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The prevalence and correlates of non-affective psychosis in the National Comorbidity Survey Replication (NCS-R)

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Abstract

Background—To estimate the prevalence and correlates of clinician-diagnosed DSM-IV non-affective psychosis (NAP) in a national household survey.

Methods—Data come from the US National Comorbidity Survey Replication (NCS-R). A screen for NAP was followed by blinded sub-sample clinical reappraisal interviews. Logistic regression was used to impute clinical diagnoses to respondents who were not re-interviewed. The method of Multiple Imputation (MI) was used to estimate prevalence and correlates.

Results—Clinician-diagnosed NAP was well predicted by the screen (AUC = .80). The MI prevalence estimate of NAP (standard error in parentheses) is 3.1 (1.5) per 1000 population lifetime and 1.4 (1.0) per 1000 past 12 months. The vast majority (87.9%) of lifetime and 12-month (74.1%) cases met criteria for other DSM-IV hierarchy-free disorders. Two-thirds of 12-month cases were in treatment, all in the mental health specialty sector.

Conclusions—The screen for NAP in the NCS-R greatly improved on previous epidemiological surveys in reducing false positives, but coding of open-ended screening scale responses was still needed to achieve accurate prediction. The lower prevalence estimate than in total-population incidence studies raises concerns that systematic non-response bias causes downward bias in survey prevalence estimates of NAP.

Keywords

non-affective psychosis; prevalence; epidemiology

The current report presents data on prevalence and correlates of DSM-IV non-affective psychosis (NAP) from the recently completed National Comorbidity Survey Replication (NCS-R; Kessler and Merikangas 2004), a nationally representative face-to-face household survey of the US population. Unlike previous community epidemiological surveys of psychiatric disorders, almost all of which used fully structured lay-administered diagnostic interviews to estimate prevalence and correlates of NAP (Keith et al 1991; Kendler et al 1996), an innovative calibration method is used here to generate probabilities of clinician-

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diagnosed NAP from a prediction equation developed in a clinical reappraisal sub-sample. Substantive analyses are based on transformations of these probabilities rather than on the diagnoses generated in the fully structured interviews, allowing nationally representative estimates to be obtained of the prevalence and correlates of clinician-diagnosed NAP.

The estimated lifetime prevalence of schizophrenia and schizophreniform disorder in community epidemiological surveys using fully structured lay-administered diagnostic interviews have been in the range 0.3–1.6% (Bland et al 1988; Canino et al 1987; Hwu et al 1989; Keith et al 1991; Kendler et al 1996; Lee et al 1990; Wells et al 1989; Wittchen et al 1992). Assuming that positive predictive value (PPV) of these diagnoses is in the .16–.30 range found in the published clinical calibration studies based on these surveys and assuming that negative predictive value (NPV) is close to 1.0, lifetime prevalence of clinician-diagnosed schizophrenia or schizophreniform disorder in these community surveys is 0.0–0.5%.

Although lifetime prevalence of more broadly defined NAP (which, in addition to schizophrenia and schizophreniform disorder, includes schizoaffective disorder, delusional disorder, and psychosis not otherwise specified) has only been examined in one large-scale community epidemiological survey (Kendler et al 1996), the results in that survey suggest that this lifetime prevalence is roughly twice that of schizophrenia or schizophreniform disorder. Assuming that ratio to be correct and also assuming that the .10 PPV of fully structured diagnoses of NAP other than schizophrenia and schizophreniform disorder that was found in that survey is accurate and that NPV is close to 1.0, lifetime prevalence of clinician-defined broad NAP in existing community surveys would be in the range 0.1–0.8%.

Based on the considerations in the last paragraph, we expected the prevalence estimate of clinician-defined NAP to be in the range 0.1–0.8% in the current study. We did not attempt to estimate the prevalence of particular types of non-affective psychosis because the sample was too small for these distinctions to be made. In addition to estimating prevalence, we studied the socio-demographic correlates of NAP and the proportion of people with NAP who received treatment. We expected, based on previous research, that NAP would be associated with low socio-economic status (low education, unemployment, low income) and being unmarried. Our expectations were less clear regarding the proportion of cases that would be in treatment because of recent changes in the organization and financing of mental health treatment.

METHODS

Sample

The NCS-R is a nationally representative, face-to-face household survey of adults (ages 18+) (Kessler et al 2004; Kessler et al 2003). A total of 9282 respondents participated in the survey (February 2001–December 2003). The response rate was 70.9%. Participants received \$50 for participation. Verbal rather than written consent was used in order to be consistent with the recruitment procedures in the baseline NCS (Kessler et al 1994). The Human Subjects Committees of Harvard Medical School and the University of Michigan both approved these procedures. All NCS-R respondents completed a Part I diagnostic interview using the WHO Composite International Diagnostic Interview (CIDI 3.0; Kessler and Ustun 2004), while a probability sub-sample of 5692 Part I respondents also received a Part II interview that assessed additional disorders and correlates. Part II respondents included all who met criteria for any Part I disorder plus a probability sub-sample of others. The sample was weighted for differential selection within households, differential recruitment intensity, over-sampling of Part I cases into Part II, and residual discrepancies with the 2000 Census on socio-demographic and geographic variables. A random sub-sample of Part II respondents ($n = 2322$) was administered the NAP screen. All analyses reported in this paper focus on this sub-sample. More complete information on NCS-R sampling and weighting is reported elsewhere (Kessler et al 2004).

The NAP screen

The screen for NAP in the Diagnostic Interview Schedule (Robins et al 1981) and of CIDI 1.0 (Robins et al 1988), the instruments used in previous large-scale community epidemiological surveys of NAP in the US, were designed to normalize reports about delusions and hallucinations in an effort to reduce respondent reluctance to admit symptoms. An undesired consequence was that the screening questions were worded in a way that many people without NAP erroneously endorsed them. For example, many people reported having very good hearing (in response to a question about hearing things other people could not hear), very good vision (in response to a question about seeing things other people could not see), and very empathetic relationships with their spouses (in response to a question about whether anyone ever read their mind). Because of this false positive problem, it was necessary to probe positive responses for examples and for experienced clinicians to review open-ended responses to rate clinical significance. This was labor-intensive. In the baseline National Comorbidity Survey, for example, over 1000 hours was needed to review the open-ended NAP responses of the 28.4% of respondents who endorsed one or more NAP symptom questions (Kendler et al 1996). In addition, the search for true NAP based on open-ended responses is prone to error.

The CIDI 3.0 screening questions for NAP, which were used for the first time in the NCS-R, were designed to reduce the false positives problem by beginning with an introduction that made it clear to respondents that the questions would ask about “unusual experiences” that are believed to be very common in the population but about which little accurate information is known. Respondents were exhorted to give thoughtful responses because it is very important to know how common these experiences are. Question wording experiments have shown that use of such normalizing and response-motivating introductions significantly improve accuracy of response to potentially embarrassing survey questions (Kessler et al 2000). This introduction was followed by six fully structured questions with yes-no response options that asked about the DSM-IV delusions and hallucinations found in the NCS (Kendler et al 1996) to be the strongest predictors of clinician-diagnosed NAP. (The full text of these questions along with the remainder of the CIDI 3.0 screening questions for NAP, which constitute Section 27 of CIDI 3.0, are posted at www.hcp.med.harvard.edu/cidi.) Although based on the original CIDI, these questions were modified with a clinical expert (IF) to be consistent with the way the symptoms are experienced by community cases. Pilot testing confirmed patient endorsement of these questions consistent with their clinical symptoms.

Respondents who endorsed any of the NAP symptom questions were asked to describe instances of the symptom questions they endorsed. Interviewers probed for complete responses and recorded responses verbatim. Follow-up questions then asked about age of first onset of these symptoms (“How old were you the very first time any of these things happened to you?”), persistence, 12-month prevalence, possible organic causes of the symptoms (e.g., whether they occurred only at times the respondent used recreational drugs), lifetime and 12-month treatment, and, among those in treatment, diagnoses and names of the medications prescribed. Once completed interviews were returned to the study office, a trained clinical rater (MH, a PhD clinical psychologist with 25 years of clinical experience) reviewed the open-ended responses and classified them probable, possible, or unlikely to meet DSM-IV criterion for the symptom. Respondents classified unlikely were further sub-divided into those with qualifying symptoms thought to be substance-induced, qualifying symptoms considered culturally appropriate, experiences judged odd but not psychotic, experiences judged realistic rather than delusional, and experiences judged to reflect misunderstanding of the question.

The clinical reappraisal interviews

Clinical reappraisal interviews with the psychosis section of the lifetime non-patient version of the Structured Clinical Interview for DSM-IV (SCID; First et al 1997) were administered

to CIDI respondents with NAP symptoms classified probable, possible, substance-induced, and culturally appropriate. Seventy-three such interviews were completed. A similar clinical re-appraisal study in the baseline NCS (Kendler et al 1996) found none of the respondents whose open-ended responses were classified unlikely to meet diagnostic criteria was found to have NAP in the clinical re-interviews, justifying no clinical re-interviews being carried out with such NCS-R respondents.

Two clinical interviewers (EG and MG, clinical psychologists each with ten years clinical experience) carried out the SCID NAP interviews by telephone. Each interviewer completed the standard SCID self-study training program, 40 hours of in-person training, and supervised practice interviewing, and successful rating of standardized videotaped interviews with complete diagnostic concordance to gold standard ratings before beginning production interviewing. Biweekly review meetings were used to prevent interviewer drift. Given the small number of clinical interviews carried out, all were reviewed by a clinical supervisor and rated based on consensus between the interviewer and clinical supervisor. In cases of initially discrepant ratings on the part of the interviewer and supervisor, respondents were re-contacted to clarify symptoms that were the focus of disagreement. Based on the small final sample size, diagnoses were made only for broadly defined NAP, not for individual non-affective psychoses (i.e., schizophrenia, schizofreniform disorder, etc.).

Comorbid DSM-IV disorders

Other DSM-IV disorders in the NCS-R include anxiety disorders (panic disorder with or without agoraphobia, generalized anxiety disorder, specific phobia, social phobia, agoraphobia without panic disorder, obsessive-compulsive disorder, post-traumatic stress disorder), mood disorders (major depressive disorder, bipolar disorder I or II, dysthymia), impulse-control disorders (oppositional-defiant disorder, conduct disorder, attention-deficit/hyperactivity disorder, intermittent explosive disorder), and substance use disorders (alcohol and illicit drug abuse and dependence). Organic exclusion rules and diagnostic hierarchy rules were used in making diagnoses. As detailed elsewhere (Kessler et al in press), blinded SCID re-interviews with a probability sub-sample found generally good concordance between DSM-IV diagnoses of anxiety, mood, and substance disorders based on the CIDI and the SCID. Impulse-control disorder diagnoses were not validated, as no gold standard clinical interviews exist for these disorders.

Other correlates of NAP

We examined three other possible correlates of NAP: socio-demographics, role impairment, and treatment. Socio-demographics included gender, age at interview, race-ethnicity, education, marital status, and employment status. Role impairment was assessed with the World Health Organization Disability Assessment Schedule (WHO-DAS; Chwastiak and Von Korff 2003), which evaluates functioning in three domains of basic activity (self-care, mobility, and cognition) and three domains of instrumental activity (days out of role, quality of productive role performance, quality of social role performance) over a 30-day recall period. Each evaluation uses a 0–100 scale that was dichotomized to distinguish high impairment (arbitrarily defined as being as close as possible to the lowest 20% of the population). Respondents with NAP were asked about past year treatment by a mental health professional, a general medical health care provider, a human services professional (e.g., religious counselor, social worker at a social services agency), and in the complementary-alternative medicine (CAM) sector (either participation in a self-help group or treatment by a CAM professional).

Analysis methods

The NAP clinical re-appraisal sample was weighted to adjust for differential inclusion of respondents with screening question responses rated definitely vs. probably meeting criteria.

Logistic regression was used to predict clinician diagnoses of NAP from the CIDI screening questions in this weighted sample. Coefficients from the best-fitting equation ($AUC = .96$) were used to assign predicted probabilities of clinician-diagnosed NAP to respondents not in the clinical re-appraisal sample. A random draw from the binomial distribution for a respondent's predicted probability was used to assign a yes-no predicted clinician diagnosis to each respondent. Further analysis was based on the total screening sample rather than the clinical re-appraisal sub-sample. The method of multiple imputation (MI; Rubin 1987) was used to adjust estimates of coefficients and statistical significance in the total screening sample for the imprecision introduced by imputing clinical diagnoses rather than carrying out clinical assessments for all respondents. MI prevalence estimates are unbiased, while estimates of correlates are conservative.

Prevalence and proportion of cases in treatment were estimated as MI means. The age-of-onset distribution was calculated using the actuarial method (Halli et al 1992). Associations with socio-demographics, disability, and comorbid disorders were estimated using MI logistic regression analysis. Because the NCS-R sample design features weighting and clustering, all parameter estimates were estimated using the Taylor series linearization method (Wolter 1985) to adjust for weighting and clustering implemented in SUDAAN (Research Triangle Institute 2002). Significance of set of coefficients was assessed with design-corrected MI Wald χ^2 tests. Significance was evaluated using two-sided design-based tests and the .05 level, which is conservative given the substantial amount of directional information in the literature.

RESULTS

Screening question responses

NAP screening questions were endorsed by 9.1% of respondents. (Table 1) The most commonly endorsed symptoms were visual (6.3%) and auditory (4.0%) hallucinations; the least commonly were thought control (0.1%) and thought insertion (0.4%). Clinical review of open-ended CIDI responses concluded that 16.8% of respondents who endorsed symptom questions were probable cases of NAP, which would yield a lifetime prevalence estimate of 1.5%. The proportions classified probable were much lower for visual (15.8%) and auditory (19.9%) hallucinations than for the other symptoms (50.2–76.5%). An additional 19.1% of respondents who endorsed questions were classified possible cases, with the remainder classified either substance-induced (2.5%), culturally appropriate (32.1%), odd but not psychotic (26.6%), realistic (0.8%), or misunderstood (0.9%). It is noteworthy that relatively high proportions of respondents who endorsed the CIDI questions about visual (25.4%) and auditory (33.6%) hallucinations were classified odd but not psychotic. The vast majority of these cases involved transient hallucinations that were limited to seeing a fleeting vision or hearing the fleeting voice of a recently deceased loved one.

Clinical reappraisal interview responses

Even though clinical interviewers were blinded to initial open-ended classifications, a significant association was found between these classifications and SCID diagnoses ($AUC = .80$). The lowest probability (standard error in parentheses) of SCID NAP was 0.0% (0.0) among respondents with an initial classification of culturally appropriate, followed by 4.8% (4.6) among respondents classified possible, 25.0% (21.6) among those classified substance-induced, and 35.3% (11.6) among those classified probable. Based on the conservative assumption that true NAP prevalence is zero among respondents who either reported CIDI symptoms that were exclusively classified in the other three categories (i.e., odd but not psychotic, realistic, or misunderstood) or who reported no NAP symptoms, none of whom were included in the SCID interviews, the lifetime prevalence estimate of NAP is 3.1 (1.5) per 1000

population. Based on CIDI reports of symptom recency among respondents classified as cases, the 12-month prevalence estimate is 1.4 (1.0) per 1000 population.

Associations between responses to CIDI screening questions and clinical diagnoses

The most powerful predictors of clinician-diagnosed NAP in the clinical reappraisal sample were endorsing both delusions and hallucinations in the CIDI, endorsing three or more of the six symptoms, and provisional clinical ratings of open-ended responses to the CIDI symptom questions. (Table 2) A multivariate equation based on this information, assuming conservatively that the prevalence of NAP is zero among respondents excluded from the reappraisal interviews, strongly predicts clinician diagnoses (AUC = .96).

This prediction equation was used to generate ten MI estimates of the predicted probability of SCID DSM-IV lifetime NAP for each respondent not in the NAP clinical reappraisal survey. Sampling from a binomial distribution defined by the predicted probability for each respondent was used to impute a yes-no case classifications to each imputation for each respondent. These predicted clinician diagnoses were used in the MI approach to study the correlates of NAP. The median (M) and inter-quartile range (IQR) of the NAP age-of-onset (AOO) distribution based on these outcomes are 21 and 13–28 in the total sample, with a somewhat earlier distribution among men (M: 13; IQR: 10–22) than women (M: 27; IQR: 13–33).

Socio-demographic correlates of NAP

Statistical power to document meaningful correlates was low due to the rarity of NAP. None of the socio-demographic variables was consequently a significant predictor of NAP. Nonetheless, meaningfully elevated odds, defined as in excess of 2.0, exist for a number of socio-demographic variables, (results not shown, but available on request) including age 18–59 compared to 60+, “other” race-ethnicity (made up largely of Asians and Native Americans) compared to Non-Hispanic Whites, less than college education compared to college graduates, previously married compared to the married, and “other” employment status (made up largely of unemployed and disabled) compared to the employed.

Comorbidity with other DSM-IV disorders

Consistently positive comorbidities are found between NAP and other DSM-IV disorders assessed in the NCS-R when the latter are diagnosed without hierarchy rules that involve NAP. (Table 3) Eighty-seven percent (87.9%) of respondents with lifetime NAP met criteria for at least one other lifetime disorder, while 74.2% of respondents with 12-month NAP met criteria for at least one other 12-month disorder. The highest lifetime odds-ratios are with bipolar disorder (11.4) and OCD (26.0), while the highest 12-month odds-ratios are with panic disorder (14.7) and drug dependence (15.8). However, variation in the ORs across disorders is not reliable due to the very wide confidence intervals of the largest ORs, all of which are associated with low-prevalence disorders. Interestingly, the ORs associated with having high comorbidity (three or more hierarchy-free diagnoses in addition to NAP) are larger (30.4 lifetime, 17.2 12-month) than those associated with any individual disorder.

Impairments in basic and instrumental functioning

Respondents with 12-month NAP have meaningfully elevated impairment in all three WHO-DAS dimensions of current basic functioning (self-care, mobility, cognition), although cognitive functioning is the only one of these three where the elevation is significant (4.6). (Table 4) Twelve-month NAP is also associated with meaningfully elevated impairment in all three WHO-DAS instrumental functioning dimensions (days out of role, productive role functioning, social role functioning), although only the first and third are statistically significant (4.4 and 4.7, respectively).

Treatment

Two-thirds (68.6%) of respondents with 12-month NAP reported treatment for emotional problems in the twelve months before interview. All these respondents were treated in the mental health specialty sector. Smaller numbers also obtained treatment in the general medical (3.3%), human services (11.2%), and complementary-alternative medicine (15.1%) treatment sectors.

DISCUSSION

The 1.5% lifetime prevalence estimate of probable NAP based on preliminary clinical review of CID open-ended responses is in the middle of the range of prevalence estimates in past community epidemiological surveys (Bland et al 1988; Canino et al 1987; Hwu et al 1989; Keith et al 1991; Kendler et al 1996; Lee et al 1990; Wells et al 1989; Wittchen et al 1992). This was achieved, though, using a much smaller set of screening questions than in previous surveys as well as with a much smaller proportion of respondents who endorsed the questions than in previous surveys (6 compared to 14 screening questions and 9.3% compared to 28.4% of respondents who endorsed screening questions in the NCS-R compared to the NCS). Only a tiny proportion of open-ended responses were classified as the respondent misunderstood the question, compared to a majority in previous surveys. This shows that the NCS-R screening question revision improved on the screens used in previous surveys.

The 0.3% lifetime prevalence estimate of clinician-diagnosed NAP in the NCS-R is considerably lower than the 1.5% estimate based on preliminary clinical review of the CIDI responses. This difference is less than in previous community epidemiological surveys, though, providing another indication that the NCS-R CIDI NAP symptom screening questions improved on those used in previous surveys. The larger discrepancy in previous surveys is due to the vast majority of self-reported psychotic symptoms in response to fully structured symptom questions representing either experiences that can easily be misinterpreted by researchers as delusions (e.g., reports of being followed) or misunderstandings of survey questions about hallucinations (e.g., reports of having excellent vision). Systematic clinical evaluations of respondents with positive responses to such questions in earlier surveys have shown only a small minority to be truly psychotic (Hanssen et al 2003; Johns et al 2004; Kendler et al 1996). It is consequently important to be cautious in interpreting the comparatively high prevalence estimates of psychotic spectrum experiences found using fully-structured assessments in recent community epidemiological surveys (Johns et al 2004; Maric et al 2003; van Os et al 2001).

NCS-R findings regarding the correlates of NAP are also consistent with previous surveys and incidence studies. These include the findings that NAP has a median age-of-onset in the late teens or early twenties that is somewhat earlier among men than women (Jablensky et al 1992), that NAP is significantly related to disadvantaged social status (Jablensky 2000), that NAP is highly comorbid with a wide range of other mental disorders (Kendler et al., 1996) and substance use disorders (Murray et al 2002), that NAP is associated with substantial impairment in all areas of life (Jablensky et al 1980), and that the vast majority of people with NAP are in contact with the treatment system (Sartorius et al 1986). We also found a somewhat higher relative-odds of NAP among men than women (1.6), which is consistent with a modest, but statistically significant, elevation among men compared to women found in meta-analysis of incidence studies (McGrath et al 2004).

There are also two noteworthy NCS-R findings that either diverge from the results of previous surveys or that raise concerns about the current results. The first is that the median age-of-onset of NAP among men (13) and the low end of the IQR of that estimate (10), as assessed by the CIDI, are both lower than in previous studies. These discrepancies could reflect nothing more

than the imprecision of sub-sample estimates based on the small number of NAP cases detected in the NCS-R. The second finding that warrants comment along the same lines is that over one-fourth of respondents diagnosed with lifetime NAP in the SCID met lifetime hierarchy-free criteria for bipolar disorder in the CIDI. Although this pattern could lead to questions about the accuracy of the SCID diagnoses, more detailed case-by-case review of complete case records confirmed that NAP was the more appropriate diagnosis than bipolar disorder in all these cases.

Despite the general consistency with previous research, the NCS-R results have to be interpreted in the context of three limitations. First, NAP was assessed comprehensively only among respondents with clinical reappraisal interviews. MI was used for the remainder. Concern about this limitation is reduced by the AUC of the imputation equation being high, which means that statistical power is close to what it would have been if NAP were assessed with the SCID for all respondents. The MI method adjusts for the imprecision introduced by imputation, with prevalence estimated without bias.

Second, a much larger sample than the 2322 Part II NCS-R respondents screened for NAP is required to study such a rare disorder powerfully. Implications of this limitation are seen in Tables 3–5, where large ORs are often not significant. Caution is needed in interpreting results because of this limitation.

Third, people with NAP might have been under-represented in the NCS-R due to any of three factors: (i) The sampling frame excluded population segments (non-English speakers, institutions, homeless) that might have a high NAP prevalence. (ii) NCS-R non-respondents might have a higher prevalence of NAP than respondents. (iii) Some respondents who screened negative for NAP in the CIDI might actually have NAP.

Each of these three is plausible. Studies of people in non-household populations (e.g., homeless, prison, nursing home) document higher prevalence of NAP than in the household population (Fischer and Breakey 1991; Keith et al 1991). This does not introduce much bias into total-population estimates, though, due to the small proportion of the population not in the English-speaking household population. Kendler et al. (1996) estimated that this exclusion leads to no more than a 0.1% downward bias in the estimated lifetime total population prevalence of NAP.

Under-representation of household residents with NAP is potentially much more important. Survey response rates have declined steadily for the past several decades (de Leeuw and de Heer 2002) and are now often as low as 50–60% (Groves and Couper 1998). With such low response rates, NAP prevalence as low as 2% among non-respondents would lead to 50% under-estimation of prevalence. We were unable to investigate this in the NCS-R non-response survey (Kessler et al 2004), as in previous non-response studies (Badawi et al 1999; Eaton et al 1992; Kessler et al 1995) due to the rarity of NAP. However, a Swedish study found that people with a history of treated schizophrenia based on registry data were significantly less likely than others to participate in a mental health survey (Allgulander 1989).

NAP screening measures having NPV less than 1.0 could have an even more dramatic effect on estimated prevalence. At least some confirmed cases of NAP are subsequently misclassified even in clinical follow-up studies (Tsuang et al 1981). Even a very small decrement in NPV, such as from 1.00 to .99, would more than quadruple the estimated lifetime prevalence of NAP in the NCS-R. This possibility can be evaluated with SCID clinical reappraisal interviews in a probability sub-sample of screened negatives. However, the number of screened negatives would have to be very large to be helpful due to the low prevalence of NAP. For example, in order to estimate prevalence in a plausible range (i.e., 0.0–0.3%) with even minimal precision (i.e., a standard error equal to half the range), SCID clinical reappraisal interviews would have

to be administered to at least 1000 screened negatives. This was not possible for financial reasons in the NCS-R.

The problem of non-response bias is even more difficult to address. A methodological study was carried out in the NCS-R where limited information was obtained from a probability sub-sample of non-respondents. However, only a minority of non-respondents agreed to participate in that survey even with a substantial financial incentive. Non-respondents with NAP could well have been less likely to participate than other non-respondents in light of common paranoid symptoms in NAP.

Based on these concerns, we should consider whether our NAP prevalence estimate is consistent with other sources of data. A number of NAP total-population incidence studies have been carried out using clinical methods to assess all incident cases in a population over some time interval (Jablensky et al 1992; Sartorius et al 1986). These results can be used to generate alternative estimates of NAP lifetime risk. Jablensky (2000) reviewed these studies. Annual NAP incidence estimates were 0.016–0.042%. In equilibrium, these estimates can be multiplied by number of birth cohorts at risk to estimate lifetime risk. Assuming conservatively that the main age range of risk is between the ages of 15 and 55 (recognizing that risk is not constant in that age range), estimated lifetime risk would be 0.64–1.68%. This is considerably higher than the adjusted 0.1–0.8% survey estimate. Estimated lifetime risk should be higher than estimated lifetime (to date) prevalence, but this should only play a small part in the discrepancy due to the early age-of-onset distribution of NAP. A much more plausible explanation for the lower survey estimates is downwardly biased because of the problems reviewed above.

Two of these three problems could be resolved with larger surveys and larger clinical re-interview sub-samples and expanded sampling frames to include homeless and institutionalized people. However, these design changes would not resolve the most serious problem – the presumed high non-response rate among people with NAP. One way to finesse this problem would be to change the focus to a more tractable research task, as in the Study on Low Prevalence (i.e., psychotic) Disorders (SLPD) carried out in conjunction with the Australian National Survey of Mental Health and Wellbeing. The SLPD carried out a screen for psychosis among all patients in treatment for mental health problems in four areas of Australia in a specified month and then carried out an in-depth assessment of NAP with screened positives (Jablensky 2000). An exercise of this sort is tractable and useful in estimating demand for treatment of psychosis even if it does not estimate unmet need for such treatment.

Realistic prospects for resolving the non-response problem to allow NAP prevalence to be estimated with reasonable precision and accuracy are less clear. Survey sampling specialists have developed several methods to estimate prevalence and correlates of rare behaviors (Kalton and Anderson 1986), but none of them is likely to be effective in dealing with the NAP non-response problem. The one possible exception is the multiplicity sampling method (Sudman et al 1988), in which informants report on rare behaviors of well-defined networks (e.g., their first-degree relatives), where probability of hearing about each detected case is calculated based on a reconstruction of the size of the case's network, and an underestimation adjustment weight is used to estimate prevalence based on network size. Family studies show that informants provide information on between 27% and 60% of independently confirmed psychotic cases (Andreasen et al 1986; Davies et al 1997; Roy et al 1996), making multiplicity sampling potentially feasible. However, probability of informant reports is significantly related to characteristics of the informant and the case as well as density of psychosis in the network (Roy et al 1996). This means that it would be complicated to reconstruct probability of detection for each confirmed case from informant reports. Despite these difficulties, though, multiplicity

sampling should be carefully considered if future general population studies attempt to estimate NAP prevalence.

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Table 1

Endorsement and Classification of Open-ended Responses to the Six CIDI NAP Symptom Screening Questions (n=2322) Symptom Screening Questions

	Symptom Screening Questions						
	Visual Hallucinations % (se)	Auditory Hallucinations % (se)	Thought Insertion % (se)	Thought Control % (se)	Telepathy % (se)	Delusions of Persecution % (se)	Any % (se)
I. Prevalence	6.3 (0.6)	4.0 (0.5)	0.4 (0.1)	0.1 (0.1)	0.8 (0.1)	0.8 (0.1)	9.1 (0.9)
II. Classification of open-ended responses							
Probable	15.8 (3.7)	19.9 (5.0)	63.7 (20.5)	76.5 (15.7)	60.6 (13.1)	50.2 (11.6)	16.8 (3.1)
Substance-induced	1.5 (1.0)	2.6 (0.8)	0.0 (0.0)	0.0 (0.0)	0.0(0.0)	6.3 (6.3)	2.5 (1.0)
Possible	19.2 (3.8)	14.3 (3.5)	23.5 (20.0)	11.7 (11.4)	23.0 (11.8)	22.5 (10.0)	19.2 (3.0)
Culturally appropriate	34.7 (3.0)	29.5 (5.6)	12.8 (9.8)	11.8 (11.4)	6.8 (3.3)	6.2 (4.3)	32.1 (3.3)
Odd but not psychotic	25.4 (4.7)	33.6 (7.8)	0.0 (0.0)	0.0 (0.0)	9.7 (8.0)	9.2 (9.0)	26.6 (4.8)
Realistic	0.5 (0.5)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	5.5 (4.1)	0.8 (0.5)
Misunderstood	1.4 (1.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.9 (0.7)

CIDI, Composite International Diagnostic Interview; NAP, non-affective psychosis; se, standard error.

Table 2

Associations of Responses to the CIDI Symptom Screening Questions and SCID Diagnoses of Lifetime DSM-IV NAP in the Clinical Reappraisal Sample (n=73)

	SCID DSM-IV NAP % (se)	OR (95%CI)	(n)
Symptom Profile			
Hallucinations and delusions	57.1 (18.7)	20.7 (3.4–125.8)	(7)
Hallucinations-only	6.8 (3.3)	1.0 -	(59)
Delusions-only	0.0 (0.0)	- -	(7)
$\chi^2_1=10.8, p=.001$			
Number of symptoms endorsed			
Three or more	66.7 (27.2)	27.0 (2.0–365.8)	(3)
Two	16.7 (10.8)	2.7 (0.4–16.8)	(12)
One	6.9 (3.3)	1.0 -	(58)
$\chi^2_2=6.4, p=.040$			
Highest classification of open-ended responses			
Probable	35.3 (11.6)	10.9 (1.2–102.6)	(17)
Substance-induced	25.0 (21.6)	6.7 (0.3–137.4)	(4)
Possible	4.8 (4.6)	1.0 -	(21)
Culturally appropriate	0.0 (0.0)	--	(31)
$\chi^2_2=4.4, p=.113$			
Ever hospitalized for these symptoms			
Yes	33.3 (27.2)	4.5 (0.4–56.2)	(3)
No	10.0 (3.6)	1.0 -	(70)
$\chi^2_1=1.4, p=.243$			
Ever prescribed anti-psychotic medications			
Yes	40.0 (21.9)	6.9 (1.0–49.7)	(5)
No	8.8 (3.4)	1.0 -	(68)
$\chi^2_1=3.7, p=.056$			

CIDI, Composite International Diagnostic Interview; SCID, Structured Clinical Interview for DSM-IV; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition; NAP, non-affective psychosis; se, standard error; OR, odds-ratio; CI, confidence interval.

* Significant at the .05 level, two-sided test

Table 3

Comorbidities (odds-ratios) of multiply imputed SCID diagnoses of DSM-IV NAP with CIDI diagnoses of other DSM-IV disorders (n=2322)[†]

	Lifetime Comorbidity		12-month Comorbidity	
	SCID DSM-IV NAP % (se)	OR (95% CI)	SCID DSM-IV NAP % (se)	OR (95% CI)
I. Mood disorders				
Major depressive disorder	26.6 (15.0)	2.2 (0.5–10.6)	22.3 (14.9)	4.5 (0.8–24.5)
Dysthymia	13.9 (9.2)	4.3 (0.8–24.2)	13.9 (9.2)	7.4 (1.3–41.1)
Bipolar disorder	28.9 (13.3)	11.4 (3.3–40.1)	4.8 (8.6)	0.0 (0.0–580.4)
Any mood disorder	55.5 (14.2)	5.9 (1.8–19.3)	27.0 (16.6)	3.9 (0.7–22.1)
II. Anxiety disorders				
Generalized anxiety disorder	17.8 (7.6)	3.9 (1.3–11.2)	15.8 (8.0)	6.2 (1.7–22.0)
Post-traumatic stress disorder	29.1 (12.6)	6.5 (1.9–22.5)	29.1 (12.6)	14.7 (4.3–50.4)
Panic disorder	13.6 (9.9)	3.8 (0.7–20.7)	6.1 (6.5)	1.2 (0.0–514.8)
Agoraphobia	7.7 (6.7)	2.5 (0.0–1655.5)	7.7 (6.7)	4.1 (0.0–3837.5)
Specific phobia	17.0 (11.7)	1.5 (0.3–8.5)	6.0 (5.8)	0.7 (0.1–6.0)
Social phobia	29.9 (18.3)	3.2 (0.5–21.1)	11.7 (11.5)	1.7 (0.2–19.8)
Obsessive-compulsive disorder	30.4 (19.9)	26.0 (2.4–287.1)	9.2 (11.3)	1.5 (0.0–14666.6)
Any anxiety disorder	71.1 (14.2)	7.4 (1.7–33.2)	54.9 (12.9)	6.5 (2.2–19.5)
III. Impulse-control disorders				
Intermittent explosive disorder	24.5 (10.5)	4.2 (1.4–13.2)	15.8 (9.5)	4.9 (1.2–19.7)
Conduct Disorder	19.3 (15.8)	1.1 (0.0–447.5)	--	--
Oppositional-defiant disorder	3.3 (6.9)	0.0 (0.0–51.2)	--	--
Any impulse-control disorder	39.7 (14.3)	2.4 (0.7–8.0)	15.8 (9.5)	4.9 (1.2–19.7)
IV. Substance use disorders				
Alcohol abuse	14.5 (12.8)	1.1 (0.0–364.0)	11.8 (9.8)	5.0 (0.0–4461.9)
Alcohol dependence	14.2 (8.9)	2.7 (0.5–13.4)	0.0 (0.0)	0.0 (0.0–0.0)
Drug abuse	17.9 (11.2)	4.3 (0.8–24.2)	7.0 (8.2)	1.8 (0.0–19040.4)
Drug dependence	6.0 (5.5)	2.0 (0.3–13.6)	6.0 (5.5)	15.8 (2.0–127.6)
Any substance use disorder	28.7 (12.4)	2.5 (0.7–9.2)	17.8 (9.4)	6.8 (1.7–27.6)
V. Any CIDI DSM-IV disorder				
Any	87.9 (9.4)	16.3 (0.2–1081.9)	74.2 (11.6)	10.3 (2.7–39.1)

	Lifetime Comorbidity		12-month Comorbidity	
	SCID DSM-IV NAP % (se)	OR (95% CI)	SCID DSM-IV NAP % (se)	OR (95% CI)
Exactly one	12.8 (8.6)	5.4 (0.1–570.2)	31.0 (14.6)	7.3 (1.4–37.8)
Exactly two	23.3 (10.6)	17.5 (0.2–1391.7)	17.2 (8.1)	11.0 (2.2–55.7)
Three or more	51.8 (12.6)	29.3 (0.5–1733.7)	26.0 (12.8)	17.2 (3.6–82.0)

SCID, Structured Clinical Interview for DSM-IV; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition; NAP, non-affective psychosis; CIDI, Composite International Diagnostic Interview; se, standard error; OR, odds-ratio; CI, confidence interval.

* Significant at the .05 level, two-sided test

[†] Odds-ratios adjust for age, sex, and race-ethnicity. CIDI diagnoses are made without invoking diagnostic hierarchy rules that involve NAP.

Table 4

Associations of multiply imputed 12-month SCID DSM-IV NAP with impairments in basic and instrumental functioning assessed in the WHO Disability Schedule (WHO-DAS) (n=2322)¹

	High impairment ² % (se)	OR (95% CI)
I. Basic functioning		
Self-care	11.2 (9.2)	2.3 (0.4–14.8)
Mobility	33.3 (14.7)	2.4 (0.6–9.1)
Cognition	34.0 (13.8)	4.6 (1.2–17.1)
II. Instrumental functioning		
Days out of role	52.1 (14.2)	4.4 (1.4–13.8)
Productive role performance	46.8 (13.6)	2.9 (0.9–8.9)
Social role performance	21.1 (11.5)	4.7 (1.1–20.1)

SCID, Structured Clinical Interview for DSM-IV; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition; NAP, non-affective psychosis; WHO-DAS, World Health Organization Disability Assessment Schedule; se, standard error; OR, odds-ratio; CI, confidence interval.

* Significant at the .05 level, two-sided test.

¹ Controlling for age, sex, and race-ethnicity

² High impairment was defined as respondents scoring above a cut-point on the continuous WHO-DAS scale selected as close as possible to the 80th percentile on the scale distribution. Percentages reported are the percent of respondents with 12-month NAP who are positive on this dichotomy.

Appendix Table 1

Bivariate socio-demographic correlates of DSM-IV/SCID NAP

	% (se)	OR (95% CI)
Age		
18–29	0.4 (0.2)	7.6 (0.0–1096.4)
30–44	0.4 (0.3)	9.1 (0.1–800.0)
45–59	0.3 (0.2)	6.7 (0.0–1133.9)
60+	0.1 (0.1)	1.0 -
$\chi^2_3=1.3$ p=.728		
Sex		
Female	0.2 (0.1)	0.6 (0.2–2.2)
Male	0.4 (0.2)	1.0 -
$\chi^2_1=0.6$ p=.428		
Race-ethnicity		
Non-Hispanic Black	0.3 (0.3)	1.3 (0.2–8.8)
Non-Hispanic White	0.2 (0.2)	1.0 -
Hispanic	0.5 (0.4)	1.1 (0.0–191.1)
Other	0.6 (0.5)	2.8 (0.5–15.4)
$\chi^2_3=1.7$ p=.639		
Education		
0–11 years	0.4 (0.3)	4.4 (0.2–89.1)
12 years	0.4 (0.2)	4.9 (0.5–53.1)
13–15 years	0.3 (0.2)	4.2 (0.3–50.9)
16+ years	0.1 (0.1)	1.0 -
$\chi^2_3=1.9$ p=.597		
Marital Status		
Married/Cohabiting	0.2 (0.2)	1.0 -
Separated/Widowed/Divorced	0.5 (0.3)	2.6 (0.4–18.9)
Never Married	0.3 (0.4)	1.2 (0.0–29.0)
$\chi^2_2=1.3$ p=.522		
Employment Status		
Retired	0.1 (0.2)	0.0 (0.0–6.3)
Other	1.2 (1.1)	4.0 (0.3–50.3)
Student	0.0 (0.0)	0.8 (0.0–281.2)
Homemaker	0.4 (0.4)	1.0 -
Working	0.3 (0.1)	1.0 -
$\chi^2_3=3.1$ p=.382		

DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition; SCID, Structured Clinical Interview for DSM-IV; NAP, non-affective psychosis; se, standard error; OR, odds-ratio; CI, confidence interval.

* Significant at the .05 level, two-sided test