.02*	−0.17 ± 0.02*	−0.17 ± 0.02*
Participation		−0.00 ± 0.00	−0.00 ± 0.00	−0.00 ± 0.00	−0.00 ± 0.00	−0.00 ± 0.00
Household size			0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Urban			−0.04 ± 0.02*	−0.02 ± 0.02	−0.03 ± 0.02	−0.03 ± 0.02
Disaster victim			0.11 ± 0.03*	0.10 ± 0.03*	0.10 ± 0.03*	0.10 ± 0.03*
Crime victim			0.12 ± 0.02*	0.13 ± 0.02*	0.12 ± 0.02*	0.13 ± 0.03*
Log(PCE)				−0.05 ± 0.01*		
Less than $2 a day					0.05 ± 0.01*	
Poorest PCE tertile						0.08 ± 0.02*
Middle PCE tertile						0.04 ± 0.02*
σ_v^2: between district	0.04	0.03	0.03	0.03	0.03	0.03
σ_u^2: between household	0.27	0.24	0.24	0.24	0.24	0.24
φ	2.17	2.09	2.09	2.09	2.09	2.09
N	29,019	25,686	25,660	25,101	25,101	25,101
DIC	143,214	124,612	124,477	121,719	121,723	121,723

Reported are posterior means ± standard deviations. *$p < .05$.

those living on less than $2 a day were estimated to have a 5% higher depression score (Poisson 3B) than their wealthier counterparts. Compared to the richest expenditure tertile, individuals from the poorest and the middle tertiles had on average 8% and 4% higher depression scores (Poisson 3C) respectively. These models demonstrate that even after adjusting for many potential confounders (such as education, physical health and rural–urban residential location), poverty still had a statistically significant association with mental health. Finally, to better understand the non-linear models, we calculated marginal means in Table 3.

Robustness analysis

In addition to the estimates obtained from MLwiN software, results obtained from three alternative multilevel modelling packages employing different estimation methods yielded very similar estimates (may be obtained on request from the authors). In the supplementary online Appendix A, we further explored different modelling techniques and specifications which include linear model, Poisson model with Huber–White standard error and analysis with multiply imputed datasets (Bates, Maechler, & Bolker, 2013; van Buuren, 2012; Carpenter, Goldstein, & Kenward, 2011; Leckie & Charlton, 2013; Rue, Martino, Lindgren, Simpson, & Riebler, 2009; Su & Yajima, 2012). Again, the finding remained consistent under these robustness checks.

Discussion and conclusion

The present analysis confirmed previous community-based and facility-based studies in developing countries showing that higher levels of poverty were associated with more depressive symptoms (Lund et al., 2010). It is inconsistent with the lack of an association found in a recent individual-based study conducted by Das et al. (2007, 2009).

The data came from a validated mental health measure, namely the CES-D and a more recent individual sample from Indonesia. The analysis shows that after controlling for a number of relevant factors, a 1% decrease in per capita household expenditure was associated with a 0.05% increase in CES-D score (worse mental health); similar inverse relationship was found when poverty was measured alternatively using poverty line or expenditure tertiles. The finding remained even after multiple imputation was used to deal with missing data. Furthermore, this inverse relationship was robust to various distributional assumptions and estimation methods. Regardless of whether the CES-D score is assumed to follow a discrete overdispersed Poisson distribution or (after transformation) a continuous normal distribution, the coefficient of poverty remains statistically significant and substantively important. Of course, one might argue that the effect is not big enough, but we believe that it is not wise to discount poverty in understanding mental health. The estimates indicate the *net effect of consumption poverty* after controlling for many possible sources of disadvantage.

The analysis also examines the effects of gender, marital status, adverse event, religiosity and social capital on mental health. Nearly all of these were statistically significant. Consistent with the

literature, unmarried individuals (along with those who are separated, divorced, or widowed) were found to have a 16–20% higher depression score than their married counterparts. Individuals whose household has been affected by disaster or crime are estimated to have a 10–14% elevated depression score compared to those whose household was not affected. As expected, religiosity correlated positively with mental health: religious individuals were mentally healthier than their secular counterparts. Social trust also exhibited positive association with mental health.

There was no difference in depression according to gender. Although surprising, this is not unknown in the literature (Dzator, 2012; Jenkins et al., 2012; WHO, 2012). Given the fact that gender effect was statistically significant in bivariate analysis but not in multivariate analysis, one may speculate that the effect is fully explained by other covariates introduced to the model as the analysis reported here used more extensive factors capturing gender disadvantages that might have been unavailable in other studies. Alternatively, one may also surmise that this is attributable to the use of IFLS dataset as we mentioned previously: it is likely that the IFLS study over-represents individuals living in areas where relatively equal role for both genders are available.

This study has a number of limitations which may motivate future work. First, although it has demonstrated that poverty was associated with more depression, no conclusion can be drawn about the effect of poverty on mental illness. Secondly, the scope of poverty measured in this study is still largely limited to the notion of monetary welfare, albeit with the inclusion of education and physical health measures in the models. Like mental health, poverty is a multidimensional concept with a broader span than merely the household income or expenditure (Alkire & Foster, 2011). Thirdly, due to the absence of cross-validation research that presents the optimal cut-off point of the 10-item CES-D instrument in Indonesia, this paper is not able to determine the clinically significant depression prevalence rate. Agreeing with Das et al. (2007), such study is urgently needed in Indonesia.

Despite its limitations, this paper presents two significant implications for policy makers. First, in contradicting the study of Das et al. (2007, 2009), it provides a further source of empirical support for the generally established view regarding the inverse association between poverty and mental health in developing countries. Policy makers may now want to look more closely at poverty alleviation efforts in the context of the considerable impact they can have on mental health. Moreover, public investment in the mental health sector – especially one that is geared towards catering for the needs of the poor – may also be regarded as an integral part of the maintenance of public mental health in developing countries. This echoes Rose's insistence that 'politics and medicine' are inextricably linked (Rose, 1992).

Indeed, a recent systematic review (Lund et al., 2011) suggests that some forms of poverty alleviation intervention (such as conditional cash transfers and asset promotion programmes) are beneficial for mental health, and that mental health interventions are generally associated with improved economic outcomes. Finally, this paper also provides empirical support for the notion of the universality of poverty as an important risk factor in regard to poor mental health as has been emphasised by the WHO above. The negative association between poverty and mental health is found not only in industrialised countries but also in developing countries, making it essential that the next global development agenda include mental health among its priority programmes. Mental health, which was not included in the Millennium Development Goals to be achieved by the year 2015, must not continue to be overlooked. Its inclusion in the post-

Table 3
Marginal effect at means.

Daily consumption	Predicted score	Expenditure tertile	Predicted score
<$2 a day	3.31	1	3.40
≥$2 a day	3.16	2	3.25
		3	3.16

Random-effects are set to zero; other covariates are held at mean values.

2015 global development agenda should certainly motivate many governments in developing countries to improve their mental health service sector.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.socscimed.2014.01.012.

References

Afifi, T. O., Cox, B. J., & Enns, M. W. (2006). Mental health profiles among married, never-married, and separated/divorced mothers in a nationally representative sample. *Social Psychiatry and Psychiatric Epidemiology, 41*(2), 122–129.

Alkire, S., & Foster, J. (2011). Counting and multidimensional poverty measurement. *Journal of Public Economics, 95*(7–8), 476–487.

Amick-Mcmullan, A., Kilpatrick, D. G., & Resnick, H. S. (1991). Homicide as a risk factor for PTSD among surviving family members. *Behaviour Modification, 15*(4), 545–559.

Andresen, E. M., Malmgren, J. A., Carter, W. B., & Patrick, D. L. (1994). Screening for depression in well older adults: evaluation of a short form of the CES-D (Center for Epidemiologic Studies–Depression Scale). *American Journal of Preventive Medicine, 10*(2), 77–84.

Bahar, E., Henderson, A. S., & Mackinnon, A. J. (1992). An epidemiological study of mental health and socioeconomic conditions in Sumatera, Indonesia. *Acta Psychiatrica Scandinavica, 85*(4), 257–263.

Bank Indonesia. (2013). *Kurs transaksi Bank Indonesia*. Available at http://www.bi.go.id/web/id/Moneter/Kurs+Bank+Indonesia/Kurs+Transaksi/ Accessed 06.06.13.

Bates, D., Maechler, M., & Bolker, B. (2013). *lme4: Linear mixed-effects models using S4 classes*. R package version 0.999999-2. Available at http://CRAN.R-project.org/package=lme4 Accessed 20.06.13.

Bir, A., & Frank, R. G. (2001). *Mental illness and the labour market in developing nations*. Paper prepared for WHO commission on macro-economics and health. Geneva: The World Health Organization.

Bromet, E., Andrade, L. H., Hwang, I., Sampson, N., Alonso, J., Girolamo, G., et al. (2011). Cross-national epidemiology of DSM-IV major depressive episode. *BMC Medicine, 9*(90), 1–16.

van Buuren, S. (2012). *Flexible imputation of missing data*. In *Interdisciplinary statistics series*. Boca Raton: CRC Press.

Cameron, A. C., & Trivedi, P. K. (1998). *Regression analysis of count data*. New York: Cambridge University Press.

Carpenter, J., Goldstein, H., & Kenward, M. (2011). REALCOM-IMPUTE software for multilevel multiple imputation with mixed response types. *Journal of Statistical Software, 45*(2), 1–14.

Das, J., Do, Q. T., Friedman, J., & McKenzie, D. (2009). Mental health patterns and consequences: results from survey data in five developing countries. *World Bank Economic Review, 23*(1), 31–55.

Das, J., Do, Q. T., Friedman, J., McKenzie, D., & Scott, K. (2007). Mental health and poverty in developing countries: revisiting the relationship. *Social Science & Medicine, 65*, 467–480.

Dein, S., Cook, C., & Koenig, H. (2012). Religion, spirituality, and mental health: current controversies and future directions. *The Journal of Nervous and Mental Disease, 200*(10), 852–855.

Dzator, J. (2012). Hard times and common mental health disorders in developing countries: insights from urban Ghana. *Journal of Behavioral Health Services & Research, 40*(1), 71–87.

Ellison, C., Boardman, J., Williams, D. R., & Jackson, J. S. (2001). Religious involvement, stress, and mental health: findings from the 1995 Detroit Area Study. *Social Forces, 80*(1), 215–249.

Galea, S., Nandi, A., & Vlahov, D. (2005). The epidemiology of post-traumatic stress disorder after disasters. *Epidemiologic Reviews, 27*(1), 78–91.

Goldberg, D. (1972). *The detection of psychiatric illness by questionnaire*. London: Oxford University Press.

Gould, W. (22 August 2011). *Use Poisson rather than regress; tell a friend. The Stata Blog*. Available at http://blog.stata.com/2011/08/22/use-poisson-rather-than-regress-tell-a-friend/ Accessed 29.10.13.

Hamad, R., Fernald, L. C. H., Karlan, D. S., & Zinman, J. (2008). Social and economic correlates of depressive symptoms and perceived stress in South African adults. *Journal of Epidemiology and Community Health, 62*(6), 538–544.

Hussain, N., Creed, F., & Tomenson, B. (2000). Depression and social stress in Pakistan. *Psychological Medicine, 30*(2), 395–402.

IHME. (2013). *Global burden of disease (GBD) visualizations*. Institute for Health Metrics and Evaluation. Available at http://www.healthmetricsandevaluation.org/gbd/visualizations/country Accessed 14.11.13.

Jenkins, R., Njenga, F., Okonji, M., Kigamwa, P., Baraza, M., Ayuyo, J., et al. (2012). Prevalence of common mental disorders in a rural district of Kenya, and socio-demographic risk factors. *International Journal of Environmental Research and Public Health, 9*(5), 1810–1819.

Kawachi, I., & Berkman, L. (2000). Social cohesion, social capital and health. In L. Berkman, & I. Kawachi (Eds.), *Social epidemiology* (pp. 174–190). Oxford: Oxford University Press.

Kemenkes. (2011). *Program terintegrasi dan penguatan lintas sektor dalam penanggulangan masalah kesehatan jiwa*. Rapat Koordinasi Tingkat Menteri. Jakarta: Kementerian Kesehatan Republik Indonesia.

Kilpatrick, D. G., & Acierno, R. (2003). Mental health needs of crime victims: epidemiology and outcomes. *Journal of Traumatic Stress, 16*(2), 119–132.

Koenig, H., King, D., & Carson, V. (2012). *Handbook of religion and health* (2nd ed.). New York: Oxford University Press.

Kohout, F. J., Berkman, L. F., Evans, D. A., & Cornoni-Huntley, J. (1993). Two shorter forms of the CES-D depression symptoms index. *Journal of Aging and Health, 5*(2), 179–193.

Leach, L. S., Butterworth, P., Olesen, S. C., & Mackinnon, A. (2013). Relationship quality and levels of depression and anxiety in a large population-based survey. *Social Psychiatry and Psychiatric Epidemiology, 48*(3), 417–425.

Leckie, G., & Charlton, C. (2013). runmlwin – a program to run the MLwiN multilevel modelling software from within Stata. *Journal of Statistical Software, 52*(11), 1–40.

Lim, C., & Putnam, R. D. (2010). Religion, social networks, and life satisfaction. *American Sociological Review, 75*(6), 914–933.

Long, J. S., & Freese, J. (2006). *Regression models for categorical dependent variables using Stata* (2nd ed.). College Station, Texas: Stata Press.

Lund, C., Breen, A., Flisher, A. J., Kakuma, R., Corrigall, J., Joska, J. A., et al. (2010). Poverty and common mental disorders in low and middle income countries: a systematic review. *Social Science & Medicine, 71*, 517–528.

Lund, C., De Silva, M., Plagerson, S., Cooper, S., Chisholm, D., Das, J., et al. (2011). Poverty and mental disorders: breaking the cycle in low-income and middle-income countries. *The Lancet, 378*(9801), 1502–1514.

Lund, C., Myer, L., Stein, D. J., Williams, D. R., & Flisher, A. J. (2013). Mental illness and lost income among adult South Africans. *Social Psychiatry and Psychiatric Epidemiology, 48*(5), 845–851.

Mackinnon, A., McCallum, J., Andrews, G., & Anderson, I. (1998). The Center for Epidemiological Studies Depression scale in older community samples in Indonesia, North Korea, Myanmar, Sri Lanka, and Thailand. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 53*(6), 343–352.

Miller, D. L., Scheffler, R., Lam, S., Rosenberg, R., & Rupp, A. (2006). Social capital and health in Indonesia. *World Development, 34*(6), 1084–1098.

Mumford, D. B., Minhas, F. A., Akhtar, I., Akhter, S., & Mubbashar, M. (2000). Stress and psychiatric disorder in urban Rawalpindi community survey. *The British Journal of Psychiatry, 177*(6), 557–562.

Mumford, D. B., Nazir, M., Jilani, F. U., & Baig, I. Y. (1996). Stress and psychiatric disorder in the Hindu Kush: a community survey of mountain villages in Chitral, Pakistan. *The British Journal of Psychiatry, 168*(3), 299–307.

Mumford, D. B., Saeed, K., Ahmad, I., Latif, S., & Latif, S. (1997). Stress and psychiatric disorder in rural Punjab: a community survey. *The British Journal of Psychiatry, 170*(5), 473–478.

Myer, L., Stein, D. J., Grimsrud, A., Seedat, S., & Williams, D. R. (2008). Social determinants of psychological distress in a nationally-representative sample of South African adults. *Social Science & Medicine, 66*(8), 1828–1840.

National Center on Addiction and Substance Abuse at Columbia University. (2001). *So help me god: Substance abuse, religion and spirituality*. New York: Columbia University.

Nichols, A. (2010). Regression for nonnegative skewed dependent variables. In *BOS10 Stata Conference 2*. Stata User Group. Available at http://repec.org/bost10/nichols_boston2010.pdf Accessed 07.11.13.

Noorbala, A. A., Yazdi, S., Yasamy, M. T., & Mohammad, K. (2004). Mental health survey of the adult population in Iran. *The British Journal of Psychiatry, 184*(1), 70–73.

Patel, V. (2007). Mental health in low- and middle-income countries. *British Medical Bulletin, 81–82*(1), 81–96.

Patel, V., Araya, R., de Lima, M., Ludermir, A., & Todd, C. (1999). Women, poverty and common mental disorders in four restructuring societies. *Social Science & Medicine, 49*, 1461–1471.

Radloff, L. S. (1977). The CES-D scale: a self-report depression scale for research in the general population. *Applied Psychological Application, 1*, 385–401.

Rai, D., Zitko, P., Jones, K., Lynch, J., & Araya, R. (2013). Country- and individual-level socioeconomic determinants of depression: multilevel cross-national comparison. *The British Journal of Psychiatry, 202*(3), 195–203.

RAND. (2011). *IFLS data updates, tips, and FAQs*. Available at http://www.rand.org/labor/FLS/IFLS/datanotes.html Accessed 07.11.13.

Roberts, B., Ocaka, K. F., Browne, J., Oyok, T., & Sondorp, E. (2009). Factors associated with the health status of internally displaced persons in northern Uganda. *Journal of Epidemiology and Community Health, 63*(3), 227–232.

Rose, G. (1992). *Strategy of preventive medicine*. Oxford: Oxford University Press.

Rue, H., Martino, S., Lindgren, F., Simpson, D., & Riebler, A. (2009). *INLA: Functions which allow to perform full Bayesian analysis of latent Gaussian models using integrated nested Laplace approximation*. R package version 0.0. Available at http://www.r-inla.org/ Accessed 20.07.13.

Santos Silva, J. M. C., & Tenreyro, S. (2006). The log of gravity. *The Review of Economics and Statistics, 88*(4), 641–658.

Satcher, D., Friel, S., & Bell, R. (2007). Natural and manmade disasters and mental health. *The Journal of the American Medical Association, 298*(21), 2540–2542.

Shrout, P. E., & Yager, T. J. (1989). Reliability and validity of screening scales: effect of reducing scale length. *Journal of Clinical Epidemiology, 42*(1), 69–78.

Stafford, M., Chandola, T., & Marmot, M. (2007). Association between fear of crime and mental health and physical functioning. *American Journal of Public Health, 97*(11), 2076–2081.

Su, Y., & Yajima, M. (2012). *R2jags: A package for running jags from R.* R package version 0.03-08. Available at http://CRAN.R-project.org/package=R2jags Accessed 20.07.13.

Tampubolon, G. (2012). Neighbourhood social capital and individual mental health. In M. van Ham, D. Manley, N. Bailey, L. Simpson, & D. Maclennan (Eds.), *Neighbourhood effects research: New perspectives* (pp. 175—194). New York: Springer. http://dx.doi.org/10.1007/978-94-007-2309-2_8.

Thomas, D., Witoelar, F., Frankenberg, E., Sikoki, B., Strauss, J., Sumantri, C., et al. (2012). Cutting the cost of attrition: results from the Indonesia Family Life Survey. *Journal of Development Economics, 98*(1), 108—123.

Vaillant, G., Templeton, J., Ardelt, M., & Meyer, S. E. (2008). The natural history of male mental health: health and religious involvement. *Social Science & Medicine, 66,* 221—231.

Wade, T. J., & Pevalin, D. J. (2004). Marital transitions and mental health. *Journal of Health and Social Behaviour, 45*(2), 155—170.

WHO. (2001). *The world health report: Mental health.* Geneva: The World Health Organization.

WHO. (2004). Prevalence, severity, and unmet need for treatment of mental disorders in the World Health Organization World Mental Health Survey. *The Journal of the American Medical Association, 291*(21), 2581—2590.

WHO. (2005). *Mental Health Atlas 2005.* Geneva: The World Health Organization. Available at http://www.who.int/mentalhealth/evidence/mhatlas05/en/index.html Accessed 03.07.13.

WHO. (2012). *Depression: A global public health concern.* Geneva: The World Health Organization.

Wind, T. R., Joshi, P. C., Kleber, R. J., & Komproe, I. H. (2013). The impact of recurrent disasters on mental health: a study on seasonal floods in northern India. *Prehospital and Disaster Medicine, 28*(3), 279—285.

World Bank. (2013). *World Development Indicators (WDI), the World Bank online database.* Available at http://data.worldbank.org/indicator Accessed 15.06.13.

Zhou, X., Yan, Z., & Therese, H. (2012). Depression and aggression in never-married men in China: a growing problem. *Social Psychiatry and Psychiatric Epidemiology.* http://dx.doi.org/10.1007/s00127-012-0638-y.