Re-estimating the prevalence of psychiatric disorders in a nationally representative sample of persons receiving care for HIV: results from the HIV Cost and Services Utilization Study

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ABSTRACT *The objective of this study was to obtain accurate estimates of the prevalence of psychiatric disorder in the population represented by the HIV Costs and Services Utilization Study cohort.*

We constructed logistic regression models to predict DSM-IV diagnoses of depression, generalized anxiety disorder, panic, and dysthymia among a subsample of the HCSUS cohort who in separate interviews completed the CIDI-SF and the full CIDI diagnostic interview. Diagnoses were predicted using responses to the CIDI-SF as well as other variables contained in the baseline and first follow-up interviews. Resulting regression equations were applied to the entire baseline and first follow-up samples to obtain new estimates of the prevalence of disorder.

Compared to estimates based on the CIDI-SF alone, estimates obtained from this procedure provide a more accurate representation of the prevalence of the presence of any one of these four psychiatric disorders in this population, yielding more correct classifications and a lower false-positive rate.

Prevalence rates reported in this study are as much as 16% lower than rates estimated using the CIDI-SF alone, but are still considerably higher than estimates for the general community population.

Key words: psychiatric disorder, HIV, recycled prediction, prevalence, CIDI-SF

The CIDI-SF, a shortened form of the World Health Organization's Composite International Diagnostic Interview (CIDI) (World Health Organization, 1990), was developed as a brief diagnosis-specific instrument for use in survey-based research (Kessler et al., 1998). Bolstered by the well-established psychometric properties and wide usage of the full diagnostic interview (Wittchen 1994), the CIDI-SF has been included in several large surveys including the National Health Interview Survey (Adams and Morano, 1995), the Healthcare for Communities Survey (Sturm et al., 1999) and the HIV Cost and Services Utilization Study (HCSUS) (Bozzette et al.. 1998; Shapiro et al., 1999). The HCSUS is a nationally representative, longitudinal study of persons in the US who were receiving medical care for HIV in early 1996. To obtain accurate, population-based estimates of the prevalence of depression, dysthymia, generalized anxiety disorder (GAD), and panic disorders in this population, these sections of the CIDI-SF were administered as part of the baseline and first follow-up interviews. Consistent with estimates obtained from non-probability samples of HIV-infected persons (Atkinson et al., 1988; Williams et al., 1991; Maj et al., 1994), results from the HCSUS suggest that the prevalence of psychiatric disorders is substantially higher in the population of persons in care for HIV than in the general population (Bing et al., in press).

Prior to its inclusion in the HCSUS, the validity of the CIDI-SF had not been established for use with this

population. We were able to examine the validity of the depression, dysthymia, panic, and GAD portions of the CIDI-SF among the subset of the sample who were administered the corresponding portion of the full CIDI shortly after the first follow-up interview, as part of the Mental Health Supplement (MHS). Using the results from the full CIDI as the standard for comparison, we concluded that the prevalence of psychiatric disorder in this population could not be accurately estimated using responses to the CIDI-SF alone (Orlando et al., 2001). With the exception of panic disorder, prevalence rates derived from the CIDI-SF at the first follow-up were up to 16% higher than rates derived from the full CIDI. Moreover, the sensitivity and specificity for any disorder on the CIDI-SF were less than ideal for the purpose of obtaining accurate prevalence estimates (80% and 78% respectively). Disorder-specific concordance rates were lower still.

In an effort to obtain more accurate estimates of the prevalence of psychiatric disorder in the population represented by the HCSUS cohort, we developed a *post hoc*, study-specific procedure for re-estimating the prevalence of disorder in this population. In what follows, we describe the analytic approach employed, report the prevalence estimates obtained with this approach, and evaluate their accuracy.

Method

Study design and sample

The HCSUS cohort is a nationally representative probability sample of HIV-infected adults receiving care in the contiguous US. For practical reasons, the reference population was limited to persons at least 18 years old with known HIV infection who made at least one visit for regular or ongoing care to a non-military, non-prison medical provider other than an emergency department during a specified 'population definition period'. This period was 5 January to 29 February 1996 in all but one metropolitan area, where the start was delayed until March. Full details of the design are available elsewhere (Frankel et al., 1999; Shapiro et al., 1999).

The HCSUS employed a multi-stage design in which geographical areas, medical providers, and patients were sampled. In the first stage, we sampled the eight Metropolitan Statistical Areas (MSAs) with the largest AIDS caseloads with certainty plus an additional 20 MSAs and 24 clusters of rural counties (Berry et al., 1999). In the second stage, we sampled 58 urban and 28 rural 'known providers' from lists of all providers known by local informants to provide HIV care. To ensure that all HIV providers were represented we also sampled 87 urban and 23 rural 'other providers' who had affirmed caring for HIV patients in a screening survey of approximately 4,000 physicians randomly selected from the physician master file of the American Medical Association. In the third stage we sampled patients from anonymous lists of all eligible patients who visited participating providers during the population definition period. To the extent possible, we removed duplicate entries across lists to minimize the possibility of persons appearing on more than one list. We set the third stage sampling rates such that the overall probability of selection was as uniform as possible within subgroups. The overall rate was doubled for women and increased again for members of staff model health maintenance organizations (HMOs).

The HCSUS enrolled 57 of 58 urban known providers and replaced the one refusing institution with a similar institution in the same city (98% to 100% response rate). We enrolled 22 of 28 rural known providers (79%), 61 of 87 (70%) urban other providers, and 19 of 23 (83%) rural other providers. We handled provider non-response by weighting rather than by replacement in these latter three provider strata. Of the 4,042 eligible participants sampled, we interviewed 76%, with 71% yielding long-form interviews (2,864 interviews) and 5% yielding short-form or proxy interviews. We obtained some basic non-response data from providers for an additional 16%. The overall coverage rate (the ratio of the population directly represented to the population that would have been directly represented if we had complete responses at all levels) is about 73% for all interviews, and 68% for long-form interviews.

Data collection

Data for this study are from the baseline, first follow-up and Mental Health Supplement interviews. The first follow-up was conducted approximately eight months after the baseline interview (median = 243 days, range = 36–517 days), with 40% of interviews completed between seven and nine months after baseline, and 80% completed between five and 11 months later. Eighty-six per cent of persons responding at baseline completed the first follow-up interview. First follow-up interviews were only attempted for sampled persons

who completed a baseline long-form interview. From the 2,466 persons responding at the first follow-up, 1,561 persons were selected and 1,489 (95% of those selected) completed the Mental Health Supplement interview shortly after the first follow-up administration (an average of 11 days later; 28% in the same day, 36% within two to seven days, 31% eight to 49 days later, and 5% 50 to 155 days later). The CIDI-SF was administered as part of the baseline and first follow-up interviews, and portions of the full CIDI assessing depression, GAD, panic, and dysthymia were administered to the Mental Health Supplement sample.

Instrument/measures

DSM-IV 12-month diagnosis indicators for major depression, GAD, panic and dysthymia, were assigned to each respondent in the Mental Health Supplement based on responses to the CIDI.

Continuous scores were derived for major depression, GAD, panic and dysthymia, based on responses to the CIDI-SF administered as part of the baseline and first follow-up surveys. The original CIDI-SF scoring corresponded to the number of symptoms endorsed for each disorder, and yielded scores from 0–7 for depression, 0–4 for dysthymia, 0–7 for GAD, and 0–6 for panic (Kessler and Mroczek, 1994). To obtain comparable scores across disorders, as well as a continuous score reflecting the sum of these four disorder scores, we recoded the depression, panic, and GAD scales to range from 0-4 by collapsing the symptom scores. The recoding method was chosen based on the observed frequencies of symptom scores in the first follow-up sample. As the lower symptom scores were observed infrequently, for depression and GAD, symptom scores of 1 to 4 were recoded as 1, and scores of 5, 6, and 7 were recoded to 2, 3, and 4, respectively, and for panic, scores of 1 to 3 were recoded as 1, and scores of 4, 5, and 6 were recoded to 2, 3, and 4, respectively. A similar pattern of responding existed in the baseline data, and symptom scores were recoded for these data in the same way. For both the baseline and first follow-up samples a total symptom score ranging from 0–16 was also calculated as the sum of the four derived disorder scales.

In addition to psychiatric disorders, both the baseline and first follow-up interviews assessed basic demographic and clinical information, health-related quality of life, physical functioning, drug use and drug dependence, and use of mental health services, among other topics. Demographic and socio-economic status variables included gender, ethnicity (White, Black, Hispanic, other), age (categorized as 18–34, 35–49, and 50 or older), education (less than high school, high school degree, some college, or college degree/post-graduate work), income ($0–$5,000, $5,001–$10,000, $10,001–$25,000, or greater than $25,000), insurance (no medical insurance; Medicaid, Medicare, or Veteran's Administration benefits; private insurance), and employment (working full- or part-time, unemployed, disabled, or not working).

Clinical variables included HIV stage (asymptomatic, symptomatic, AIDS), CD4 count (less than 50, 50–199, 200–499, or 500 or more), HIV symptom count (symptoms queried included new or persistent headaches; fevers, sweats, or chills; pain in the mouth, lips or gums; white patches in the mouth; painful rashes or sores on the skin; nausea or loss of appetite; trouble with the eyes; sinus infection, pain or discharge; numbness or tingling in the hands or feet; Kaposi's sarcoma lesions; persistent cough, or difficulty breathing; diarrhoea or watery stools; and among women, an abnormal vaginal discharge), and antiretroviral drug use (used HAART therapy in the last six months yes/no).

Health-related quality of life and physical functioning variables included continuous measures of emotional wellbeing, number of days in bed because of health, energy level, and general health (Ware and Sherbourne, 1992; Ware et al., 1996). Substance use was indicated as any drug use excluding marijuana in the past year, and respondents were classified as drug dependent if they reported using any of eight classes of drugs in the past year and either reported having had emotional/psychological problems related to use or reported using larger amounts of the drug than usual to get the same effect. Finally, we categorized respondents according to whether or not they had used any mental health services for emotional problems within the last six months in the baseline interview, and in the interval between baseline and the first follow-up.

Analytic approach

Data were weighted to assure valid inference to the reference population. Each respondent was assigned an analysis weight at baseline, which can be interpreted as the number of persons represented by that respondent (Duan et al., 1999). An additional attrition weight was used for the first follow up and Mental Health

Supplement samples to allow inferences to the population of persons eligible for the baseline and who were observed at the first follow up. We used linearization methods (Kish and Frankel, 1974) available in the Stata (StataCorp, 1999) software package to adjust all standard errors for the differential weighting and complex design, specifically the clustered nature of the sample.

The first phase of analysis involved the estimation of prediction models using the Mental Health Supplement sample. We developed five logistic regression equations predicting 12-month CIDI DSM-IV diagnoses of depression, dysthymia, GAD, panic, and any one of these disorders. For each outcome modelled, predictor variables measured at the first follow-up interview were tested hierarchically in blocks. The appropriate CIDI-SF symptom score was entered first, followed by demographic variables, socio-economic status variables, clinical variables, quality of life and physical functioning variables, substance use and dependence variables, and finally service-use variables. This order was chosen to incorporate variables with the least collinearity with the symptom score first, and add more closely related variables after other characteristics had been considered. At each stage, the block of variables was retained if it added significantly to the model as indicated by the Wald test. Models were subsequently simplified by removing individual non-significant predictors, and regression diagnostics were performed to ensure that each final model was in line with the data. Next, we checked the stability of the observed relationships by replicating the simplified models, substituting predictors measured at baseline for those measured at the first follow up. We retained variables in our final models only if the direction of the coefficients was stable, and the strength of the relationship was comparable across the baseline and first follow-up analyses.

In the second phase of the analysis, we applied the results from the regression analyses to the entire HCSUS cohort to estimate the prevalence of depression, dysthymia, GAD, panic, and any of these disorders (at least one of the four) at both the baseline and first follow-up assessments. Using the coefficients from the five final regression equations, and responses to the corresponding predictor variables from the full baseline and first follow-up samples, we calculated a predicted probability of DSM-IV diagnosis for each respondent as well as an overall predicted proportion in each sample for each and any disorder. The recycled prediction procedure implemented in Stata (StataCorp 1999) was augmented to obtain correct standard errors by accounting for the sampling and study design, and the error associated with the prediction model itself.

Finally, respondents were assigned a dichotomous indicator of the presence of any disorder at baseline and at the first follow up based on their predicted probability. To make this assignment, we identified a cut point for each sample that, if used as an assignment criterion, would yield the correct overall predicted sample probability. Respondents whose predicted probability was equal to or higher than this value were assigned a 1, and those lower were assigned a 0. To evaluate the accuracy of the new predictions for the sub-sample included in the Mental Health Supplement, we calculated the concordance rate between this dichotomous indicator at the first follow-up and the DSM-IV diagnoses and compared these to the concordance rates obtained originally for the CIDI-SF administered at the first follow-up. We also calculated the area under the ROC curve based on the prediction of DSM-IV caseness from the model-generated probabilities of the presence of any disorder at the first follow-up.

Results

In all five models predicting 12-month DSM-IV diagnoses in the Mental Health Supplement sample, the CIDI-SF symptom score was a significant predictor (Table 1). The higher the symptom score, the higher the probability of a diagnosis. Emotional wellbeing and use of services for emotional problems were also strong predictors in every model. Respondents who scored higher on the emotional wellbeing scale were less likely to have a diagnosis, and those using services were more likely to have a diagnosis. Other predictors remaining at the end of the selection process varied for the five outcomes.

Applying these prediction models, the estimated prevalence of having at least one of the four psychiatric disorders was 33% in the baseline and 27% in the first follow-up sample (Table 2). At both time points, the predicted prevalence of all diagnoses except panic were lower than the corresponding prevalences estimated from the CIDI-SF alone. In all cases, the prevalence of diagnosis decreased from baseline to first

follow-up. As expected, the new predicted prevalence rates at the first follow up were more similar to the prevalence rates derived from the full CIDI for the Mental Health Supplement sample than were the prevalence rates estimated from the CIDI-SF alone.

Using the presence of any CIDI DSM-IV diagnosis as the standard, we calculated the sensitivity, specificity, and positive and negative predictive values for the new predicted prevalence of having any disorder at the time of the first follow-up survey among members of the Mental Health Supplement sample (Table 3).

Compared with rates for the CIDI-SF estimated prevalence, the new rates yielded higher specificity and positive predictive values, and lower sensitivity and negative predictive values. The new estimates correctly classified 81.5% of the sample as compared with 78.6% correctly classified with the CIDI-SF estimate, and yielded a more balanced percentage of false positives and negatives (9% and 9.5% versus 16% and 5.4% respectively). In addition, the area under the ROC curve based on the prediction of DSM-IV caseness from the model-generated probabilities of the presence of any disorder at the first follow-up was 0.735, indicating reasonable identification of caseness.

Discussion

Evaluation of the performance of the CIDI-SF in the HCSUS indicated that the screener tended to overestimate the number of people with psychiatric

Table 1. Prediction model odds ratios and 95% CIs for 5 DSM-IV CIDI diagnosis outcomes

Covariate	Outcome				
	Any diagnosis	Depression	Dysthymia	GAD	Panic
Intercept	0.47 0.26–0.85	0.58 0.32–1.04	0.06 0.02–0.19	0.06 0.01–0.36	0.19 0.06–0.56
CIDI-SF symptom score	1.27 1.20–1.35	1.35 1.21–1.50	1.34 1.10–1.64	1.66 1.43–1.92	1.49 1.29–1.73
Emotional wellbeing	0.97 0.96–0.98	0.97 0.96–0.98	0.97 0.96–0.99	0.97 0.95–0.99	0.98 0.97–0.99
Service use for emotional problems	2.42 1.59–3.67	1.87 1.19–2.94	2.33 1.24–4.38	2.46 1.15–5.23	3.49 1.93–6.32
Substance use/ dependence	1.68 1.15–2.46			1.83 1.06–3.14	1.58 1.03–2.42
Ethnicity	1.56[A] 1.13–2.17	1.61[B] 1.19–2.17	2.51[A] 1.40–4.49		0.69[C] 0.50–0.97
General health			0.98 0.97–0.99		
Age over 50			3.28 1.73–6.23		
High school education or less			2.26 1.28–3.99		
Income 5k or less				0.36 0.20–0.63	
Number of HIV symptoms					1.11 1.02–1.21
CD4 count <49					0.60 0.41–0.89
Male gender					0.62 0.40–0.95

Note: A = odds ratio for white or other ethnicity as compared to black, Asian, and Hispanic;
B = odds ratio for white ethnicity as compared to black, Asian, Hispanic, and other;
C = odds ratio for black ethnicity as compared to white, Asian, Hispanic, and other.

Table 2. Weighted DSM-IV prevalence estimates for the baseline and first follow-up samples based on the CIDI-SF screener and predicted using regression equations

Diagnosis	Predicted Dx+ (95% C I) Baseline	Predicted Dx+ (95% C I) First follow-up	CIDI-SF Screener + Baseline	CIDI-SF Screener + First follow-up	Full CIDI+ Mental Health Supplement
Any psych.	32.8 (30.1–35.3)	27.2 (24.9–29.5)	47.9	37.5	27.0
Depression	22.0 (19.5–24.5)	18.6 (16.5–20.8)	36.0	27.3	18.5
Dysthymia	5.0 (3.5–6.5)	3.8 (2.5–5.1)	26.5	20.5	3.8
GAD	4.1 (2.9–5.3)	3.2 (2.4–4.1)	15.8	10.6	3.2
Panic	15.5 (12.9–18.1)	12.6 (10.3–14.9)	12.6	10.5	8.9

Table 3. Concordance rates for presence of any disorder estimated with the regression approach and with the CIDI-SF in the HCSUS Mental Health Supplement sample (full CIDI presence of any DSM-IV diagnosis is used as the standard)

	Regression	CIDI-SF
Sensitivity	64.7	79.9
Specificity	87.7	78.1
PPV	66.1	57.5
NPV	87.1	91.3
Correctly classified	81.5	78.6
False positives	9.0	16.0
False negatives	9.5	5.4

disorders (Orlando et al., 2001). The prevalence estimates obtained with the regression approach in this study appear to be more accurate than the estimates derived from responses to the CIDI-SF alone. For the purpose of estimating prevalence of disorder, it is of most interest to minimize the number of false classifications, and false positives in particular. The estimates based on the regression approach in this study correctly classified a slightly larger proportion of the Mental Health Supplement sample than did estimates from the CIDI-SF alone. In addition, the regression estimates can be considered more conservative than those from the CIDI-SF; the rates of false classification from the regression estimates were fairly evenly distributed as positives and negatives, whereas the CIDI-SF yielded more false positives than false negatives.

The adjusted prevalence estimate reported in this study of having any of the four disorders was close to 33% at the baseline assessment (January 1996 – April 1997), and decreased to 27% at the first follow-up assessment (approximately six months later). Although the re-estimated prevalence rates reported in this study are as much as 10%–15% lower than the CIDI-SF screener rates (Bing et al., 2001), they are still considerably higher than estimates for the general population (Kessler et al., 1994). For example, the estimated 12-month prevalence of depression from the National Comorbidity Survey is 10.3%, which is 50% lower than the 12-month prevalence of depression in the HIV+ population represented by the HCSUS baseline sample estimated in this study.

It is clear that the screener tends to over-estimate the number of respondents with psychiatric diagnoses in this population, but responses on the CIDI-SF are useful in the HCSUS for purposes other than deriving prevalence estimates. For example, the Mental Health

Supplement interview was intended to include all respondents at high risk for psychiatric disorder. Selection based on responses to the CIDI-SF, although a liberal estimate of risk for mental health problems, served this purpose well by ensuring that only a few at-risk respondents were missed. Furthermore, using continuous CIDI-SF symptom scores in analyses seeking to characterize the scope of mental health problems and potential need for services in this population yields meaningful, informative, and practically relevant results (Sherbourne et al., 2000; Burnam et al., 2001).

Although the CIDI-SF was designed as a short, diagnosis-specific instrument, in the population of HIV+ adults represented by the HCSUS cohort, the screener performed similarly to existing general psychiatric screening instruments, perhaps identifying the presence of psychiatric distress rather than 'true' psychiatric illness (Sandanger et al., 1998; Sandanger et al., 1999). For this reason, the present study was conducted to obtain new estimates of the prevalence of psychiatric disorder in this population. Evaluation of the new estimates indicates that they provide a more accurate reflection of the population in care for HIV. The new estimated prevalence rates of depression, dysthymia, GAD, panic, and any one of these disorders are within the range of rates reported for HIV+ populations by other studies, and higher than estimated rates for the general community population.

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