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# Occupational characteristics and the occurrence of psychotic disorders

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**Summary.** This study was undertaken to investigate whether individuals working under various occupational stressors are at increased risk of three forms of psychotic conditions. This paper presents prospective analyses of antecedent occupational stressors in psychotic conditions with interview data from a community sample in five US metropolitan areas – the NIMH Epidemiologic Catchment Area Program. Three non-overlapping conditions were defined using DSM-III definitions as assessed by the Diagnostic Interview Schedule (DIS): (1) DSM-III schizophrenia criterion A; (2) full schizophrenia; and (3) criterion A and affective episode. Artistic (RR = 3.32, 95% CI 1.08–10.14) and construction trades occupations (RR = 2.58, 95% CI 1.15–5.77), "noisome working conditions" occupations (RR = 1.20, 95% CI 0.99–1.47) and physically demanding occupations (RR = 1.39, 95% CI 1.05–1.72) were associated with increased risk of developing DIS/DSM-III schizophrenia criterion A, even after adjustment for sociodemographic and psychopathology factors including alcohol and marijuana use. Psychologically demanding occupations (RR = 0.85, 95% CI 0.75–0.95) were associated with decreased risk of developing DIS/DSM-III schizophrenia. This finding is supported by results from experimental studies on the arousability of pre-schizophrenics. Finally, teachers (RR = 11.35, 95% CI 2.56–50.38), sales occupations (RR = 4.16, 95% CI 1.00–21.30) and occupations characterized by low control over work were associated with increased risk of developing DIS criterion A and affective episode, resembling previous findings on occupational stressors and depression. Overall, our results replicate and extend previous work on occupational stressors and psychotic conditions through use of prospective data, several psychotic conditions, multiple assessment of occupational stressors and adjustment for potential confounders.

The present study investigates whether individuals working under various occupational stressors are at increased risk of developing three different psychotic conditions: DSM-III schizophrenia criterion A (delusions and hallucinations), DSM-III schizophrenia, and DSM-III schizophrenia criterion A with affective episode (psychotic affective syndrome).

Empirical evidence on the association between occupation and psychotic conditions has been a part of the literature on social class and schizophrenia (Liberatos et al. 1988). The inverse relationship of social class to risk of schizophrenia is one of the most replicated findings in epidemiological psychiatry (Neugebauer et al. 1980; Eaton et al. 1988). However, it has been difficult to explain the relationship between macro-level variables such as social class and individual psychopathology. As a consequence, research has increasingly focussed on the study of social class-linked micro-level risk factors, such as occupational stress (Dohrenwend 1990; Johnsson 1990).

In a study using treatment cases and community controls, Link et al. (1986) showed that first full-time occupations expose schizophrenic patients to "noisome" environments (hazards, noise, heat, humidity, fumes and cold), which are found mostly in working class occupations. The authors controlled for some possible confounders including sociodemographic variables, prestige of first full-time occupation and family history of mental illness. Link et al. concluded that a particular type of occupational stress linked to social class could be an etiologic factor for schizophrenia.

Despite that finding, the relationship between occupational stress and schizophrenia could still be artifactual for three reasons. First, a study based on treatment samples may suffer from selection bias (Berkson 1946). This is particularly true for schizophrenia which often goes untreated (Von Korff et al. 1985).

Second, potential confounders such as unemployment which is associated with psychotic conditions (Brenner 1973) and with working class occupations, were not considered. Other potential confounders include alcohol and marijuana use, which produce psychotic symptomatology and are correlated with certain occupations (NIAAA 1981; Gust 1989).

Finally, to increase the number of cases, Link et al., pooled DSM-III non-affective psychoses (paranoid, schizoaffective, and schizophreniform disorders and atypical psychosis) together with DSM-III schizophrenia. The onset of conditions of the former group has been associated with stressful life events while the onset of DSM-III schizophrenia is often characterized by a more insidious, developmental course (Day 1981). Thus, the observed association between occupational stress and schizophrenia might have been the consequence of including these other non-affective psychoses in the case group.

The present study attempts to replicate Link et al. findings on occupational stressors and schizophrenia. The aforementioned problems are also addressed through use of longitudinal data, the assessment of various psychotic conditions and occupational stressors, and the methods for adjusting for potential confounders.

## Methods

### *Sample and data*

Data were obtained from the Epidemiologic Catchment Area (ECA) study, a collaborative multisite longitudinal study on the incidence of psychiatric disorders (Eaton and Kessler 1985). Collaborators at each site (New Haven, Connecticut: Baltimore, Maryland; Durham, North Carolina; St. Louis, Missouri; and Los Angeles, California) conducted interviews with adult household residents, drawn from strict probability samples. The NIMH Diagnostic Interview Schedule (NIMH-DIS; Robins et al. 1981) was administered once at baseline and again approximately one year later to determine the incidence of psychiatric disorders. The initial mean survey participation rate was 76 per cent (intersite range 68–79) and about 20 per cent of participants were lost at follow-up at reinterview. Interviews were obtained with 15,283 participants at both waves. For the present study of occupational stressors, the sample was restricted to household residents in the 18–64 year range who reported at baseline ever having a full-time job and whose reported occupation was their most recent full-time occupation ($n = 11{,}789$).

The DIS is a semi-structured interview which gathers information on various psychiatric conditions through symptoms based on the third version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-III; APA 1980). Data on the reliability and validity of the DIS have been reported elsewhere (Robins et al. 1981; Anthony et al. 1985).

Standard survey questions were used to assess sociodemographic characteristics. Occupation was assessed with four standard open-ended questions from the U.S. Labor Force Surveys which referred to current or most recent full-time job: for whom do/did you work?; what kind of business or industry is/was this?; what kind of work are/did you do(ing)?; and what are/were your most important activities?. Trained coders used verbatim responses from the interviews to categorize jobs in one of the 502 detailed occupational categories of the 1980 U.S. Census Occupational Classification System (U.S. Bureau of the Census 1980).

### *Case definition*

Participants who met the DIS/DSM-III criteria for schizophrenia at baseline ECA assessment were excluded from the risk group on which follow-up data was available. Following the revision of the DSM-III, the DSM-III-R, the age criteria was not used (APA 1987). This method yielded 42 incident cases of DSM-III schizophrenia at follow-up. In order to study the specificity of the association between occupational stressors and schizophrenia, we next restricted the analysis to subjects who completed baseline and follow-up DIS and were without lifetime occurrence of DIS/DSM-III schizophrenia criterion A (delusions or hallucinations) at baseline ECA assessment. From this risk group two case groups were defined: those who at follow-up met the criteria for DIS/DSM-III criterion A but did not meet criteria for DIS/DSM-III Schizophrenia or any affective episode ("DIS delusions or hallucinations"); and those participants who met the criteria for DIS/DSM-III schizophrenia criterion A as well as the criteria for DIS/DSM-III depressive or manic episode ("DIS psychotic affective syndrome"). Depressive and manic episodes were considered together because the number of cases was too small otherwise.

To control for inter-site methodological variability, controls were drawn randomly from the cases's site of origin at a constant ratio. To increase the power for multivariate analyses, fifty controls per case were obtained for DIS/DSM-III schizophrenia and DIS psychotic affective syndrome cases. Because there were many more cases of DIS/DSM-III schizophrenia criterion A, only fifteen controls per case were selected (Breslow et al. 1983).

### *Measurement of occupational stress*

A first measure of occupational stress was based on Karasek et al.'s (1982) scoring system of occupational characteristics for census occupational categories. This consists of scale scores based on self-reports of workers aged 18–65 from three national surveys on employment conditions conducted by the Department of Labor. Mean and adjusted (for age, gender and other characteristics) scores can be assigned to occupational categories in other samples through data linkage (Schwartz et al. 1988).

Five different scales (control over work, psychological demands, job insecurity, physical demands and supervisor-worker support) were used to assess occupational stress (Karasek et al. 1985). These scales were in part based on questions drawn from the US Department of Labor/University of Michigan Quality of Employment Surveys. The control over work scale was defined as the arithmetic sum of two subscales: (1) skill discretion, measured by six items (degree to which the job involves learning new things, requires skills, task variety, repetitiveness, creativity, and development of the individual's special abilities), and (2) decision authority, measured by four items (individual's ability to have freedom to make decisions, to choose how to perform work and to influence company policy). The psychological demands scale is defined by the sum of responses to five items (excessive

work, conflicting demands, insufficient time to work, how hard and how fast the respondent has to work). The job insecurity scale is defined by the sum of responses to three items (degree of job security; how steady is the job, possibility of lay-off). The physical demands scale includes one item measuring degree to which job involves physical exertion. The supervisor-worker support scale sums responses to four items measuring co-worker's competence, helpfulness in getting the job done, friendliness, and degree to which they take a personal interest in the respondent; and four items measuring supervisor's concern for subordinates' welfare, creation of good teamwork, helpfulness in getting the job done, and degree to which he/she pays attention to what the respondent says. This scale is standardized.

Questions are scored on a Likert scale 1 to 4 (1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree). Reported internal consistencies and stabilities have been acceptable (Schwartz et al. 1988).

In collaboration with one of the authors of the scoring system (C.Pieper), five scale scores [control over work (mean = 67.26, SD = 11.60), psychological demands (mean = 31.06, SD = 3.10), job insecurity (mean = 5.00, SD = 0.93), physical demands (mean = 2.60, SD = 0.62), and supervisor-worker support (mean = 0.028, SD = 0.50)] were assigned to the subset of respondents who had reported ever having a full-time job and whose reported occupation was their most recent full-time occupation ($n = 11{,}789$). For the present analyses, only the mean Karasek scale scores were used.

The ECA occupation was classified according to 1980 codes and the Karasek scale scores are assigned according to 1970 codes. There had been a 14% increase in the number of occupational categories from 1970 to 1980 (an increase of 61 occupations). Therefore, a conversion to 1970 census codes from the 1980 census codes was performed before linkage of the data. A document which quantifies the relationship between the 1970 and 1980 occupation classification was obtained from the Bureau of the Census. Thus, the 1970 code which comprised the largest share of each 1980 category was assigned to that 1980 category. However this procedure did not account for the possible changes in the distribution of the labor force between 1970 and 1980 as these distributions are based on what a worker in 1970 would have been coded if the 1980 classification system were used. The ECA sample was assigned 1970 occupation codes and by multiplying the number of observations in each 1980 occupation by the proportion of the 1980 code which was not made up by the modal 1970 category according to the Bureau of the Census, we obtained the number of ECA observations miscoded. The coding error rate for the overall ECA sample was approximately 13%. Individual occupations with higher error rates were mainly from the "operators, fabricators and laborers" census codes. Because the Karasek scores assess psychosocial working conditions common to broad categories of occupations, the 1970 codes should tap similar psychosocial working conditions in spite of coding error.

A second measure of occupational stress was based on the Dictionary of Occupational Titles ratings (DOT; US Department of Labor 1977). The DOT provides 12,099 different occupational descriptions derived from on-site ratings made by occupational analysts. In addition to these descriptions, the DOT provides ratings for 44 occupational characteristics (measurements of complexity of work, the education and training required, the aptitudes, interests, and temperaments appropriate for the occupation, the physical demands of the occupation, and the physical conditions under which the work is performed; Cain and Treiman 1980). Scores on these occupational ratings are of unequal length ranging from 2 to 9 rating scale units. In the present study, we used the occupational ratings from the DOT for the 1980 census occupational categories developed by England and Kilbourne (1988) which yields a score for each of the 44 DOT occupational ratings for each 1980 occupational category. A factor analysis was performed on DOT ratings from the DOT tape where each occupation from the 1980 census ($n = 502$) was an observation. This procedure yielded 6 factors with eigenvalues greater than one after Varimax rotation. Factor scores were then linked with ECA data based on the occupation of the ECA respondent. Six factorial scales were constructed using 0.40 loadings as cut point, as in Cain and Treiman (1980). The length of factorial scales ranged from 19 factor scores (Factor 1) to 4 factor scores (Factor 6). In previous factor analytical studies of DOT ratings, Cain and Treiman (1981), found a factor loaded with ratings of hazards, aversive atmospheric conditions and extreme heat; in a similar analysis performed by Link et al., a factor emerged with loadings on these three variables plus loadings on extreme cold, excessive humidity, and noise. One of the factors emerging from the analysis replicated the "noisome work conditions" factor found by Link et al. (Muntaner et al. submitted).

### *Data analysis*

We used logistic regression to estimate the association between the occupational stressors and each one of the psychotic conditions separately. This procedure allowed for statistical control of potential confounders (Schlesselman 1982). Because psychotic conditions are rare diseases, the relative odds approximates the relative risk (Schlesselman 1982). Non-significant relations are indicated by confidence intervals (C.I.) including one.

Because our goal was not the study of the five site areas but the analysis of risk factor associations in occupations, sample design weights were not used. When design effects and sample weights were incorporated into the analysis, similar results to unweighted parameters were obtained.

For each disorder three equations were estimated, each one with a different method of assessing occupational stressors independent variables: (1) category of occupations; (2) DOT factors; and, (3) Karasek et al.'s scale scores. This approach allowed for the comparison of the three methods and helped avoid multicollinearity among independent variables.

The first step of model building involved reduction of the number of occupational categories. The second step

involved introduction of sociodemographic and DIS/DSM-III psychopathological variables which were potential confounders. During the analysis, any of the potential confounders which did not reach statistical significance in the regression equations were dropped.

Because of the large number ($n = 502$) of census detailed occupational categories, broader categories were created using the Census Classified Index of Occupations (US Bureau of the Census 1980). This system groups occupations in 3 successive hierarchical levels of increasing generality (the 502 Census Detailed Occupations are grouped successively into 40, 13 and 6 occupational categories). Although the grouping might be somewhat arbitrary, the rationale for its use relies on the assumption that broad occupational categories (defined according to the technical content of jobs) reflect similar working conditions (i.e., managerial occupations share working conditions which are different from those shared by transportation occupations). There is some evidence in support of this assumption. First, there are large differences in mortality rates between the census five broadest occupational categories in the US (Navarro 1990). Furthermore, psychosocial job characteristics are differentially distributed between 9 broad occupational categories similar to the census 13 occupational categories grouping (Karasek and Theorell 1990). Thus, to reduce the number of occupational categories from the Classified Index of Occupations, the 40 categories classification was used.

For each case group, those occupational categories whose crude odds ratios did not reveal an association with a given psychotic condition ($P > 0.49$) were collapsed according to the less specific 13 occupational categories grouping to increase power in the logistic regression. Four occupational categories (artists, construction trades, teachers and mail and message distributing) were retained from the 40 category grouping while the remaining occupations belonged to the 13 category grouping. We chose executive, administrative, and managerial occupations as our reference category. According to previous literature, managers were expected to show clear differences in psychosocial job characteristics (high demand/high control), when compared with other occupational categories (Karasek and Theorell 1990).

As a second step of model building, 8 sociodemographic factors and 23 DIS/DSM-III psychopathology variables associated with increased risk of occurrence of at least one of the three psychotic conditions (Tien and Eaton, in press), were entered in their regression equations as potential confounders. In the second and third models (Karasek and DOT measures), occupational stress variables which were no longer statistically significant after controlling for sociodemographic and psychopathology variables were dropped from the model.

## Results

Site incidence rates for DIS/DSM-III Schizophrenia ($n = 42$), DIS Delusions or Hallucinations ($n = 169$), DIS Psychotic Affective Syndrome ($n = 34$) have been reported elsewhere (Tien and Eaton, in press). Table 1 gives the adjusted relative risks and 95% CI's for occurrence of DIS delusions or hallucinations based on the multivariate model. Significant covariates included: gender, age, marital status, current employment and years of scholling; DIS psychopathological variables (somatization, anxiety, affective, antisocial and cognitive); DIS alcohol problems and DIS daily marijuana use. After adjusting for significant covariates, participants whose current or last full-time occupation at baseline was classified in the category of artists (writers, artists, entertainers and athletes) were 3.32 times more likely to experience DIS delusions or hallucinations at follow-up, as compared to participants whose baseline occupation was classified into the category of executive, administrative and managerial occupations (95% CI: 1.08–10.14). Construction trade occupations (i.e. carpenters, painters, roofers, electricians, plumbers) were 2.58 times more likely to experience DIS delusions or hallucinations than managerial occupations (CI: 1.15–5.77).

**Table 1.** Estimated relative risks and 95% confidence intervals for occurrence of DIS/DSM-III schizophrenia criterion A (delusions and hallucinations), based on the multivariate logistic regression model with occupation categories from the Classified Index of Industries and Occupations of the US Bureau of the Census; data from the Epidemiologic Catchment Area probability samples in New Haven, Baltimore, St. Louis, Durham and Los Angeles, 1980–1984

| Suspected risk factors | Estimated relative Risk[a] | 95% Confidence interval | *P*-value |
|---|---|---|---|
| Occupations: | | | |
| Professionals[b] | 0.48 | 0.15– 1.46 | ns |
| Technicians | 0.87 | 0.32– 1.39 | ns |
| Sales | 0.96 | 0.44– 2.11 | ns |
| Administrative support & clerks | 1.00 | 0.54– 1.83 | ns |
| Private household | 1.76 | 0.63– 4.89 | ns |
| Protective service | 0.36 | 0.04– 3.05 | ns |
| Other service | 0.84 | 0.43– 1.64 | ns |
| Farming | 1.85 | 0.71– 4.85 | ns |
| Precision, craft & repairing[c] | 1.27 | 0.56– 2.83 | ns |
| Operators, assemblers & inspectors | 0.96 | 0.49– 1.87 | ns |
| Transportation | 0.74 | 0.23– 2.35 | ns |
| Handlers, cleaners helpers & laborers | 1.76 | 0.77– 4.02 | ns |
| Artists | 3.32 | 1.08–10.14 | 0.035 |
| Construction trades | 2.58 | 1.15– 5.77 | 0.022 |

[a] Controlling for socio-demographic, psychopathological, alcohol and marijuana use factors
[b] Does not include artists
[c] Does not include construction trades

Table 2 shows the relative risks and associated 95% CI's for occurrence of DIS/DSM-III schizophrenia, based on the multivariate model. Adjustment for covariates revealed that participants in private household occupations (i.e., housekeepers, launderers, cleaners and servants) were 4.13 times more likely to become schizophrenic at follow-up than were participants in managerial occupations, although 95% CI's included "1" (CI: 0.97–17.64).

The estimated relative risks and associated 95% CI's for occurrence of DIS psychotic affective syndrome are

**Table 2.** Estimated relative risks and 95% confidence intervals for occurrence of DIS/DSM-III schizophrenia, based on the multivariate logistic regression model with occupation categories from the Classified Index of Industries and Occupations of the US Bureau of the Census; data from the Epidemiologic Catchment Area probability samples in New Haven, Baltimore, St. Louis, Durham and Los Angeles, 1980–1984

| Suspected risk factors | Estimated relative risk[a] | 95% Confidence interval | *P*-value |
|---|---|---|---|
| Occupations: | | | |
| Professionals | 0.63 | 0.11– 3.44 | ns |
| Technicians | 1.28 | 0.14– 5.26 | ns |
| Sales | 1.18 | 0.28– 4.86 | ns |
| Administrative support & clerks | 0.29 | 0.07– 1.21 | ns |
| Private household | 4.13 | 0.97–17.64 | 0.056 |
| Protective service | 1.37 | 0.12–14.75 | ns |
| Other service | 0.44 | 0.12– 1.67 | ns |
| Farming | 0.95 | 0.09– 9.42 | ns |
| Precision, craft & repairing | 0.77 | 0.13– 3.58 | ns |
| Operators, assemblers & inspectors | 0.83 | 0.25– 2.70 | ns |
| Transportation | 0.87 | 0.09– 7.73 | ns |
| Handlers, cleaners helpers & laborers | 0.40 | 0.04– 3.54 | ns |

[a] Controlling for socio-demographic, psychopathological, alcohol and marijuana use factors

displayed in Table 3. After adjustment for significant covariates, including alcohol problems and gender, participants in mail and message distributing occupations (i.e., postal clerks, mail carriers and messengers) were still 20.90 times as likely to experience the psychotic affective syndrome as were managerial occupations (CI: 3.06–142.70). Teachers, librarians and counselors (including primary, secondary and postsecondary school teachers) were more than 11 times as likely to develop a psychotic affective syndrome than participants in managerial occupations (C.I.: 2.56–50.38). Finally, sales occupations were 4.16 times more likely to experience DIS psychotic affective syndrome at follow-up than participants in managerial occupations (CI: 1.00–21.30).

Relative risks and 95% associated CI's for the second model including Karasek et al.'s scales of job characteristics as measures of occupational stress are displayed in Table 4. Additional scoring units on the physical demands scale increased 1.39 times the risk of DIS delusions or hallucinations (CI: 1.05–1.72) and 1.89 times the risk of DIS/DSM III schizophrenia, although 95% CI's included "1" (CI: 0.91–3.91). Additional scoring units on the psychological demands scale decreased the risk of DIS/DSM III Schizophrenia (RR = 0.85; CI: 0.75–0.95). Additional scoring units on the control over work scale decreased the risk of the DIS psychotic affective syndrome (RR = 0.95; CI: 0.93–0.97).

Table 5 presents the results for the third model including the DOT factors as measures of occupational stress. Only results for DIS delusions or hallucinations are presented because DOT factors could not be retained in the models for DIS/DSM-III schizophrenia and DIS Psychotic Affective Syndrome since none of them made a significant contribution to the incidence of these psychotic conditions. Additional scoring units on the "noisome working conditions" factor (a 12 item factorial scale) increased 1.20 times the risk of DIS delusions or hallucinations (CI: 0.99–1.47), after adjustment for demographic and psychopathology variables. Thus, the relative risk for DIS delusions or hallucinations for a participant who had scored on all 12 items from the "noisome working conditions" scale, compared with someone who did not score on any "noisome working conditions" item, would be 1.20 to the 12th power or 8.92.

## Discussion

The epidemiological evidence derived from the present study indicates that several occupational stressors might place subjects at increased risk of developing specific psychotic disorders. Furthermore psychosocial work characteristics such as high physical demands and lack of control over work, and environmental working conditions such as noise, humidity and extreme temperatures place subjects at increased risk of occurrence of psychotic conditions. Results from the three models highlight the convergence among the occupational measures.

The finding of artists being at increased risk of DIS delusions and hallucinations echoes results from clinical studies on creativity and psychosis showing higher rates of

**Table 3.** Estimated relative risks and 95% confidence intervals for co-occurrence of DIS/DSM-III schizophrenia criterion A (delusions and hallucinations) and major depressive episode or manic episode, based on the multivariate logistic regression model with occupation categories from the Classified Index of Industries and Occupations of the US Bureau of the Census[a]; data from the Epidemiologic Catchment Area probability samples in New Haven, Baltimore, St. Louis, Durham and Los Angeles, 1980–1984

| Suspected risk factors | Estimated relative risk[b] | 95% Confidence interval | *P*-value |
|---|---|---|---|
| Occupations: | | | |
| Sales | 4.16 | 1.00– 21.30 | 0.049 |
| Administrative support & clerks[c] | 2.82 | 0.68– 11.60 | ns |
| Other service | 2.38 | 0.53– 2.13 | ns |
| Precision, craft & repairing | 1.28 | 0.40– 12.47 | ns |
| Operators, assemblers & inspectors | 2.13 | 0.44– 10.25 | ns |
| Transportation | 2.05 | 0.17– 23.80 | ns |
| Handlers, cleaners helpers & laborers | 5.58 | 0.85– 36.65 | ns |
| Teachers | 11.35 | 2.56– 50.38 | 0.001 |
| Mail & message distributing | 20.90 | 3.06–142.70 | 0.002 |

[a] Due to the low number of cases, some occupational categories (professionals except teachers, technicians, private household, protective service, farming, forestry and fishing) could not enter the model

[b] Controlling for socio-demographic, psychopathological, alcohol and marijuana use factors

[c] Does not include mail and message distributing occupations

**Table 4.** Estimated relative risks and 95% CI's for occurrence of three DIS-DSM-III psychotic disorders, based on the multivariate logistic regression model with Karasek et al.'s scales of job characteristics[a]; data from the ECA probability samples in New Haven, Baltimore, St Louis, Durham and Los Angeles, 1980–1984

| | DIS-DSM-III psychotic disorders | | |
|---|---|---|---|
| | Delusions and hallucinations ($n = 104$) | Schizophrenia ($n = 22$) | Psychotic-affective ($n = 24$) |
| Suspected Risk factors[b] | RR 95% C.I. *P*-value | RR 95% C.I. *P*-value | RR 95% C.I. *P*-value |
| Control over work | | | 0.05 0.93–0.97 0.007 |
| Psychological demands | | 0.85 0.75–0.95 0.009 | |
| Physical demands | 1.39 1.05–1.72 0.047 | 1.89 0.91–3.91 0.086 | |

[a] Controlling for sociodemographic, psychopathological, alcohol and marijuana use factors
[b] Karasek et al. scales

**Table 5.** Estimated relative risks and 95% CI's for occurrence of DIS-DSM-III schizophrenia criterion A (delusions and hallucinations)[a] based on the multivariate logistic regression model with DOT factors of job characteristics[b]; data from the ECA probability samples in New Haven, Baltimore, St Louis, Durham and Los Angeles, 1980–1984

| | | DIS-DSM-III Delusions or hallucinations ($n = 108$) | |
|---|---|---|---|
| Suspected Risk factor[c] | RR | 95% Confidence interval | *P*-value |
| "Noisome working conditions" | 1.20 | 0.99–1.47 | 0.062 |

[a] Results for DIS-DSM-III Schizophrenia and DIS Psychotic-Affective Syndrome are reported because no DOT factors could be retained in the model
[b] Controlling for sociodemographic, psychopathological, alcohol and marijuana use factors
[c] DOT Factor 3

affective disorders among artists (e.g. Andreasen 1987). Laboratory studies have found that creative persons and psychotic individuals perform similarly on attentional and cognitive processing tasks (Dykes and McGhie 1976; Andreasen and Powers 1974; Keefe and Magaro 1980). Self-selection into artistic occupations is a likely explanation for our findings because first year students of Arts and Letters Schools have been reported to have higher rates of psychotic-like experiences such as perceptual aberration and magical ideation (Muntaner et al. 1987). Statistical control for the effects of alcohol problems and daily marijuana use adds credibility to a self-selection interpretation. Alternative explanations could be the presence of socialization (e.g. socially reinforced to behave "creatively") or psychophysiological (e.g. sleep disturbances) factors.

Construction and extractive trades showed increased risk of DIS delusions and hallucinations, as are working under "noisome working conditions" and occupations with high physical demands. These results can be interpreted as a stronger replication of Link et al.'s (1986) study because we controlled for alcohol problems and daily marijuana use. They also point out that the relationship between "noisome working conditions" and their broadly defined schizophrenic cases might be due to the inclusion of acute non-affective psychotic disorders, characterized by positive symptomatology (APA 1980).

Although our original sample was large enough for estimating incidence rates of schizophrenia and psychotic-affective syndrome, the low number of cases in those categories forced occupational groupings into broader categories (census 13 occupational categories grouping). As a consequence, occupational categories increased in heterogeneity. Another limitation is that there were too few occurrences of the DIS psychotic affective syndrome for multivariate analysis of some occupational categories.

Occupations with high psychological demands placed participants at decreased risk for DIS-DSM-III schizophrenia which most likely reflect the avoidance of psychologically demanding jobs by future schizophrenic individuals. There is experimental evidence on the fact that schizophrenic individuals, schizotypal personalities and subjects judged to be at risk for schizophrenia respond to environmental demands with high levels psychophysiological activity, thus compromising their performance (Claridge 1985; Falloon, Boyd and McGill, 1984). The relationship between arousal and performance is particularly important at work (Sundstrom 1986), thus explaining why pre-schizophrenic individuals would avoid psychologically demanding occupations.

The occupational categories of sales, mail and message distributing and teachers, librarians and counselors showed increased risk for the DIS psychotic affective syndrome. Teachers and sales occupations have been found to be among the occupations with a higher prevalence of depression (Eaton et al. 1990), thus indicating that those occupations are associated with different forms of affective disorders.

Occupations with high control over work placed subjects at decreased risk of DIS psychotic affective syndrome. A "learned-helplessness" model (Lennerlof 1988), which emphasizes lack of control, could be a good model for explaining the relation between occupation and DIS psychotic affective syndrome. In addition, managerial occupations are characterized for the highest levels of control over work (Wright et al. 1982), and thus could explain the uniform and large relative risks for the occurrence of the DIS psychotic affective syndrome when used as reference group.

Finally, in our three models, the associations between occupational variables and psychotic conditions were after the addition of terms for baseline psychiatric

symptoms and disorders, as well as alcohol and marijuana use.

As stated in the introduction section, the retrospective study showing that psychotic disorders are associated with exposure to occupational stressors developed out of the literature on the role of social class in the onset of schizophrenia (Link et al. 1986). However, occupational titles and social class show a substantial but imperfect overlap (Wright et al. 1982). Therefore, it could be possible that what places subjects at increased risk of psychotic conditions is not the technical content of jobs (occupation), but the power and economic relations in which those technical activities are performed (Wright et al. 1982). Additional research is needed to replicate the present results, and to investigate the mechanisms relating social class to occupational stressors and the mechanisms relating occupational stressors to psychotic disorders in specific occupations.

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## References

Andreasen NC (1987) Creativity and mental illness: prevalence rates in writers and their first-degree relatives. Am J Psychiatry 144: 1288–1292

Andreasen NC, Powers PS (1974) Creativity and psychosis: a comparison of cognitive style. Arch Gen Psychiatry 32: 70–73

Anthony JC, Folstein M, Romanoski AR et al. (1985) Comparison of the lay diagnostic interview schedule and a standardized psychiatric diagnosis: experience in East Baltimore. Arch Gen Psychiatry 42: 667–675

American Psychiatric Association (1980) Diagnostic and statistical manual of mental disorders, 3rd edn. American Psychiatric Association Washington

American Psychiatric Association (1987) Diagnostic and statistical manual of mental disorders, 3rd ed. rev American Psychiatric Association Washington

Berkson J (1946) Limitations of the application of fourfold table analysis to hospital data. Biometrics Bull 2: 47–53

Brenner HM (1973) Mental illness and the Economy. Harvard University Press Cambridge Massachusetts

Breslow NE, Lubin JH, Marek P, Langholz B (1983) Multiplicative models and cohort analysis. J Am Stat Association 78: 1–12

Cain PS, Treiman DJ (1981) The dictionary of occupational titles as a source of occupational data. Am Sociol Review 46: 253–278

Claridge G (1985) The origins of mental illness. Basel Blackwell New York

Day R (1981) Life events and schizophrenia: the "triggering" hypothesis. Acta Psychiat Scand 64: 97–122

Dohrenwend BP (1990) Socioeconomic status (SES) and psychiatric disorders. Are the issues still compelling? Soc Psychiatry Psychiatr Epidemiol 25: 41–47

Dykes M, McGhie A (1976) A comparative study of attentional strategies of schizophrenic and highly creative normal subjects. Brit J Psychiatry 128: 50–56

Eaton WW, Kessler LG (1985) Epidemiologic field methods in psychiatry: the NIMH Epidemiological Catchment Area Program. Academic Press New York

Eaton WW, Day R, Kramer M (1988) The use of epidemiology for risk factor research in schizophrenia: an overview and methodological critique. In: Tsuang M, Simpson J (eds) Handbook of schizophrenia, vol 3: Nosology, epidemiology and genetics. Elsevier Amsterdam

Eaton WW, Anthony JC, Mandell W, Garrison R (1990) Occupations and the prevalence of DIS/DSM-III major depressive disorder. J Occup Med 32: 1079–1087

England P, Kilbourne B (1988) Occupational measures from the dictionary of occupational titles for 1980 census detailed occupations. Inter-University Consortium for Political and Social Research Ann Arbor

Falloon IRH, Boyd JL, McGill CW (1984) Family Care of Schizophrenia. Guilford Press New York

Gust SW, Walsh JM (1989) Drugs in the workplace: research and evaluation data. National Institute on Drug Abuse Research Monograph 91. National Institute on Drug Abuse Rockville

Johnsson JV (1990) Work organization, stress and occupational health: a social epidemiological perspective: In: Abrahamsson B et al. (eds) Perspectives on work and welfare. Sage London

Keefe JA, Magaro PA (1980) Creativity and schizophrenia: an equivalence of cognitive processing. J Abnor Psychology 89: 390–398

Karasek RA, Pieper C, Schwartz J, Fry L, Schier D (1985) Job content instrument questionnaire and user's guide. Columbia University Job/Heart Project New York

Karasek RA, Schwartz JE, Pieper C (1982) A job characteristics scoring system for occupational analysis, Part I. Center for the Social Sciences, Columbia University New York

Karasek RA, Theorell T (1990) Healthy work. Stress, productivity and the reconstruction of working life. Basic Books New York

Korff M von, Nestadt G, Romanoski A et al. (1985) Prevalence of treated and untreated DSM-III schizophrenia. Results of a two-stage community survey. J Nerv Ment Dis 173: 577–581

Lennerlof L (1988) Learned helplessness at work. Int J Health Services 18: 207–222

Liberatos P, Link BG, Kelsex JL (1988) The measurement of social class in epidemiology. Epidemiol Rev 10: 87–121

Link BG, Dohrenwend BP, Skodol AE (1986) Socio-economic status and schizophrenia: noisome occupational characteristics as a risk factor. Am J Sociol 51: 242–258

Muntaner C, Torrubia R, Perez G (1987) Predisposition towards schizotypal and borderline personality disorders in university students. Rev Dept Psiquiat 14: 187–192

Muntaner C, Eaton WW, Garrison R (submitted for publication) Dimensions of the psychosocial work environment

National Institute on Alcohol Abuse and Alcoholism (1982) Occupational alcoholism: a review of research issues. Research Monograph No 8. Superintendent of Documents, US Government Printing Office Washington

Navarro V (1990) Race or class versus race and class: mortality differentials in the U. S. Lancet 336: 1238–1240

Neugebauer R, Dohrenwend B, Dohrenwend B (1980) Formulations of hypotheses about the true prevalence of functional psychiatric disorders among adults in the United States. In: Dohren-

wend B, Dohrenwend B, Gould M, Link B, Neugebauer R, Wunsch-Hitzig R (eds) Mental illness in the United States: epidemiological estimates. Praeger, New York
Robins LN, Helzer JE, Croughan J, Ratcliff KA (1981) National Institute of Mental Health Diagnostic Interview Schedule: its history, characteristics, and validity. Arch Gen Psychiatry 38: 381–389
Schlesselman JJ (1982) Case-control studies: design, conduct and analysis. Oxford University Press New York
Schwartz JE, Pieper CF, Karasek RA (1988) A procedure for linking psychosocial data to health surveys. Am J Public Health 78: 904–909
Sundstrom E (1986) Work places: the psychology of the physical environment in offices and factories. Cambridge University Press New York
Tien AY, Eaton WW (in press) Sociodemographic risk factors and psychopathologic precursors for the schizophrenia syndrome. Arch Gen Psychiatry
US Burea of the Census (1980) Classified index of industries and occupations. US Department of Commerce Washington
US Department of Labor (1977) Dictionary of occupational titles. 4th edn. US Government Printing Office Washington
Wright EO, Hachen D, Costello C, Sprague J (1982) The American class structure. Am Sociol Rev 47: 709–726

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