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Individual and societal impact on earnings associated with serious mental illness in metropolitan China

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ABSTRACT

To evaluate individual-level and societal-level losses of income associated with serious mental illness in metropolitan China, a multi-stage probability survey was administered to adults aged 18–70 years in Beijing and Shanghai. We used data to estimate individual-level expected earnings from a model that included information about the respondents' education level, marital status, age, and gender. Expected earnings were compared to observed earnings among respondents with mental illness and serious disability. The result shows that the 12-month prevalence of such serious mental illness was 0.6%. Its impact on earnings was significant in the total sample and was higher for males (76% of gender-specific expected salary was lost) than for females (32%). When projected to societal level, the annual impact was estimated to be 466 million *Renminbi* (RMB 8.27 = USD 1), less than 0.2% of the gross domestic product (GDP) of the two cities. Serious mental illness was associated with a substantial decrease in individual-level earnings, but the burden that resulted from societal-level loss of earnings was not large enough to help drive mental health policy and programs in China.

1. Introduction

A fast growing body of research has shown that mental illness is associated with substantial functional impairments that are costly to society (Greenberg et al., 1993; Harwood et al., 2000; Eaton et al., 2008; Kessler et al., 2008). Using various econometric indices, researchers have argued that, from the perspective of societal investment, it is cost-justified to expand efforts to treat mental illness. Of the different measures of the costs of impairments associated with mental illness, lost earnings may be particularly relevant to the cost-saving argument. This is because earnings are readily quantifiable and to a good extent capture the cumulative effects of mental disorders on educational, occupational, social, and other impairments that society could reduce by treating mental illness adequately. However, studies of the association between mental illness and loss of earnings are largely confined to the U.S. (Rice et al., 1990; Harwood et al., 2000; Kessler et al., 2008).

Studies on the economic burden of mental illness in Asian countries are limited despite the enormous size of their populations. This is partly because of the paucity of specific epidemiological information required for making econometric estimations (Hu, 2004). Although the Global Burden of Disease (GBD) study reported that in China unipolar depressive disorder was the fourth highest leading cause of Disability Adjusted Life Years (DALYs — the sum of years of potential life lost due to premature mortality and the years of productive life lost due to disability, Mathers et al., 2003), the data sources from which this estimate (4.5% of total DALYs) was derived can be questioned (Eaton et al., 2008). Epidemiological studies of mental disorders in China have focused on prevalence estimates of severe disorders and their basic socio-demographic correlates. Severity was usually based on diagnosis (especially psychotic disorders) rather than measures of high levels of disability arising from a range of mental disorders. This is not surprising because the notions of severe non-psychotic disorders defined by disability, dimensional measures of severity, and direct versus indirect economic costs are relatively new in China. From a search of the Chinese psychiatric literature, we found several clinical studies of the economic burden of patients with schizophrenia (Tan et al., 2005) and only two recent clinical studies of the economic burden of anxiety and depression diagnosed using the Chinese Classification of Mental Disorders (Chinese Society of Psychiatry, 2001). One showed that Chinese outpatients with anxiety disorders had higher overall health care costs than those with depressive disorder, but the two groups did not differ on indirect cost as calculated by income lost because of absence from work (Zhang and Ou, 2008). The

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other study estimated the economic burden of 652 outpatients with depression in Shanghai (Chen et al., 2006). Direct cost was based on consultation and treatment fee ("direct medical cost"), health products, transportation, and payment for care-taker ("direct non-medical cost"). Indirect cost consisted of lost income because of absence from work for patients and their family members. The results showed that the total annual economic burden of each depressed outpatient was RMB 6808.56 (approximately USD 825 [RMB 8.27—USD 1], equivalent to 33.1% of the average annual salary in Shanghai in 2003). The estimated total economic burden of depression was RMB 396 millions. In this study, direct medical cost (RMB 197 million) was nearly half (49.7%) of the total cost. The proportion was high compared to studies of the direct costs of depression (about 20–40% of total) in other countries (Nuijten, 2001; Hu, 2004). This may be because the effects of mental illness on reduction in labor force participation (i.e., reduced probability of being employed) was not considered, thereby under-estimating the indirect costs of depression (Kessler et al., 2008).

The usefulness of the above Chinese studies for formulating policy and programs on mental disorders is limited for several reasons. First, they could under-estimate economic burden because indirect cost was only estimated from loss of income due to absence from work. Second, since the great majority of people with depression did not receive any medical treatment in China (Lee et al., 2007a,b; Lee et al., 2009), the generalizability of findings from these clinical studies to the community is greatly limited. Third, the findings cannot be compared with those of other countries because the studies did not use standardized definitions of mental disorders and methods of cost estimation. Finally, these studies did not use a control group and did not examine the proportions of direct/indirect cost and lost earnings associated with mental disorders.

As part of the World Mental Health (WMH) Survey Initiative, which is a cross-national epidemiological survey of mental disorders on prevalence, risk correlates, course, and consequences (Kessler and Üstün, 2008), the present study aims to estimate the cost of mental disorders on earnings at both individual and societal levels in metropolitan China.

2. Methods

2.1. Sample

A three-stage clustered area probability sampling strategy according to household register was employed to survey 18- to 70-year-old adults in the metropolitan areas of Beijing and Shanghai (Heeringa et al., 2008). In first-stage sampling, 4162 neighborhood committees (NCs) in Beijing (containing 2,009,253 households) and 2319 NCs in Shanghai (containing 2,507,416 households) were designated in the sampling pool. According to probabilities proportional to size (PPS) measures, 47 NCs in Beijing and 44 NCs in Shanghai were selected and the field samplers went to these NCs to check their actual residential distribution against the obtained demographic data. In the second stage, a sample of household was selected randomly for each NC according to pre-decided sampling intervals and the random starting point. In the third stage, all eligible members of the selected household were recorded by the field sampler and one eligible person was randomly chosen (Shen et al., 2006). Finally, 5201 interviews (Beijing: $n=2633$; Shanghai: $n=2568$) were administered face to face by trained lay interviewers in the homes of respondents between November 2001 and February 2002. The response rates were 74.8% (Beijing) and 74.6% (Shanghai). The interviews were in two parts. Part one included the core diagnostic assessment. Part two, which was administered to all part-one respondents with any core disorder and a 25% probability sub-sample of other part one respondents ($n=1628$), included information about social demographic correlates (including income and financial status of the respondents) and disorders of secondary interest such as conduct disorder and separation anxiety disorder. Earnings were assessed in part two. The sample was weighed to adjust for differential probability of sample selection, including those in part two, and discrepancies on socio-demographic distribution between the sample and the census population (see Shen et al., 2006 for details of weighting).

All respondents provided written informed consent after the nature of the interview was fully explained. Training and assessment of interviewers, sampling, and field procedure were undertaken according to the standardized procedures of the surveys conducted by all participants of the WMH Consortium (Heeringa et al., 2008; Pennell et al., 2008). Ethical approval for conducting the survey in both cities was obtained from the Peking University Institute of Mental Health and Shanghai Institute of Mental Health, respectively.

2.2. Measures

2.2.1. Mental disorder

The WMH version of the WHO Composite International Diagnostic Interview (WMH-CIDI, Kessler and Üstün, 2004) is a fully structured diagnostic interview for assessing DSM-IV mental disorders, including anxiety disorders, mood disorders, impulse-control disorders, substance use disorders, and a screen for non-affective psychotic symptoms. One-year and lifetime prevalences of these disorders were previously reported (Shen et al., 2006; Lee et al., 2007b). The WMH-CIDI was translated into Chinese using the standard WHO protocol in which a team of survey experts completed the initial translation and a separate team carried out an independent back translation to ensure preservation of the meaning of the original English version. Discrepancies between translation and back translation were reviewed and adjusted. Blind clinical reappraisal interviews were administered to psychiatric patients and normal controls. WMH-CIDI diagnoses were found to have good concordance with diagnoses generated by semi-structured diagnostic interviews (Huang et al., 2008).

Respondents are categorized as having serious mental illness (SMI) if they (1) were diagnosed with 12-month bipolar I, (2) attempted suicide in the last 12 months and had any core 12-month diagnosis (core disorders are defined as any of the following in the past 12 months: major depressive episode, agoraphobia, PTSD, generalized anxiety disorder, social phobia, specific phobia, intermittent explosive disorder, adult separation anxiety, dysthymia, bipolar I, bipolar II, or bipolar sub-threshold), or (3) had one or more core 12-month diagnosis and a high level of impairment on the Sheehan Disability Scale (SDS, Leon et al., 1997).

2.2.2. Earnings

All part-two respondents were asked to report their personal pre-tax earnings in the previous 12 months. Only wages and other stipends from employment, but not pensions, investments, or other financial assistance, were counted. Twenty-three respondents with missing values on earnings were excluded from analysis.

2.3. Analysis

As in our previous publications of the same survey, data from the two cities were combined for analysis because of the relatively low prevalence of mental disorders (Shen et al., 2006; Lee et al., 2007b). We used regression analysis to predict monthly personal earnings. The predictors included 12-month SMI, age, gender, substance use disorders, and interactions between sex and all other model variables (Goldsmith et al., 1997; Bowles et al., 2001). The inclusion of interactions allowed us to estimate the effect of SMI for men and women separately. Although educational and marital status might be influenced by mental disorders (Forthofer et al., 1996), we included these variables in the multivariate model in order to estimate the extent to which they mediated the total effects of SMI. We also used the generalized linear model (GLM) because the earnings distribution was highly skewed and included a number of people with no earning at all. Then we simulated two estimates of predicted earnings for each respondent within the best-fitting models: one based on the actual characteristics of the respondent and another based on the counterfactual assumption that the respondent had no SMI. Individual-level differences between the two estimates were averaged across all respondents with SMI to estimate the mean individual-level decrease in earnings associated with SMI. This estimate was projected to the societal level by multiplying the estimated prevalence of SMI with the size of population. Because the sample design was geographically clustered and the data were weighted, the method of jackknife repeated replication was used to generate design-based standard errors (Wolter, 1985). Statistical significance was evaluated using two-tailed tests with an alpha level of 0.05.

3. Results

3.1. Distributions of SMI, earnings, and demographic variables

The 12-month prevalence estimate of SMI was 0.6% (SE = 0.24%), whereas the 12-month prevalence estimate of mental disorder of other severity was 5.7% (SE = 0.85%). Another 3.4% (SE = 0.47%) of the sampled population was estimated to have a lifetime history of mental disorders (Table 1). Among those with SMI, the three most prevalent disorders were major depressive episode (68%), intermittent explosive disorder (43.3%), and specific phobia (25.3%) for male; for female they were specific phobia (76.4%), major depressive episode (29%), and social phobia (10.9%) (further details of distribution are available upon request). There was no significant difference between genders on having SMI ($\chi^2_{df=1}=1.8$, $P=0.16$). However, males outnumbered females on 12-month alcohol abuse ($\chi^2_{df=1}=73.2$, $P<0.01$) and dependence ($\chi^2_{df=1}=10.7$, $P<0.01$), lifetime alcohol abuse ($\chi^2_{df=1}=20.9$, $P<0.01$), and lifetime illicit drug abuse ($\chi^2_{df=1}=6.1$, $P=0.02$). Females outnumbered males on 12-month illicit drug abuse ($\chi^2_{df=1}=4.8$, $P=0.03$).

Table 1
Clinical and demographic characteristics of World Mental Health — metropolitan China respondents.

	Total sample ($n=1439$)		Males ($n=733$)		Females ($n=706$)	
Characteristics	%	SE	%	SE	%	SE
Prevalence of DSM-IV/CIDI mental disorders						
12-month serious mental illness	0.6	*0.24*	0.3	*0.11*	0.9	*0.49*
Other 12-month mental illness	5.7	0.85	7.0	1.45	4.3	0.94
Other lifetime mental illness	3.4	0.47	3.2	0.71	3.5	0.63
Prevalence of alcohol use disorders[a]						
12-month alcohol abuse without dependence	1.1	*0.37*	2.1	*0.72*	0.01	*0.01*
12-month alcohol dependence	0.6	*0.16*	1.1	*0.29*	0.1	*0.10*
Other lifetime alcohol abuse without dependence	2.7	0.44	4.8	0.89	0.4	*0.25*
Other lifetime alcohol dependence	0.4	*0.12*	0.8	*0.23*	0.0	*0.00*
Prevalence of illicit drug use disorders[a]						
12-month abuse without dependence	0.1	*0.04*	0.01	*0.01*	0.1	*0.09*
12-month dependence	0.0	*0.00*	0.0	*0.00*	0.0	*0.00*
Other lifetime abuse without dependence	0.4	*0.22*	0.7	*0.39*	0.1	*0.09*
Other lifetime dependence	0.01	*0.01*	0.0	*0.00*	0.03	*0.03*
Earnings in the previous month[b]						
Any earnings in the previous month	66.2	1.97	69.1	2.30	62.9	2.57
Low (<RMB 700)	22.0	2.01	19.3	2.13	25.4	3.30
Low-average (RMB 700–<1020)	31.0	2.24	33.1	3.23	28.0	2.85
Average-high (RMB 1020–<1524)	24.0	2.18	23.4	2.66	24.5	3.65
High (>=RMB 1524)	23.4	2.06	24.3	3.00	22.2	3.05
Demographic control variables						
Gender						
Females	53.1	1.80				
Males	46.9	1.80				
Age						
18–24	20.4	1.52	21.1	2.37	19.5	2.56
25–39	34.5	2.12	35.0	2.60	34.0	3.00
40–54	31.4	1.95	31.2	2.60	31.5	2.81
55–64	13.8	1.24	12.7	1.41	15.0	1.85

SMI: Serious mental illness.
Figures in *italic*, especially the large SE compared with the mean values because of small sub-sample size, should be interpreted with caution.
[a] The four categories of alcohol disorders and illicit drug disorders are mutually exclusive. Respondents with a lifetime history of substance dependence who were in partial remission in the 12 months before interview were coded as having 12-month dependence. Only respondents who did not meet criteria for a 12-month disorder were eligible for classification as having a lifetime disorder.
[b] Earnings in the previous month were divided roughly into quartiles in the sub-sample of respondents who had any earnings (RMB 1 = USD 0.121 during interview period).

Table 2
Mean expected monthly earnings in the absence of SMI compared to observed monthly earnings among respondents with 12-month DSM-IV/CIDI SMI.

	Total sample ($n=1439$)		Males ($n=733$)		Females ($n=706$)	
In RMB per person	Estimate	SE	Estimate	SE	Estimate	SE
All respondents						
Observed earnings	364	51	300	38	392	78
Expected earnings	779	*151*	1246	158	576	*114*
Mean estimated impact of SMI	415	*166*	946	*235*	185	*180*
Impact % of expected earnings	53%		76%		32%	
Impact per person as share of median earnings	0.41	*0.17*	0.95	*0.24*	0.19	*0.18*
Employed respondents						
Observed earnings	510	*119*	601	58	486	*138*
Expected earnings	1136	*293*	1760	171	968	*275*
Mean estimated impact of SMI	625	*267*	1159	*455*	482	*302*
Impact % of expected earnings	55%		65%		50%	
Impact per person as share of median earnings for the employed only	0.63	0.04	1.16	*0.46*	0.48	0.04
Total population						
Observed earnings	953	22	1053	28	841	28
Expected earnings	956	22	1056	28	843	28
Mean estimated impact of SMI	3	*1*	3	*1*	2	*2*
Percentage reduction in mean income per person associated with SMI (%)	0.26%	*0.11%*	0.3%	*0.11%*	0.2%	*0.2%*

Control variables include — gender, age, household size, alcohol and substance abuse and dependence (12 months and lifetime), marital status, and education.
Interaction variables include — gender × predictor (SMI in 12 months), gender × controls.
Impact per person as share of median earnings = mean estimated impact of SMI/the median of earnings.
Percentage reduction in mean income per person due to SMI = mean estimated impact of SMI (total population)/mean expected earnings (total population).
Figures in *italic*, especially the large SE compared with the mean values because of small sub-sample size, should be interpreted in caution.

More than half (66.2%) of the sample had some personal earnings in the previous 12 months. There were significantly more male than female respondents reporting personal earnings (69.1% versus 62.9%, $\chi^2_{df=1}=4.7$, $P=0.04$), but the difference between male and female respondents on level of earnings among those with any earnings was not significant ($\chi^2_{df=1}=1.0$, $P=0.41$).

3.2. Simulated individual-level and societal-level effect estimates

Using generalized linear models, we found that SMI significantly predicted individual-level earnings in the total sample as well as among respondents who were employed (detailed result of analysis available upon request). As shown in Table 2, the mean observed monthly earnings of a respondent with SMI was RMB 364 (SE = 51) compared with the expected monthly earnings if the respondent had no SMI (RMB 779, SE = 151). The difference between expected and observed values (RMB 415, SE = 166) was interpreted as the estimated impact of SMI on earnings. That is, SMI was associated with 53% loss of the expected salary. This estimated impact was higher for males (76%, RMB 946, SE = 235) than for females (32%, RMB 185, SE = 180). The estimation of the model and the simulation were then repeated in the sub-sample of respondents who were employed. The mean impact of SMI on earnings was 55% of the expected salary (RMB 625, SE = 267), which was lower than in the total sample. The differences in the estimates in the total sample and in the sub-sample of respondents who were employed were due to the fact that SMI not only predicted reduced earnings among the employed but also predicted probability of being employed. Similar to the total sample, the impact was higher among employed males (65%, RMB 1,159, SE = 455) than employed females (50%, RMB 482, SE = 302).

The societal-level impact of SMI was estimated by projecting the individual-level impact to the 19.4 million persons aged 18–70 years in the populations of Beijing and Shanghai. The estimated annual societal-level impact of SMI added up to RMB 466 million. Because of the low prevalence of SMI in the population, this total represented only RMB 24 per person in the population annually. That is, for each person in the population, his/her income was reduced by only 0.26% (SE = 0.11) in association with SMI.

4. Discussion

4.1. Comparisons with other studies

To our knowledge, there is only one U.S. study on the associative effect of mental illness on earnings that used a similar methodology as ours (Kessler et al., 2008). Several similar findings are noteworthy.

First, more males than females reported having any earnings and, among these respondents with earnings, males reported higher levels of earnings than females. That many females were housewives and more likely to occupy low-income jobs might account for this. Second, people with SMI were significantly less likely to have any earnings and, among those with any earnings, had significantly lower earnings than people of the same age and gender without SMI. In the present study, people with SMI earned only one-third of the earnings expected from their age and gender had they not had SMI. The U.S. study showed a more modest lowering of earnings, namely people with SMI earned approximately two-thirds of the expected amount. Third, the impact of SMI on earnings was larger on males than on females.

Regarding differences, there was no significant gender difference in the prevalence of SMI in our study, whereas the U.S. showed a female dominance. Our failure to find a gender difference is cross-nationally atypical but consistent with previous Chinese psychiatric surveys (Lee et al., 2009). Another difference is that a lower proportion of Chinese (66.2%) than of U.S. (86.1%) respondents reported any 12-month personal earnings. This could partly be due to a higher rate of unemployment in our sample. But the most notable difference between the two studies was in the estimated level of societal loss of income.

4.2. Individual versus societal impact

Kessler et al. (2008) found that the annual impact associated with SMI was USD 193.2 billion. When this amount was shared by the entire U.S. population, the mean impact of SMI per year was USD 1075.7 per person. This amount was even larger than the USD 145 billion economic stimulus package proposed to help avoid recession in the U.S in January 2008. The authors therefore argued that mental disorders were associated with substantial societal-level impairments that should be considered in the allocation of resources. Although we found a substantial individual-level impact associated with SMI, the societal impact was hardly staggering. The annual impact on earnings associated with SMI (RMB 466 million) represented a very small portion (<0.2%) of the GDP of Beijing and Shanghai in 2001 (RMB 284.6 billion and RMB 495.1 billion respectively). When the cost was shared by the entire population of both cities, the mean estimated impact of SMI per year was only RMB 24 (USD 3.1) per person.

The finding of low societal cost could partly be explained by the low prevalence of mental disorders found. The 12-month prevalence estimate of SMI (0.6%) was only a fraction of that found in the U.S. study (6.5%). The fact that the most recent surveys in China found somewhat higher prevalence estimates of mental disorders (Shen et al., 2006) suggests that the actual societal-level cost of mental disorders could be higher. Another factor that could lead to low societal impact was the competitiveness of the job market in urban China following rapid market reform (Li et al., 2008). Since people with SMI could have been marginalized to perform low-pay jobs, the loss of their earnings might not reflect the real magnitude of societal economic loss due to SMI.

4.3. Implications for public health policy

Even in urban areas of China, people with mental illness still face considerable discrimination in multiple domains of everyday life and poor access to treatment (Yang et al., 2007; Lee and Kleinman, 2000; Lee et al., 2007a). Partly because of the lack of societal burden data, however, evidence-based mental health advocacy efforts are rare in China. Yet, the societal burden argument should theoretically appeal to the Chinese government which has put continued economic growth high on its policy agenda. If a high societal economic burden of mental disorders could be demonstrated, this would mean considerable room for societal-level gains by addressing the huge treatment gap of mental disorders (Lee and Kleinman, 2000; Lee et al., 2007a).

Nonetheless, the societal-level impact on lost earnings we found may hardly appeal to the Chinese government in the face of a host of other challenges that await allocation of resources (Lee and Kleinman, 2000). Additionally, the social meanings of the so-called indirect costs of mental illness may vary cross-culturally. In China, common mental disorders are frequently endured and even trivialized. Mental health policy and programs are still formulated on the basis of psychotic disorders and propelled by unfortunate acts of violence committed by individuals who were reported to have mental illness.

4.4. Limitations

General limitations of our study include the restricted generalizability of our findings to rural China and the possible under-estimation of the prevalence of mental disorders (Shen et al., 2006; Lee et al., 2007b). Owing to the small size of sub-samples, some figures in our result were vulnerable to large variability and should be interpreted with caution. Regarding specific limitations, we relied on respondents' self-report of earnings instead of administrative records. We also did not obtain further details of labor force activity and status, such as those who were looking for work, being employed full-time or part-time, and working for family without wages in family business. Previous research has suggested that people's socioeconomic background and concerns about disclosure to taxation authorities can affect their propensity to provide information about their personal income during face-to-face interviews (Turrell, 2000). In our study, lay interviewers asked about many types of income, including wages (including second job if any), stipends, bonus, pensions, investments, welfare/financial assistance, and gifts. Some respondents might not be comfortable about revealing such personal information to strangers even if confidentiality was assured. Recent reports have documented that, following China's rapid transition to market economy, obtaining "gray" income that is not taxable is common (Zhang, 1994; Ye, 2008). Under-reporting of staff salary to avoid tax payment is also said to be widespread (Yan, 2006). For these reasons, the self-reported information on income that we used might not accurately reflect the true earnings of respondents.

Although domestic work was mostly performed by females in China, we did not consider the monetary value of women's domestic productivity. Consequently, the true financial impact of SMI on females would be under-estimated. Moreover, we did not consider the possibility of reduced job retention related to mental illness (Lerner et al., 2004). This would result in under-estimation of economic cost of mental illness. As in previous cost-of-illness studies, we did not take account of the reciprocal relationship between low earnings and risk of mental disorder. Along with the fact that the study was cross sectional, we cannot ascertain how much of the association we found was a direct result of SMI causing low earnings. Although our study has not examined the admittedly complex nature of the association, it should be noted that earning gaps might partly arise from poorer job productivity among people with mental disorders as mental status could affect both working time lost as well as diminished work performance (Waghorn and Chant, 2006). It is also interesting to study gaps of earnings by industry type in future studies. As low education and unmarried status could be causes of SMI as well as causes of low earnings, our estimates of the effects of mental disorders on earnings, by controlling education and marital status, might be upwardly biased. Longer-term experimental study using sophisticated econometric models of analysis will address these issues of causality more definitively (Kessler et al., 2008).

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