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Disability associated with mental disorders in metropolitan China: An application of the quantile regression approach

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Abstract

Recently active mental disorders are associated with substantial disability, but there is little research on residual disability once symptoms have subsided. The aim of this study is to estimate the degree to which recent disability might be due to recent or past history of mental disorders using a quantile regressions model that makes it possible to study the full range of disability. Data were from cross-sectional surveys of Chinese living in Beijing and Shanghai, China (n=1,628). The World Health Organization Disability Assessment Schedule and the WHO Composite International Diagnostic Interview was used to assess recent disability and common mental disorders, respectively. Recently active mental disorders are found to be associated with elevated levels of disability, especially for current substance use disorder. Anxiety disorders stand out with high levels of disability. Individuals at the higher disability levels show large variations in their disability levels. These epidemiological estimates from China add to the evidence base on the global burden of neuropsychiatric disorders, quantifying the hypothesized influence of recently active and past disorders with the novel quantile regression approach. In future studies, we hope to complete more detailed studies of the causal role of mental disorders in the development of disability.

Keywords

survey; epidemiology; methods; disability; substance use disorders; anxiety disorders

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1. Introduction

Disability is a major facet of disease burden for both individuals and societies (WHO, 2001a). Substantial disability has been attributed to mental and neuropsychiatric disorders, which can be equally or more disabling than general medical conditions (Ormel et al., 1994; Murray and Lopez, 1997b; Ormel et al., 2008; Scott et al., 2009; Armenian et al., 1998).

Most epidemiological survey evidence on disabilities due to psychiatric disorders has been focused on recently active cases, often defined in terms of symptoms or episodes found to be present within a pre-assessment interval of one month, six months, or 12 months. For example, in a comparison with non-cases identified during community surveys in six European countries, cases with recently active mental disorders had more difficulties with daily activities, higher levels of cognitive impairment, less participation in community activities, and more days unable to work (Alonso et al., 2004; Buist-Bouwman et al., 2006). There is similar evidence from community surveys in the United States (Compton et al., 2007; Hasin et al., 2007; Kessler and Frank, 1997). Stronger evidence came from a prospective study in the Netherlands. In this study, Spijker and colleagues found newly-incident depression cases had decreased social functioning and role limitations due to emotional problems, compared to their own levels before depression onset, which tended to differ from disability levels of individuals with no history of depression and of those who had recovered from depression. Disability levels among those who recovered from depression were similar to their own levels before depression onset (Spijker et al., 2004).

The issue of residual disabilities among individuals with a past history of mental disorder has not been studied in detail. Studying cases and non-cases in community survey data from the Netherlands, Bijl and Ravelli (2000) found that individuals with a past history of mental disorders (with no recent episode) presented slightly higher levels of disability as compared to individuals with no history of mental disorders. As was true for Spijker et al. (2004), some researchers have focused on major depression and found evidence for residual disability after the active phase of major depression. For example, using data from the National Comorbidity Survey of the United States (US), Mojtabai found that difficulty in fulfilling daily responsibilities persisted for up to 12 months, and depression-related clinical features were observed more than 12 months after depression cases no longer met full DSM-III-R criteria of major depressive episode (Mojtabai, 2001). These findings provided empirical support congruent with the conceptualization of possible residual disability after episodes of depression – at least in high income countries such as the Netherlands and the US. The theoretical plausibility of higher disability levels for individuals with a past history rests upon residual symptoms, secondary mental or physical conditions, or a recognition of social stigma attached to mental disorders, as might disrupt one's capacities to do well due to false expectations or prejudices of others. Nonetheless, initial estimates are needed to gauge these hypothetical possibilities and provide a basis for future investigations, not only in the high-income countries but also in the middle and low-income parts of the world.

Against this background, the aim of this study is to extend these lines of research on disabilities attributable to mental disorders in several ways. As in some of the prior studies, this study involves the use of a multiple regression model with an allowance for disability level associations with recently active mental disorders (i.e., 'current cases'), and independently with a prior history of mental disorders not in an active phase (i.e., 'past cases,' and possibly 'in remission'); the multiple regression method also allows statistical adjustment for an array of potentially comorbid general medical conditions that might account for the disabilities observed in mental disorder cases. In addition to providing a more comprehensive picture for various categories of mental disorders in the emerging market economy of metropolitan China, the research approach does not ask the participants

to state what accounts for their disabilities; this self-report attribution might produce a distortion of estimates, particularly in the contrast of past and recent cases. Instead, we have used a highly standardized World Health Organization Disability Assessment Schedule (WHO-DAS), which includes measurement of health-related difficulties without requiring the participant to designate a specific cause of the disabilities. Furthermore, in a departure from prior WHO-DAS research (e.g., Von Korff et al, 2008; Scott et al., 2009), we do not impose cutpoints or threshold values to signify who is disabled and who is not disabled (e.g., 90th percentile cutpoint), nor do we use the general linear regression model to study variation of the conditional mean disability level. Instead, we make use of the full range of the WHO-DAS values in the context of a quantile regression (QR) model that has gained popularity due to recent innovations in computational software. As noted by the statisticians who developed and refined the QR approach (Koenker and Bassett, 1978; Hao and Naiman, 2006), when a response variable is ordinal or continuous, cross-group differences can be manifest at different locations along the response distribution. For example, variations in disability across past or recent mental disorder status may be larger among individuals with high disability levels, as compared to those with low-to-medium disability. In another scenario, an association linking mental disorder status with disability may only be present among individuals at the higher disability level. Under these circumstances, the conditional means from the general linear model may not disclose important cross-group differences, and the use of a somewhat arbitrary cutpoint such as the 90th percentile may hide important variation that can be seen when the full range of the response distribution is examined. To the best of our knowledge, this project is the first to apply the QR approach to the study of disability associated with neuropsychiatric disorders; this model has been applied previously in health research conducted by other research groups (e.g., Austin et al., 2005; Mann et al., 1994; Shih and Konrad, 2007).

As is true elsewhere in the world, many people in China are affected by disabilities attributable to these disorders. According to estimates from the second national disability survey, 7%–8% of Chinese people with disability suffer from psychiatric disability (Tian et al., 2007), but the specific mental disorders accounting for the psychiatric disability have not been studied thoroughly, and related findings from Western countries may not apply to the Chinese population (e.g., see Demyttenaere et al., 2004). Thus, estimates from Chinese samples are essential to provide a basis for future studies in China. In a future extension of this research project, it is our intent to investigate cross-national variations in the degree to which disability levels depend upon past and recently active mental disorders.

2. Materials and Methods

2.1. Study design and sample selection

Previous publications have provided detailed descriptions of the Beijing and Shanghai World Mental Health metropolitan China surveys (WMH-mC; Shen et al., 2006). Here, we provide a brief summary. The WMHS-mC is a cross-sectional survey of household-dwelling adults in Beijing and Shanghai, China. To promote representativeness of the samples in these two cities, a multi-stage probability sampling method was used to select respondents. In the first stage, neighborhood-level primary sampling units (PSU) were selected using the probability proportional to size sampling method. For the second stage, households within each PSU were randomly selected. In the final stage, one adult from each identified household was randomly selected to be the respondent. This standard survey procedure was designed to yield a representative sample of household dwelling adults living in these two cities.

Data were collected through face-to-face interviews between November 2001 and February 2002. All respondents were informed about the study and provided written informed consent

prior to the interview using a study protocol approved by the designated Institutional Review Board. Participation levels were 75% in both cities.

The interview was administered in two parts. Part I included the core diagnostic assessment. Part II included suspected correlates or determinants as well as additional topics. Part II was administered to all respondents who were suspected to have a history of past or recent core mental disorders, as assessed in Part I, plus a 25% random sample drawn from the rest of respondents. A total of 5201 participants completed Part I; 1628 completed Part II.

The World Mental Health version of the World Health Organization Disability Assessment Schedule (WMH-WHODAS) was included in Part II. Thus, the final sample consisted of 1628 individuals. Since stratified probability sampling has been used, analysis weights are required. To illustrate, an adult living alone has a 100% chance of selection; the analysis weight is the inverse of 1 = 1. An adult living with another adult has a 50% chance of being selected; the analysis weight is the inverse of 50% = $1/0.5 = 2$. An adult living with two other adults has a 33.3% chance of being selected; the analysis weight is the inverse of 33.3% = $1/0.333 = 3$. And so on. An additional analysis weight is used to correct the differential probability to be included in the Part II assessment. For the individuals sampled with 100% probability, the analysis weight for estimates based on Part II data is the inverse of 100% = 1. In contrast, for individuals sampled for Part II with 25% probability, the analysis weight for Part II data is the inverse of 25% = $1/0.25 = 4$. There was also post-stratification adjustment to bring the sample distributions into balance with population socio-demographic and geographic distributions, applying a standard research convention now is widely used in large sample population surveys (Kessler and Ustun, 2004).

2.2. Assessments

The key response variables in this study are WMH-WHODAS scores (i.e., the same score described in detail elsewhere, Scott et al., 2009; Von Korff et al., 2008). Five dimensions of disability are included in the current study, namely, self-care, mobility, cognition, social interaction, and role functioning. Prototypical standardized survey items for each dimension are as follows. For self care, a prototypical item is “Was there ever a time in the past 30 days when health-related problems caused you difficulties with self care, such as washing your whole body, getting dressed, or feeding yourself?” For mobility, a prototypical item is “Was there ever a time in the past 30 days when health-related problems caused you difficulties with mobility, such as standing for long periods, moving around inside your home, or getting out of your home?” For cognition, a prototypical item is “Was there ever a time in the past 30 days when health-related problems caused difficulties with either (READ SLOWLY) your concentration, memory, understanding, or ability to think clearly?” For social interaction, a prototypical item is “Was there ever a time in the past 30 days when health-related problems caused you difficulties either getting along with people, maintaining a normal social life, or participating in social activities?” For role functioning, a prototypical question is “Beginning yesterday and going back 30 days, how many days out of the past 30 were you totally unable to work or carry out your normal activities because of problems with either your physical health, your mental health, or your use of alcohol or drugs?” A complete list of WHODAS items can be found at the World Health Organization WHODAS website (www.who.int/icidh/whodas/index.html). It is standard practice to derive a WHODAS summary score by dividing the sum of the five dimensional scores by five (5). The WHODAS does not require the person to have insight into the cause or causes of recent health-related disability. The score reflects level of disability during the 30 days prior to the assessment, includes attention to duration and severity, and is expressed in a value from 0 (no disability) to 100 (extreme disability).

Of central interest in this research is the degree to which disability level is associated with mental disorders common enough to be seen in community samples. These mental disorders were assessed by a version of the World Health Organization World Mental Health Composite International Diagnostic Interview (WMH-CIDI). WMH-CIDI is designed to be administered by trained lay interviewers, and offers a fully structured diagnostic assessment of the more common mental disorders, based on the American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders Fourth Edition, which has been used to structure the computerized algorithm for diagnosis (DSM-IV, Kessler et al., 2004; Kessler and Ustun, 2004). The Chinese version of the WMH-CIDI was derived using standard protocols of iterative translation, back translation, and harmonization conducted by panels of bilingual experts. A clinical reappraisal study produced evidence of CIDI validity in the Chinese context (Huang et al., 2008).

In this study, the WMH-CIDI covered DSM-IV mood disorders (major depressive disorder and dysthymia), anxiety disorders (generalized anxiety disorder, agoraphobia, social phobia, specific phobia, and panic disorder), and substance use disorders (alcohol abuse and alcohol dependence, drug abuse and dependence, and tobacco dependence). Mental disorder status is categorized into three groups, i.e. “never mental disorder,” “former mental disorder,” and “current mental disorder.” Less common disorders such as schizophrenia and other psychoses were not assessed because they are too rare to produce a sufficient number of cases in community surveys of this sample size, and there was some uncertainty about the validity of the WMH-CIDI diagnostic method for these rare disorders. Former mental disorder is defined as a history of any mental disorder (among those assessed in this study) but absent during the 12 months prior to the assessment. Current mental disorder is defined as the presence of mental disorder during the 12 months prior to the assessment. Other covariates were sex, age, and general medical conditions including arthritis, heart disease, diabetes, and cancer. Physical conditions are based solely on the respondents’ answers to a series of questions such as “Have you had any of the following in the past 12 months: arthritis or rheumatism?”

2.3. Analysis

Initial analyses involved estimation of the means and standard deviations in order to shed light on underlying distributions of WHODAS scores, with weights for the inverse probabilities of selection and post-stratification adjustments as described in Section 2.1. During the first steps of estimation, general linear regression is used to estimate cross-group differences in the conditional mean of the WHODAS disability score by mental disorder status. Estimates are adjusted for sex and age first, and then additionally adjusted for the presence of any physical conditions during the past 12 months.

Since the overall distribution of the WMH-WHODAS score is highly skewed (see Table 1), we turn to the QR approach in the next steps of estimation. The equation for QR is given by $y_i = \beta_0^{(p)} + \beta_i^{(p)} x_i + \varepsilon_i^{(p)}$, where p is a given quantile; β_0 is the constant at the p^{th} quantile point (e.g., WHODAS score for the ‘never’ group at the p^{th} quantile point in this study); β_i is the regression coefficient for a certain covariate x at the p^{th} quantile point (e.g., estimated difference in WHODAS score at the p^{th} quantile point when comparing the ‘current’ or ‘former’ vs. the ‘never’ mental disorder group); ε is the error term at the p^{th} quantile point. Thus, QR is able to estimate cross-group variations at any given p^{th} quantile of the outcome, and it does not rely heavily on the specification of the overall distribution as is required for parametric regression methods (Hao and Naiman, 2006). In this study, estimates are provided for overall mental disorder status, as well as mood disorder, anxiety disorder, and substance use disorder status, respectively.

For means, standard deviations, and general linear regression, a conventional Taylor Series Linearization ('delta') method is used to adjust for design effects in variance estimation due to departure from simple random sampling (e.g., sampling of multiple households from the same PSU). For QR analyses, the bootstrap approach was used to estimate 95% confidence intervals (CI). One thousand PSU-stratified bootstrap samples (with replacement) are drawn to yield 1000 estimates. Point estimates and empirical 95% CI are obtained using the percentile method with the median being the point estimate and 2.5 and 97.5 percentile as boundaries for the 95% CI.

3. Results

Table 1 presents means and standard deviations of the WMH-WHODAS scores. One thousand one hundred and eighty three individuals were have no history of the mental disorder addressed in the WM-CIDI assessment, 202 with one or more former mental disorder(s), and 243 with one or more current disorder(s). Mean values of WHODAS scores are generally higher among individuals with former or current mental disorders compared to those with none of the assessed mental disorders; the largest difference is found in the dimension of "role functioning." Large standard deviations suggest WHODAS scores do not follow a normal distribution; results from the general linear regression models must be regarded as tentative.

Due to small variations in WHODAS scores in "cognition," "mobility," "social activities," and "self-care," these four dimensions are only included in the global WHODAS score and not analyzed individually. Limited evidence is found from general linear regression on disability associated with mental disorders, which disclosed no statistically significant association linking any former mental disorder with WHODAS global or "role functioning" score. With respect to current mental disorders, higher level of disability is found for "current substance use disorder" as compared to the "never" group. No statistically robust differences are found for current mood or anxiety disorder.

Quantile regressions disclosed a different scenario. For example, with covariate adjustment for sex and age, the QR disclosed "former disorder" and "current disorder" to be associated with higher disability levels (Figure 1). In this figure, the y axis depicts the value of QR regression coefficient (i.e., the β_i in the equation); the x axis values are quantile points (i.e., the p in the equation). The comparison group is the 'never disorder' group (i.e., non-cases), for whom $\beta_i = 0$ across all x-axis values. Thus, when the figure shows a departure from the x-axis, it is showing a difference in WHODAS score at a specific quantile point for the 'former' or 'current mental disorder' group compared to the 'never' group. If and when 'current' and 'former' cases have disability levels that are not appreciably different from the disability levels of non-cases, the resulting plot is flat at $\beta_i = 0$ for all values along the x-axis. As shown, the patterns of associations vary across categories of mental disorders. For example, disability associated with "current substance use disorder" is much more pronounced in its departure from $\beta_i = 0$, while "former substance use disorder" is not robustly associated with any elevation in disability levels relative to non-cases. The same pattern is seen for mood disorder although the difference is to a lesser extent between "former" and "current mood disorder." A distinct pattern is found for anxiety disorders. Both "current" and "former anxiety disorder" are associated with higher disability levels, but the estimates are larger for individuals with "former anxiety disorder" than for cases of "current anxiety disorder." Overall disability (represented by the global WHODAS score) and role impairment generally follow the same trends.

We were interested in learning whether the observed associations with disability might be attributable to comorbid disease states that might themselves be influential (e.g., cancer,

heart disease). Terms for each recently active general medical condition were added to the QR models, and this statistical adjustment yielded a similar pattern of estimates, with some attenuation of the estimates for current mental disorders and for extremely high disability levels (corresponding to the 0.95 quantile of the WHODAS score, Figure 2). Statistical adjustment for recent general medical conditions produced no appreciable changes in estimates for the ‘former mental disorder’ group. Table 3 presents quantile points where there are robust differences as disclosed by bootstrapped 95% confidence intervals that do not entrap zero, the null value).

Quantile regression results also can be used to examine shifts in scale (i.e., when the associations might become more pronounced at higher quantile points). For all mental disorder subgroups, the estimates become larger at higher quantile points (e.g. 0.85, 0.90, or 0.95) as compared to lower quantile points (e.g. 0.5). For example, in the contrast of the ‘current mood disorder’ versus ‘never mood disorder’ subgroups, there is an estimated 2.1 subgroup difference in the WHODAS score at 0.6 quantile point, while the corresponding subgroup difference is 22.6 at the 0.90 quantile point. The evidence tends to support the idea that disabilities associated with mental disorders are more evidence among people at the higher disability levels.

4. Discussion

Main findings of this study can be summarized as follows. First, current mental disorders are associated with higher disability levels, even after adjusting for selected chronic general conditions. According to results from QRs, disabilities associated with mental disorders are more evident among people with higher disability levels. Second, heterogeneous patterns of association linking mental disorder and disability are found for different categories of mental disorder, i.e., mood disorder, anxiety disorder, and substance use disorder. Third, elevated disability levels among former mental disorder cases are largely intact when controlling for current general medical conditions. In contrast, statistical adjustment for these medical conditions produced attenuation of the estimates for current mental disorder cases. Fourth, differences in overall disability can largely be traced to variation in the WHODAS role functioning dimension.

Before detailed discussion of findings, several limitations must be mentioned. First, the current study utilizes observational data from a cross-sectional design. Thus, findings are associative in nature; causal inference is a matter of judgment, and in our view, it now is premature to draw causal inferences from this study’s evidence because replications are needed, along with evidence from longitudinal studies. Second, central to any discussion of the findings is a core distinction between three states with respect to the recently active or prior psychiatric disturbances under study. To the extent that the WMH-CIDI measures a disturbance and also has the capacity to assign the disturbance as ‘recently active’ versus ‘formerly active,’ the measurement plan assigns individuals to either the ‘current’ or the ‘former’ group. Because the WMH-CIDI is not 100% comprehensive in its coverage of all neuropsychiatric disturbances (e.g., schizophrenia or other psychotic disorders or personality disorders), the ‘never’ group (reference in this study) should not be taken as the ‘disorder-free’ group; rarely, some of the ‘non-case’ group members will suffer from schizophrenia or one of the other mental disorders not assessed by the WMH-CIDI. As such, the findings of this study cannot be generalized to apply to disturbances not covered in the diagnostic assessment plan for this population survey. The assumption here is that the occurrence of schizophrenia or psychotic disorder in the study population is too rare to produce a sizable change in estimates from a population perspective.

Although a previous clinical reappraisal study found acceptable validity of CIDI for the assessment of any history of the WMH-CIDI-assessed mental disorders (as 'ever' vs. 'never,' Huang et al., 2008), there may be imprecision or inaccuracy in the assessment of what is current and what is past, and the degree of this imprecision may vary across disability levels. A standardized assessment protocol for recency of each condition was in place, but subtle gradations such as 'in partial remission' and 'in full remission' were not evaluated. It is possible that some of the 'former' cases remained 'in partial remission' and this might account for the appearance of higher disability levels in the former cases relative to the 'never' cases.

Finally, in a previous study, it was found that the duration of the premorbid state (before major depression episode) and the severity of the depression helped to determine whether residual disability would be seen (Spijker et al., 2004.). These variables were not in the conceptual model when the World Mental Health Surveys were designed, and could not be taken into account in this study.

With respect to the population under study, non-household dwelling adults or individuals under 18 years old were not included in the current study. With respect to the sample size, small numbers of cases for each specific DSM-IV mental disorder (e.g. drug dependence) precluded disorder-specific estimates. Additionally, due to limited numbers of cases for each category, we are not able to explore disability according to the comorbidity profile (e.g., mood disorder only, anxiety disorder only, and comorbid mood and anxiety disorder).

With respect to the assessment of disability levels, to reduce interview burden, filter questions with high predictive value were asked at the beginning of each WHODAS domain so as to shorten the length of the interview session when the filter questions predicted little or no health-related disability. For example, a negative response to a filter question qualified the respondent to skip the rest of the disability questions in that specific WHODAS domain. Although previous studies have found acceptable validity of the WHODAS, there also is some evidence that the predictive filter questions can sometimes reduce sensitivity of the instrument, especially among individuals with very mild disabilities (Buist-Bouwman et al., 2008; Von Korff et al., 2008). We do not judge this limitation to have had a substantial influence on this study's results; we hope to be able to probe this assumption in future field surveys that compare and contrast results with and without the predictive filter questions.

Within the context of these limitations, the findings of the study are in line with previous research documenting positive associations linking current mental disorder to disability. Nonetheless, some interesting specifications merit attention. In particular, a number of previous studies have found current mood disorders were associated with the highest level of disability, followed by anxiety disorder, with substance use disorder the lowest (Armenian et al., 1998; Bijl and Ravelli, 2000; Buist-Bouwman et al., 2006; Lee et al., 2009; Ormel et al., 2008; Phillips et al., 2009). The current study found that current substance use disorder is associated with the largest increment in disability. This difference between the current study and studies in other samples might reflect differences in the composition of substance use disorders across countries. It has been well documented that there are wide variations in types of commonly used internationally regulated drugs (IRD) across countries. For example, previous studies found that the most commonly used IRD are the sedative-hypnotic compounds in metropolitan China and Nigeria, while cannabis smoking is more prevalent in the United States and some other countries (Cheng et al., 2010; Degenhardt et al., 2008; Gureje et al., 2007; van Heerden et al., 2009). Thus, it is possible that substance use disorder cases in China differ from cases in the US in terms of their motive to use IRD extra-medically (e.g., symptom relief vs. recreational use). Future studies are needed to explore what might account for these observed differences. Nonetheless, results from this

study are directly applicable to the source population, non-institutionalized adults, where the majority of disease burden from mental disorders resides (Demyttenaere et al., 2004). One previous study in four provinces in China found a pattern that might be considered inconsistent with the above interpretation of the high disability associated with substance use disorders: the proportion of people with moderate to severe disability was much lower among substance use disorder cases (4%) than cases of mood disorder (39%) and anxiety disorder (Phillips et al., 2009). The difference in findings might be due to differences in the study frame as well as to methodological variations. For example, the current study was conducted in two metropolitan cities with the highest income levels in mainland China, while the four-province study was conducted in areas with lower economic levels. There may be differences in types of drugs used, demographic variations in drugs users, etc. Also, the estimates of the four-province study were not adjusted for sex, age and physical conditions. Controlling for these variables may introduce significant changes in the association structure linking mental disorders with disability (Merikangas et al., 2007).

Another feature of the current study is the use of the WHO-WHODAS-II questionnaire, which is not oriented toward any specific health conditions and includes various domains of disability and functioning in the assessment of disability levels (WHO, 2001b). Hence, the WHODAS score provides a more global view on disability and is arguably less affected by respondents' self-perception of mental disorders when compared to symptom-oriented assessments.

This study's finding on residual disability levels among former mental disorder cases is noteworthy. The key finding from the current study is the distinct pattern of association linking disability with former anxiety disorder, in a degree comparable or even greater compared to current anxiety disorder. In contrast, no such association is found for mood and substance use disorder. To the best of authors' knowledge, this has not been reported in previous studies. Again, the observed residual disability associated with past anxiety disorder might highlight cross-country variations. One possibility is that anxiety disorder cases may develop secondary conditions after anxiety symptoms subside, which remain unmeasured in this study, and these later conditions may contribute to disability to individuals with non-active anxiety disorders (Beesdo et al., 2007; Martens et al., 2010; Schoevers et al., 2005). As mentioned in the limitations, due to the cross-sectional nature of the study, the influence of recall bias cannot be ruled out. For example, individuals with currently high levels of disability may dig into their memory more thoroughly for past symptoms of anxiety disorders, or individuals with low disability level may be more likely to forget their past symptoms of anxiety disorders. It is also possible that current anxiety disorder cases tend to under-report their disability levels. Furthermore, there might be individuals who appreciate persistence of disability, but who possess a clouded view or lack of insight into the persistence of active symptoms, and this would lead to an apparently elevated disability level among apparently 'former' cases as compared to 'active' cases. Because it is unexpected, the current finding should be regarded as a potential lead for future research that can be probed more deeply for causal or clinical significance, if the finding can be replicated elsewhere. Readers may judge for themselves, but our judgment is that it now is premature to regard former anxiety disorder as the cause of the observed residual disability levels.

Previous studies found some evidence about residual disability associated with major depression (Mojtabai R, 2001; Spijker et al., 2004). Although this study did not find any robust association, results from QR are in line with previous findings: the point estimates for past mood disorders were positive, especially among those with high disability levels. Actually, the estimates for past mood disorder was of borderline robustness at 0.85 ($\beta=9.9$, 95% CI= -0.03, 40.2) and 0.90 ($\beta=13.4$, 95% CI= -1.3, 42.3) quantile points.

An important strength of the current study is the use of the QR approach which is capable of studying the disability response distribution in its full range, and provides a more panoramic view of associations than can be seen using the more conventional linear regression model or the logistic regression model based on binary cutpoints (e.g., at the 90th percentile). Based on our findings, there is little variation in disability in relation to mental disorder status among persons with low disability level (e.g. below the median), but meaningful differences emerge above the median point and become much more pronounced at higher quantile points (e.g., equivalent to the WHODAS 0.8 or 0.9 quantile points). These new findings underscore the utility of QR in comparative disability research of this type.

Despite the well-documented association between mental disorder and disability, there have been relatively few studies focused on disability-reduction among mental disorder cases (e.g., Forsberg et al., 2010). Results from the current study may bear some implications for future intervention programs: immediate intervention to prevent disability may be crucial after the occurrence of mental disorders, and this may be especially true for the substance use disorders. Moreover, if the comparatively high disability levels experienced by former anxiety disorder cases can be replicated and confirmed in other studies, this finding may highlight the importance of care and management of these patients even after active symptoms subside.

In summary, this study pushes forward the current knowledge of disability attributable to mental disorders, with a focus on the people of China. Its methodological novelty creates some new directions for future disability research, and sets the stage for a line of cross-national disability research using the QR approach. Findings from this study may be useful in the context of clinical care and management of psychiatric patients, serving as a reminder that the disabilities attributable to neuropsychiatric disorders do not always disappear when active symptoms subside.

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Figure 1. Quantile coefficients of the WHODAS score by mental disorder status adjusting for sex and age. Comparison group is the 'never' group.

Figure 2. Quantile coefficients of the WHODAS score by mental disorder status adjusting for sex, age, and physical conditions. Comparison group is the ‘never’ group.

Table 1
WHODAS global and dimensional scores by mental disorder status. Data from WMH-mC, 2001–2002.

		Global score		Cognition		Mobility		Social activities		Self-care		Role functioning	
	n	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Mental disorder status													
never disorder	1183	4.4	20.4	0.1	1.1	0.8	5.7	0.2	1.8	0.4	4.5	2.9	13.6
former disorder	202	7.1	25.0	0.5	3.7	1.1	7.1	0.5	4.3	0.2	1.7	4.9	15.6
current disorder	243	8.1	23.4	0.7	3.0	1.0	5.5	0.3	1.7	0.5	3.8	5.6	14.9
Mood disorder status													
never disorder	1415	4.6	20.7	0.2	1.5	0.8	5.7	0.2	2.0	0.4	4.3	3.1	13.6
former disorder	108	8.5	24.3	0.2	1.0	1.7	7.5	0.7	5.1	0.2	2.8	5.7	17.3
current disorder	105	10.4	27.5	1.2	3.6	1.3	7.0	0.4	1.5	0.7	4.7	6.9	17.6
Anxiety disorder status													
never disorder	1419	4.6	20.8	0.2	1.5	0.8	5.9	0.2	2.1	0.4	4.3	3.1	13.7
former disorder	82	8.0	22.1	0.6	2.1	1.3	6.8	0.2	0.9	0.3	2.8	5.6	13.9
current disorder	127	8.4	22.5	0.6	3.1	0.6	3.5	0.3	1.9	0.6	4.3	6.3	15.7
Substance use disorder status													
never disorder	1488	4.6	20.3	0.2	1.3	0.8	5.6	0.2	1.9	0.4	4.4	3.1	13.6
former disorder	74	7.8	30.1	0.9	5.3	1.3	8.8	0.6	4.6	0.1	0.6	5.0	17.3
current disorder	66	12.5	27.8	0.6	3.0	1.9	7.2	0.6	2.7	0.9	3.6	8.6	18.0
Number of types of mental disorders during the past 12 months													
0	1385	4.6	20.7	0.2	1.4	0.8	5.8	0.2	2.1	0.4	4.3	3.1	13.7
1	192	6.0	20.2	0.6	2.5	0.8	5.0		1.1	0.4	3.3	4.1	12.0
2	47	13.4	32.0	1.2	4.7	1.4	7.4	0.6	3.3	0.7	5.1	9.5	21.9
3	4	37.3	25.9	0.9	0.9	3.7	2.5	2.4	1.6	3.9	8.1	26.5	23.6

Table 2
Disability associated with former and current mental disorders. Results from linear regression. Data from WMH-mC, 2001–2002.

	Global WHODAS score				Role functioning			
	Adjusting for sex and age		Adjusting for sex, age, and physical condition		Adjusting for sex and age		Adjusting for sex, age, and physical condition	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI
All mental disorders								
Former disorder	1.9	-1.4, 5.1	1.9	-1.4, 5.1	1.4	-0.8, 3.6	1.4	-0.8, 3.6
Current disorder	3.6	0.3, 6.9	3.6	0.3, 6.9	2.6	0.3, 4.9	2.6	0.3, 4.9
Mood disorder								
Former disorder	2.6	-2.8, 8.1	2.4	-3.1, 7.9	2.2	-1.8, 6.1	2.0	-1.9, 6.0
Current disorder	6.0	-0.6, 12.7	5.3	-1.3, 12.0	3.9	-0.8, 8.7	3.5	-1.1, 8.1
Anxiety disorder								
Former disorder	3.3	-1.6, 8.2	3.2	-1.6, 7.9	2.6	-0.7, 5.9	2.5	-0.7, 5.7
Current disorder	3.8	-1.5, 9.0	3.1	-2.2, 8.4	3.3	-0.6, 7.1	2.9	-0.9, 6.7
Substance use disorder								
Former disorder	3.4	-2.2, 8.9	3.2	-2.4, 8.7	1.6	-1.8, 5.0	1.5	-2.0, 4.9
Current disorder	9.9	4.5, 15.4	9.4	4.1, 14.8	6.3	2.3, 10.4	6.0	2.1, 10.0

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Table 3

Quantile points with statistically significant differences in disability when comparing individuals with mental disorder to those without mental disorders.
Data from WMH-mC 2001–2002.

	Non-recently active disorder	Recently active disorder
Global WHODAS score		
Overall mental disorder		0.70, 0.75, 0.80, 0.85, 0.90, 0.95
Mood disorder		0.75, 0.80, 0.85, 0.90, 0.95
Anxiety disorder	0.75, 0.80, 0.85, 0.90	0.75, 0.80, 0.85
Substance use disorder		0.65, 0.70, 0.75, 0.80, 0.85, 0.90, 0.95
Role functioning WHODAS score		
Overall mental disorder		0.75, 0.80, 0.85, 0.90, 0.95
Mood disorder		0.90
Anxiety disorder	0.85, 0.90	0.80, 0.85, 0.90
Substance use disorder		0.80, 0.85, 0.90, 0.95