ORIGINAL ARTICLE

Association of Mental Disorders in Early Adulthood and Later Psychiatric Hospital Admissions and Mortality in a Cohort Study of More Than 1 Million Men

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Context: Mental disorders have been associated with increased mortality, but the evidence is primarily based on hospital admissions for psychoses. The underlying mechanisms are unclear.

Objectives: To investigate whether the risks of death associated with mental disorders diagnosed in young men are similar to those associated with admission for these disorders and to examine the role of confounding or mediating factors.

Design: Prospective cohort study in which mental disorders were assessed by psychiatric interview during a medical examination on conscription for military service at a mean age of 18.3 years and data on psychiatric hospital admissions and mortality during a mean 22.6 years of follow-up were obtained from national registers.

Setting: Sweden.

Participants: A total of 1 095 338 men conscripted between 1969 and 1994.

Main Outcome Measure: All-cause mortality according to diagnoses of schizophrenia, other nonaffective psychoses, bipolar or depressive disorders, neurotic and adjustment disorders, personality disorders, and alcohol-related or other substance use disorders at conscription and on hospital admission.

Results: Diagnosis of mental disorder at conscription or on hospital admission was associated with increased mortality. Age-adjusted hazard ratios according to diagnoses at conscription ranged from 1.81 (95% CI, 1.54-2.10) (depressive disorders) to 5.55 (95% CI, 1.79-17.2) (bipolar disorders). The equivalent figures according to hospital diagnoses ranged from 5.46 (95% CI, 5.06-5.89) (neurotic and adjustment disorders) to 11.2 (95% CI, 10.4-12.0) (other substance use disorders) in men born from 1951 to 1958 and increased in men born later. Adjustment for early-life socioeconomic status, body mass index, and blood pressure had little effect on these associations, but they were partially attenuated by adjustment for smoking, alcohol intake, intelligence, educational level, and late-life socioeconomic status. These associations were not primarily due to deaths from suicide.

Conclusion: The increased risk of premature death associated with mental disorder is not confined to those whose illness is severe enough for hospitalization or those with psychotic or substance use disorders.

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People with severe mental illness, such as schizophrenia and other psychoses, and those with substance use disorders tend to have increased mortality.[1-5] These premature deaths are not primarily due to suicide or accidents, although risk of both is increased,[4] but to a range of natural causes, particularly cardiovascular disease.[2,3,6]

Most evidence on this association is based on individuals whose disorder was severe enough to require hospital admission.[3,7,8] A few studies[9] in community-based samples have found that diagnosed depression is linked with increased mortality, but less is known about the effects on mortality of clinically diagnosed neurotic or adjustment disorders, most cases of which do not need inpatient care. One such disorder—generalized anxiety disorder—may be an important cause of premature death.[10]

The reasons why mental disorder is associated with increased mortality from natural causes is uncertain. In some forms of mental illness, such as alcohol or other substance use disorders, the disease itself contributes directly to mortality risk. Psychosocial factors, such as lack of social support or socioeconomic disadvantage, may partially mediate the association.[8] However, the high prevalence of modifiable risk factors in people with severe mental ill-

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ness may also play a part. Smoking, diabetes mellitus, and obesity occur more frequently in these individuals than in the general population,[11,12] and hypertension too may be more common in this group, although a recent meta-analysis[11] suggests that this difference in prevalence is slight. In the few studies[6,8] that have examined whether smoking mediates or confounds the association between mental illness and mortality, the extent to which it explained the association varied greatly. Little is known about the part that obesity or hypertension might contribute to the mental illness–mortality association.

In this study, we used data on more than 1 million Swedish men who underwent psychiatric and medical assessment as part of military conscription examinations in early adulthood and were followed up for psychiatric hospital admission and mortality for approximately 22.6 years. Our first objective was to investigate whether the risks of death associated with the range of disorders diagnosed in young men are similar to those associated with hospital admission for these disorders. For this, we separately determined all-cause mortality according to a diagnosis of schizophrenia, other nonaffective psychotic disorders, bipolar disorders, depressive disorders, neurotic and adjustment disorders, personality disorders, alcohol-related disorders, or other substance use disorders in 2 groups of men: those whose conditions were diagnosed during the conscription examination and those whose conditions were diagnosed on hospital admission in the years after conscription. Our second objective was to examine the extent to which risk factors measured at conscription—blood pressure, body mass index (BMI), smoking, alcohol intake, and intelligence, together with socioeconomic status (SES) in childhood or later adult life—explained associations between diagnoses of mental disorder, either at conscription or on later hospital admission, and mortality.

METHODS

STUDY PARTICIPANTS AND RECORD LINKAGE OF REGISTERS

The record linkage methods used to generate this cohort study have been reported previously.[13,14] The cohort comprised all nonadopted men born in Sweden from 1950 to 1976 for whom both biological parents could be identified in the Multi-Generation Register. Using unique personal identification numbers, we linked the Multi-Generation Register with the Military Service Conscription Register, Population and Housing Censuses records (1960 and 1970), Cause of Death Register, and National Hospital Discharge Register. This approach resulted in 1 346 545 successful matches. Study approval was obtained from the Regional Ethics Committee, Stockholm, Sweden.

CONSCRIPTION EXAMINATION

The military service conscription examination involves a structured, standard medical assessment of physical and mental health and intelligence. During the years covered by this study, the law required this examination; only men of foreign citizenship or those with severe disability (including disability caused by mental illness) were excused. This data set covers examinations from September 15, 1969, through December 31, 1994, after which testing procedures used to assess intelligence changed. Mean age at examination was 18.3 years (range, 16-25 years).

Men underwent a medical examination during which blood pressure, height, and weight were measured using standard protocols. The BMI was calculated as weight in kilograms divided by height in meters squared. The examination included a structured interview by a psychologist. Men who reported or presented any psychiatric symptoms were assessed by a psychiatrist. Diagnoses were made according to the Nordic version of the *International Classification of Diseases (ICD), Eighth Revision* or *ICD-9*.

In early life, SES was based on the highest occupation of either parent from the 1960 and 1970 Population and Housing Censuses. The 1990 Census records were used to ascertain later-life SES. The SES was classified in 5 categories: nonmanual (high or intermediate), nonmanual (low), skilled, unskilled, and other. Highest educational level was based on 4 categories (<9 years of primary school, 9-10 years of primary school, full secondary school, and higher education).

Intelligence was measured by 4 subtests representing verbal, logical, spatial, and technical abilities.[15] All test scores, including a total score (IQ), were standardized at source to give a gaussian-distributed score between 1 and 9. Higher values indicate greater intellectual capacity.

For a subgroup of participants conscripted in 1969-1970 only (n=34 561), information was collected on smoking (>20, 11-20, 6-10, or 1-5 cigarettes per day or nonsmoker) and alcohol consumption. Alcohol consumption was assessed using responses to questions regarding frequency and mean consumption of alcohol measured in grams per week. Risky use of alcohol was defined as the presence of at least 1 of the following: (1) consumption of 250 g or more of 100% alcohol per week, (2) ever consumed alcohol during a hangover, (3) ever been apprehended for drunkenness, and (4) often been drunk (response options in the questionnaire were "often," "rather often," "sometimes," and "never").[16]

HOSPITAL ADMISSIONS

The Swedish National Hospital Discharge Register covers nearly all inpatient care for psychiatric disorders (including admissions to forensic psychiatric clinics) since 1973, with the exception of admissions in a few counties during some of the early years of data collection.[17] Admissions were coded according to the Nordic version of the *ICD-8*, *ICD-9*, or *ICD-10*. We extracted data on psychiatric admissions from 1968 to December 31, 2004.

We grouped diagnoses (primary and secondary) from the conscription examinations and hospital admissions into the following categories using the *ICD* codes listed in **Table 1**: schizophrenia, other nonaffective psychotic disorders (excluding alcohol or drug psychoses), bipolar disorders, depressive disorders, neurotic and adjustment disorders, personality disorders, alcohol-related disorders (including alcoholic psychoses), and other substance use disorders (including drug psychoses).

ANALYTICAL SAMPLE

Of 1 346 545 men whose records were matched, 1 095 338 had complete data on psychiatric diagnoses at the conscription examination and the covariates. We used these 1 095 338 men to examine the association between mental disorders at conscription and mortality. We then excluded 8081 men who had been admitted to a psychiatric hospital before conscription and used the remaining 1 087 257 men to examine the association between hospital admission for mental disorders after conscription and mortality.

STATISTICAL ANALYSIS

Having checked that the proportional hazards assumption was met, we used Cox proportional hazards models to examine all-cause mortality according to whether men had been diagnosed as having a mental disorder at conscription. Survival time in days was calculated from date of conscription to date of death, date of emigration, or December 31, 2004, whichever occurred first. In total, 90.1% of the participants were followed up to December 31, 2004. We adjusted for age at conscription, conscription testing center, and year of testing and then, in addition, for early-life SES, BMI, diastolic blood pressure, IQ, educational level, and later-life SES. We adjusted for diastolic blood pressure because it predicts mortality more strongly than systolic blood pressure in this cohort.[18] In the subset with data on smoking and alcohol intake, we examined the effect on the associations of adjustment for these factors.

To examine the risk of death according to diagnosis on hospital admission, we used Cox models in which diagnosis was treated as a time-varying covariate and adjusted for the covariates as listed. Because later-born men had a shorter follow-up time than those born earlier and were conscripted when hospitalization for mental disorders was less common,[5] we investigated whether associations between diagnoses on hospital admission and mortality varied according to year of birth. There was evidence that these associations were significantly stronger in men born later. We therefore conducted separate Cox models for hospital admissions and mortality according to whether men had been born in 1951-1958, 1959-1967, or 1968-1976. These models met proportional hazards assumptions. Associations between diagnoses at conscription and mortality did not vary by year of birth.

We estimated the effect on the hazard ratio of adjusting for a particular covariate using the following formula[19]:

$$([\text{Hazard Ratio}_{\text{adjusted for age}} - 1] - [\text{Hazard Ratio}_{\text{adjusted for age and covariate}} - 1]/[\text{Hazard Ratio}_{\text{adjusted for age}} - 1]) \times 100.$$

RESULTS

DIAGNOSES OF MENTAL DISORDERS DURING THE CONSCRIPTION EXAMINATION

In total, 61 677 (5.6%) of our sample of 1 095 338 men were diagnosed as having schizophrenia, other nonaffective psychotic disorders, bipolar disorders, depressive disorders, neurotic and adjustment disorders, personality disorders, alcohol-related disorders, or other substance use disorders during the conscription examination. During the follow-up period, 15 110 men died. **Table 2** lists the hazard ratios (95% CIs) for all-cause mortality according to whether men had received one of these diagnoses at conscription. (The proportion of men with severe mental disorder was small because individuals with very disabling illness before 18 years of age were excused from conscription.) In analyses adjusting for age at conscription, conscription testing center, and year of testing, men who had received a diagnosis of any of these disorders had a significantly higher risk of death than those who had not been diagnosed as having the disorder in question. Men diagnosed as having bipolar disorders, schizophrenia, or substance use disorders had the highest increase in risk (between 3.5 and 5.5 times those without these disorders), but risk was also nearly doubled in men with neurotic and adjustment disorders.

Table 1. Diagnostic Categories and Codes According to *ICD-8*, *ICD-9*, and *ICD-10*

Diagnostic Category	*ICD-8*	*ICD-9*	*ICD-10*
Schizophrenia	295	295	F20-21 F25
Other nonaffective psychoses	297.0-9 298.2-3 298.9	297 298.2-4 298.8-9	F22-24 F28-29
Bipolar disorders	296.1 296.3 298.1	296.0 296.2-5 298.1	F30-31
Depressive disorders	296.0 296.2 298.0 300.4	296.1 298.0 300.4 311	F32-34 F38-39
Neurotic and adjustment disorders	300.0-3 300.5-9 305 307	300.0-3 300.5-9 306 308-9	F40-48
Personality disorders	301	301	F60-69
Alcohol-related disorders	291 303	291 303 305.0	F10
Other substance use disorders	294.3 304	292 304 305.1-8	F11-F19

Abbreviation: *ICD*, *International Classification of Diseases*.

Further separate adjustment for early-life SES, BMI, or diastolic blood pressure at conscription had little attenuating effect on these associations. In general, adjustment for intelligence had the strongest attenuating effect, but the percentage reduction in the estimates was small (17%-30%). Adjustment for educational level and later-life SES had a small attenuating effect on most of the estimates but slightly strengthened that between other nonaffective psychoses and mortality. Even after adjusting for all covariates simultaneously, although some attenuation was seen, men diagnosed as having a mental disorder had a risk of death that was between 1.5 and 5.2 times that of men without such a diagnosis. In total, 0.9% of deaths in men diagnosed as having a mental disorder at conscription were due to suicide (definite or uncertain). Exclusion of these deaths markedly weakened the association between bipolar disorder and mortality, but other associations were little attenuated or even slightly strengthened.

We checked whether results given in Table 2 differed in men who were excluded from the sample because of incomplete data on the covariates; age-adjusted estimates differed little.

In the subset of this sample who were conscripted between 1969 and 1970 (n=34 561), we were able to examine the extent to which smoking and alcohol intake at conscription accounted for the link between mental disorder and mortality. During the follow-up period, there were 1297 deaths in this subgroup. There were too few cases of schizophrenia or bipolar disorder to permit analysis of these diagnoses, but, in general, smoking and drinking appeared to provide only a partial explanation for the links between other types of mental disorder and mortality (**Table 3**). Smoking habits accounted for 15% to 36% of the associations among the various types of mental disorders at that age and mortality. Risky alcohol in-

Table 2. HRs (95% CIs) for All-Cause Mortality According to Diagnosis of Mental Disorders at Conscription in 1 095 338 Men[a]

Diagnostic Category	No. (%) Diagnosed	HR (95% CI)							
		Age	Age and Early-Life SES	Age and BMI	Age and Diastolic Blood Pressure	Age and IQ	Age, Educational Level, and Later-Life SES	All Covariates	All Covariates and Excluding Deaths From Suicide
Schizophrenia	73 (<0.001)	3.78 (1.68-8.31)	3.73 (1.68-8.32)	3.75 (1.68-8.24)	3.70 (1.66-8.24)	2.99 (1.34-6.66)	2.71 (1.22-6.03)	2.52 (1.13-5.72)	2.69 (1.12-6.47)
Other nonaffective psychoses	12 366 (1.1)	1.98 (1.77-2.21)	1.98 (1.77-2.21)	1.83 (1.64-2.04)	1.95 (1.76-2.17)	1.81 (1.62-2.02)	1.75 (1.56-1.95)	1.62 (1.45-1.81)	1.69 (1.49-1.91)
Bipolar disorders	31 (<0.001)	5.55 (1.79-17.2)	5.78 (1.86-17.9)	5.52 (1.78-17.1)	5.55 (1.79-17.2)	4.88 (1.57-15.1)	5.55 (1.79-17.2)	5.19 (1.67-16.1)	2.29 (0.32-16.3)
Depressive disorders	9237 (0.9)	1.81 (1.54-2.10)	1.78 (1.53-2.08)	1.76 (1.51-2.06)	1.77 (1.52-2.07)	1.66 (1.42-1.95)	1.59 (1.36-1.86)	1.53 (1.31-1.79)	1.51 (1.26-1.81)
Neurotic and adjustment disorders	47 296 (4.3)	1.83 (1.73-1.93)	1.81 (1.71-1.91)	1.80 (1.71-1.91)	1.81 (1.71-1.91)	1.61 (1.52-1.71)	1.54 (1.45-1.62)	1.48 (1.40-1.57)	1.39 (1.49-1.59)
Personality disorders	8940 (0.8)	2.53 (2.31-2.78)	2.47 (2.25-2.70)	2.55 (2.33-2.80)	2.52 (2.30-2.76)	2.12 (1.93-2.32)	1.93 (1.76-2.12)	1.88 (1.72-2.06)	1.93 (1.74-2.14)
Alcohol-related disorders	2606 (0.2)	3.69 (3.21-4.24)	3.54 (3.08-4.07)	3.64 (3.16-4.18)	3.65 (3.17-4.20)	2.89 (2.51-3.32)	2.50 (2.17-2.87)	2.38 (2.07-2.74)	2.48 (2.13-2.90)
Other substance use disorders	9372 (0.9)	3.53 (3.23-3.86)	3.56 (3.22-3.95)	3.52 (3.17-3.90)	3.53 (3.19-3.91)	3.12 (2.82-3.46)	2.74 (2.47-3.04)	2.68 (2.41-2.97)	2.80 (2.49-3.15)

Abbreviations: BMI, body mass index; HR, hazard ratio; SES, socioeconomic status.
[a] All adjustments include conscription testing center and year of examination. The BMI, diastolic blood pressure, and IQ were measured at conscription. The reference group in each case consists of men who were not diagnosed as having the disorder in question.

Table 3. HRs (95% CIs) for All-Cause Mortality According to Diagnosis of Mental Disorders at Conscription: 34 561 Men Conscripted in 1969-1970 Only[a]

Diagnostic Category	No. (%) Diagnosed	HR (95% CI)		
		Age	Age and Smoking Habits	Age and Risky Alcohol Intake
Other nonaffective psychoses	500 (1.4)	1.59 (1.11-2.29)	1.50 (1.08-2.15)	1.55 (1.08-2.24)
Depressive disorders	381 (1.1)	1.46 (0.95-2.43)	1.31 (0.85-2.03)	1.35 (0.88-2.09)
Neurotic and adjustment disorders	2073 (6.0)	1.39 (1.14-1.70)	1.28 (1.05-1.56)	1.30 (1.06-1.58)
Personality disorders	934 (2.7)	2.35 (1.87-2.95)	2.04 (1.62-2.57)	1.97 (1.56-2.48)
Alcohol-related disorders	154 (0.4)	4.75 (3.22-7.01)	3.55 (2.44-5.28)	2.91 (1.95-4.34)
Other substance use disorders	207 (0.6)	3.04 (1.99-4.63)	2.30 (1.50-3.51)	2.17 (1.42-3.33)

Abbreviation: HR, hazard ratio.
[a] All adjustments include conscription testing center and year of examination. Smoking and risky alcohol intake were measured at conscription. The reference group in each case consists of men who were not diagnosed as having the disorder in question.[2] There were too few cases of schizophrenia (n = 10) or bipolar disorder (n = 1) for separate analysis.

take accounted for 6.8% to 49% of these associations. Unsurprisingly, the associations between substance use disorders and mortality were attenuated most strongly by adjustment for these factors. By contrast, neither of these behaviors appeared to account for more than a tiny proportion of the link between other nonaffective psychoses and mortality.

In total, 17 224 men (27.9%) with a diagnosis of mental disorder at the conscription examination were diagnosed as having more than 1 type of disorder at that time, and 11 310 (18.3%) were admitted to a psychiatric hospital during follow-up. To investigate whether the associations between each disorder at conscription and mortality were concentrated among those with comorbidity or with a subsequent history of hospitalization, we repeated our analyses excluding these men in turn. Effect sizes changed little when men with comorbidity were excluded and were only slightly attenuated when men with a subsequent history of hospitalization were excluded (data not shown).

In the sample as a whole, 8081 men (0.7%) had a history of inpatient psychiatric care before conscription. Only 19% of these men were given a diagnosis of mental disorder during the conscription examination, perhaps because they did not report or show the type of symptoms during the psychological assessment that led to referral for psychiatric examination. Underdiagnosis of mental disorder in these men at conscription might mean our results do not accurately reflect the effect of such diagnoses on mortality risk. We therefore repeated our analyses excluding all men who had been admitted to a psychiatric hospital before conscription. In the remaining sample of 1 087 257 men, effect sizes for the association between diagnoses of mental disorder at conscription and mortality were virtually the same as those obtained in the full sample (data not shown), with the sole exception of diagnoses for

schizophrenia for which effect sizes increased (the age-adjusted hazard ratio [95% CI] was 5.02 [2.25-11.2] compared with 3.78 [1.68-8.31] in the full sample).

DIAGNOSES OF MENTAL DISORDERS ON HOSPITAL ADMISSION DURING FOLLOW-UP

Of the 1 087 257 men in our sample of 1 095 338 who had no history of hospital admission for mental disorder at conscription, 60 333 (5.5%) had at least 1 admission during the follow-up period. Of these 60 333 men, 1807 (3.0%) emigrated after admission and were lost to follow-up at that point and 4879 died (8.1%). **Table 4** lists the hazard ratios (95% CIs) for all-cause mortality according to diagnoses during hospital admission and year of birth. The proportion of men admitted to a hospital with any diagnosis fell in successive birth cohorts. In general, the risk of death associated with hospital admission was higher in later-born cohorts; after adjustment for age, conscription testing center, and year of conscription, men born in 1951-1958 had a risk of death that was 5 to 11 times higher than their contemporaries who had not been admitted, whereas men born in 1968-1976 had a risk of death that was 7 to 29 times higher. Further separate adjustment for early-life SES, BMI, or diastolic blood pressure at conscription had little attenuating effect on these associations; adjustment for BMI slightly strengthened some associations. Adjustment for intelligence or for educational level and later-life SES tended to have a stronger attenuating effect, but after adjusting for all covariates simultaneously, hospital admission for mental disorder was associated with a markedly higher risk of death in all 3 birth cohort groups. The proportion of deaths by the end of follow-up in 2004 that were due to suicide (definite or uncertain) ranged from 20% in men born in 1951-1958 to 32% in men born in 1968-1976. Exclusion of these deaths attenuated most associations to some extent, particularly in the latter group, but risk of premature death remained high: men born in 1951-1958 had a risk of death that was 3 to 9 times higher than men who had not been admitted, whereas men born in 1968-1976 had a risk of death that was 4 to 17 times higher.

In the subset of this sample conscripted in 1969-1970, we examined the extent to which smoking or risky drinking at the time of conscription explained these associations (**Table 5**). The largest attenuating effect was seen in the case of admission for other substance use disorders for which adjustment for smoking habits and risky drinking attenuated the associations with mortality by 18% and 21%, respectively.

In total, 37.6% of men who were admitted to a hospital were diagnosed as having more than 1 disorder, either concurrently or sequentially. To explore whether the increased mortality associated with hospital admission was concentrated among this group, we repeated our analyses excluding men with comorbidity. Estimates were slightly lower after this exclusion (data not shown).

Among the 60 333 men admitted to a psychiatric hospital after conscription, 10 665 had also been diagnosed as having a mental disorder during the conscription examination. These men had higher mortality rates than those who were admitted to a psychiatric hospital during the follow-up period but were free of mental disorder at the time of conscription; compared with men who were not diagnosed as having a mental disorder, either at conscription or on hospital admission, the odds ratio for dying prematurely (adjusted for age, year of conscription, and conscription testing center) was 8.45 (95% CI, 8.13-8.79) in men admitted to the hospital but with no prior diagnosis and 12.4 (95% CI, 11.7-13.3) in men who had early-onset mental disorder and required hospital admission subsequently. By contrast, compared with men who were not diagnosed as having a mental disorder, either at conscription or on hospital admission, the odds of premature death in men who were diagnosed as having a mental disorder at conscription but never subsequently required inpatient care was 1.93 (95% CI, 1.81-2.07).

COMMENT

In this cohort of more than 1 million men, we examined the mortality risk of 2 groups with mental disorders: one comprising young adults diagnosed primarily as having milder forms of illness during a psychiatric examination at conscription and one made up of men whose illness was severe enough to require hospital admission during follow-up. Those who were diagnosed as having a mental disorder at conscription had a risk of death that was approximately 2 to 5 times higher than those who were not diagnosed as having a mental disorder. This increase in risk was not primarily due to death from suicide and not confined to those with psychotic or substance use disorders; men with a neurotic or adjustment disorder (the most common diagnosis in this group) were nearly twice as likely to die as those without these disorders. In the group of men who were diagnosed as having a mental disorder on admission to a hospital after conscription, risk of death was even higher, particularly in those born later. Suicide increased among Swedish male psychiatric patients during the latter part of our follow-up period.[5] Consistent with this, exclusion of suicide deaths had the strongest attenuating effect on our estimates for the association between mental disorders on hospital admission and mortality among the latest born men, but risk of death remained high. In the sample as a whole, risk of death was highest in men who were diagnosed as having a mental disorder in young adulthood and later admitted to a psychiatric hospital. In regard to explanatory factors, BMI or blood pressure measured at the time of conscription or early-life SES played little or no part in these associations. Smoking habits and risky alcohol intake at conscription accounted for some of the increased risk of death associated with having a substance use disorder at this time, but, in general, these behaviors appeared to play only a minor part. Adjustment for intelligence at conscription, educational level, and later-life SES tended to have the strongest attenuating effect on the mental disorders–mortality associations.

Most previous studies on the link between mental disorder and mortality have been based on individuals who required hospitalization[3,7,8] or other specialist psychiatric care.[20] Consistent with these studies, we found that men admitted to a hospital had a markedly higher likelihood of dying prematurely. Evidence on the association

Table 4. HRs (95% CIs) for All-Cause Mortality According to Diagnosis of Mental Disorders on Hospital Admission After Conscription and Year of Birth in 1 087 257 Men[a]

Diagnostic Category and Year of Birth[b]	No. (%) Diagnosed[c]	HR (95% CI)							
		Age	Age and Early-Life SES	Age and BMI	Age and Diastolic Blood Pressure	Age and IQ	Age, Educational Level, and Later-Life SES	All Covariates	All Covariates and Excluding Deaths From Suicide
Schizophrenia									
1951-1958 (n=368 334)	2745 (0.7)	5.84 (5.21-6.55)	5.85 (5.22-6.56)	5.97 (5.32-6.69)	5.78 (5.16-6.48)	5.03 (4.48-5.64)	4.09 (3.64-4.59)	4.00 (3.55-4.49)	2.98 (2.56-3.45)
1959-1967 (n=338 317)	2006 (0.6)	10.4 (8.91-12.0)	10.4 (8.93-12.1)	10.6 (9.10-12.4)	10.2 (8.83-12.0)	8.85 (7.59-10.3)	7.69 (6.58-8.98)	7.51 (6.43-8.78)	4.17 (3.25-5.25)
1968-1976 (n=380 606)	1024 (0.3)	20.7 (16.3-26.3)	20.6 (16.2-26.1)	21.0 (16.5-26.6)	20.8 (16.3-26.3)	17.9 (14.1-22.8)	14.5 (11.4-18.4)	14.8 (11.6-18.8)	5.05 (3.08-8.28)
Other nonaffective psychoses									
1951-1958 (n=368 334)	2627 (0.7)	7.67 (6.86-8.56)	7.65 (6.85-8.55)	7.75 (6.93-8.65)	7.62 (6.82-8.51)	6.75 (6.04-7.54)	6.00 (5.36-6.69)	5.83 (5.22-6.52)	4.30 (3.73-4.97)
1959-1967 (n=338 317)	2276 (0.7)	11.7 (10.1-13.5)	11.8 (10.2-13.6)	11.8 (10.2-13.7)	11.6 (10.0-13.4)	10.2 (8.82-11.8)	9.40 (8.13-10.9)	9.14 (7.89-10.6)	5.25 (4.18-6.60)
1968-1976 (n=380 606)	1423 (0.4)	17.4 (13.9-21.9)	17.3 (13.8-21.8)	17.6 (14.0-22.1)	17.4 (13.9-21.9)	15.2 (12.1-19.1)	13.3 (10.6-16.7)	13.6 (10.8-17.1)	6.07 (4.01-9.18)
Bipolar disorders									
1951-1958 (n=368 334)	1229 (0.3)	6.14 (5.08-7.41)	6.18 (5.11-7.46)	6.14 (5.09-7.42)	6.13 (5.07-7.40)	5.73 (4.74-6.93)	5.54 (4.86-6.69)	5.41 (4.48-6.54)	3.41 (2.62-4.45)
1959-1967 (n=338 317)	854 (0.2)	10.5 (8.03-13.6)	10.5 (8.06-13.7)	10.5 (8.08-13.7)	10.4 (7.98-13.5)	10.1 (7.74-13.1)	9.47 (7.27-12.3)	9.34 (7.17-12.2)	4.21 (2.61-6.79)
1968-1976 (n=380 606)	444 (0.1)	8.77 (4.85-15.9)	8.80 (4.86-15.9)	8.76 (4.84-15.8)	8.77 (4.85-15.9)	8.38 (4.63-15.2)	8.18 (4.52-14.8)	8.23 (4.55-14.9)	4.44 (1.66-11.9)
Depressive disorders									
1951-1958 (n=368 334)	7336 (2.0)	6.55 (6.05. 7.09)	6.46 (5.97-6.99)	6.61 (6.11-7.16)	6.54 (6.04-7.08)	5.92 (5.47-6.41)	5.45 (5.03-5.90)	5.37 (4.96-5.82)	3.56 (3.20-3.95)
1959-1967 (n=338 317)	4325 (1.3)	10.7 (9.36-12.1)	10.5 (9.24-12.0)	10.8 (9.48-12.3)	10.6 (9.34,12.1)	9.48 (8.32-10.8)	8.84 (7.76-10.1)	8.72 (6-9.95)	3.83 (3.05-4.81)
1968-1976 (n=380 606)	2620 (0.7)	17.4 (14.2-21.3)	17.3 (14.2-21.9)	17.5 (14.3-21.5)	17.4 (14.2-21.3)	15.7 (12.9-19.3)	13.4 (11.0-16.4)	13.6 (11.1-16.6)	5.75 (4.00-8.33)
Neurotic and adjustment disorders									
1951-1958 (n=368 334)	8697 (2.4)	5.46 (5.06-5.89)	5.36 (4.96-5.78)	5.51 (5.11-5.95)	5.44 (5.04-5.87)	4.85 (4.50-5.24)	4.41 (4.09-4.76)	4.35 (4.03-4.70)	3.28 (2.98-3.62)
1959-1967 (n=338 317)	5945 (1.8)	8.31 (7.39-9.34)	8.19 (7.29-9.20)	8.39 (7.46-9.43)	8.27 (7.36-9.29)	7.23 (6.43-8.13)	6.70 (5.95-7.53)	6.58 (5.85-7.40)	4.24 (3.57-5.04)
1968-1976 (n=380 606)	3448 (0.9)	6.58 (6.21-6.96)	10.6 (8.73-13.0)	10.8 (8.83-13.1)	10.7 (8.82-13.1)	9.26 (7.59-11.3)	7.59 (6.22-9.25)	7.74 (6.34-9.44)	4.81 (3.56-6.50)
Personality disorders									
1951-1958 (n=368 334)	3312 (0.9)	6.89 (6.25-7.60)	6.75 (6.11-7.44)	7.01 (6.36-7.74)	6.87 (6.22-7.58)	5.87 (5.31-6.48)	5.00 (4.53-5.53)	4.91 (4.44-5.42)	3.90 (3.44-4.41)
1959-1967 (n=338 317)	2259 (0.7)	12.2 (10.7-14.0)	12.1 (10.5-13.8)	12.5 (10.8-14.3)	12.1 (10.6-13.9)	10.1 (8.80-11.6)	8.77 (7.63-10.1)	8.58 (7.46-9.88)	5.10 (4.11-6.33)
1968-1976 (n=380 606)	1194 (0.3)	12.7 (9.63-16.6)	12.5 (9.49-16.4)	12.7 (9.70-16.8)	12.7 (9.63-16.6)	10.8 (8.20-14.2)	7.91 (6.01-10.4)	8.00 (6.08-10.5)	4.79 (3.10-7.38)
Alcohol-related disorders									
1951-1958 (n=368 334)	15 478 (4.2)	11.7 (11.1-12.3)	11.5 (10.9-12.1)	11.8 (11.2-12.4)	11.7 (11.1-12.2)	10.6 (10.1-11.2)	9.23 (8.82-9.79)	9.32 (8.84-9.82)	9.01 (8.55-9.61)
1959-1967 (n=338 317)	7901 (2.3)	13.7 (12.6-15.0)	13.5 (12.4-14.7)	13.9 (12.7-15.1)	13.7 (12.5-14.9)	11.8 (10.7-12.9)	10.4 (9.46-11.4)	10.3 (9.36-11.3)	9.51 (8.49-10.7)
1968-1976 (n=380 606)	4515 (1.2)	10.9 (9.21-12.8)	10.7 (9.07-12.6)	10.9 (9.22-12.8)	10.9 (9.21-12.8)	9.28 (7.86-11.0)	7.52 (6.36-8.89)	7.71 (6.52-9.10)	6.48 (5.20-8.08)
Other substance use disorders									
1951-1958 (n=368 334)	5740 (1.6)	11.2 (10.4-12.0)	11.0 (10.3-11.8)	11.4 (10.6-12.2)	11.2 (10.4-12.0)	9.88 (9.21-10.6)	8.13 (7.57-8.74)	8.12 (7.56-8.73)	7.66 (7.05-8.33)
1959-1967 (n=338 317)	4386 (1.3)	19.0 (17.3-20.9)	18.7 (17.0-20.6)	19.2 (17.5-21.2)	18.9 (17.2-20.8)	16.1 (14.6-17.7)	13.6 (12.3-15.1)	13.5 (12.2-14.9)	13.1 (11.5-14.8)
1968-1976 (n=380 606)	2774 (0.7)	29.0 (25.0-33.6)	28.5 (24.6-33.0)	29.0 (25.1-33.7)	29.0 (25.0-33.6)	23.7 (20.4-27.6)	16.3 (14.0-18.9)	16.8 (14.4-19.5)	17.2 (14.3-20.7)

Abbreviations: BMI, body mass index; HR, hazard ratio; SES, socioeconomic status.

[a] All adjustments include conscription testing center and year of examination. The BMI, diastolic blood pressure, and IQ were measured at conscription. The reference group in each case consists of men who were not diagnosed as having the disorder in question.

[b] The number of deaths and number of men in each birth cohort group are as follows: 1951-1958: 8420 deaths in 368 334 men; 1959-1967: 3824 deaths in 338 317 men; and 1968-1976: 2587 deaths in 380 606 men.

[c] Percentages of men diagnosed as having a disorder on admittance in individual birth cohorts.

Table 5. HRs (95% CIs) for All-Cause Mortality According to Diagnosis of Mental Disorders on Hospital Admission After Conscription: 33 677 Men Conscripted in 1969-1970 Only[a]

Diagnostic Category	No. (%) Diagnosed	HR (95% CI)		
		Age	Age and Smoking Habits	Age and Risky Alcohol Intake
Schizophrenia	272 (0.01)	5.56 (4.09-7.56)	5.57 (4.09-7.58)	5.28 (3.88-7.18)
Other nonaffective psychoses	239 (0.01)	7.86 (5.77-10.7)	7.54 (5.54-10.3)	7.39 (5.43-10.1)
Depressive disorders	798 (2.4)	5.10 (4.10-6.35)	4.64 (3.73-5.79)	4.66 (3.73-5.78)
Bipolar disorders	129 (0.04)	4.26 (2.41-7.53)	4.37 (2.48-7.74)	3.98 (2.25-7.04)
Neurotic and adjustment disorders	858 (2.5)	4.39 (3.53-5.45)	4.07 (3.27-5.05)	4.02 (3.23-5.00)
Personality disorders	357 (1.1)	5.36 (4.08-7.04)	4.74 (3.60-6.23)	4.49 (3.40-5.92)
Alcohol-related disorders	1776 (5.3)	10.1 (8.90-11.5)	9.04 (7.91-10.3)	9.30 (8.11-10.7)
Other substance use disorders	505 (1.5)	10.1 (8.22-12.4)	8.47 (6.87-10.4)	8.22 (6.65-10.2)

Abbreviation: HR, hazard ratio.
[a] All adjustments include conscription testing center and year of examination. Smoking and risky alcohol intake were measured at conscription. The reference group in each case consists of men who were not diagnosed as having the disorder in question.

between mental disorder diagnosed during surveys of nonpsychiatric samples and mortality is still relatively sparse and largely confined to studies of depression.[9] Our finding that a clinical diagnosis of a neurotic and adjustment disorder or a personality disorder during a screening examination in early adulthood was associated with an approximately 2-fold risk of death, even in those with no evidence of comorbid mental illness, suggests that the mortality risk associated with mental disorder is not limited to those whose disease is severe enough to require inpatient care.

The mechanisms underlying the link between mental disorders and all-cause mortality remain unclear. The fact that in the present study risk of death was markedly higher in the hospitalized group, especially in those who were diagnosed as having a mental disorder at conscription and subsequently hospitalized, suggests that severity of illness and perhaps length of exposure to severe illness play some part in the association. Consistent with this finding, educational attainment and later-life SES appeared to have a stronger mediating role in the association between mental disorder and mortality among men whose conditions were diagnosed on hospital admission than among those whose conditions were diagnosed during the conscription examination. Deprivation and poor living conditions are risk factors for physical illness and tend to occur more commonly in people with severe mental disorder. The presence of severe mental illness may affect educational attainment and achieved SES, but there is also evidence that lower SES directly, and indirectly through adverse economic circumstances, increases risk of mental disorder.[21]

Lower intelligence in early life has been linked with an increased risk of developing mental disorders[22-24] and of premature death.[19,25] Herein, IQ accounted for 17% to 30% of the associations between mental disorders at conscription and mortality. IQ accounted for a smaller percentage of the associations between later hospital admissions and mortality, where educational level and later-life SES tended to play a much larger role, but it may have an indirect part in the associations via its influence on educational attainment and achieved SES.[26,27]

Other possible explanations for the associations between mental disorder and all-cause mortality are lifestyle factors and other risk factors, such as obesity and hypertension.[8,28] Risky alcohol intake at conscription accounted for nearly 50% of the association between alcohol-related or other substance use disorders at this age and mortality, but it seemed to play little part in associations between other types of disorder and mortality. It also explained very little of the link between hospital admission for substance use disorders and mortality. Smoking habits appeared to explain 15% to 36% of the associations between mental disorders diagnosed at conscription and mortality, consistent with earlier observations,[8] but very little of the associations between hospital admission for mental disorders and mortality. It is possible that for many men self-reports of smoking and drinking behavior at conscription provided only a partial reflection of how much they smoked or drank at the time of hospital admission or indeed at conscription. There is evidence that low levels of physical activity and poorer dietary quality may be more common in people with more severe forms of mental illness,[8,28-30] but we were unable to examine the role of these lifestyle factors. Little is known about the possible role that BMI and blood pressure may play in the associations between mental disorder and mortality, and evidence that these factors are linked with mental disorder is inconsistent.[8,11,12,28] Herein, we found little indication that either factor played a part in the links between mental disorders and all-cause mortality.

Other potentially important explanations for the associations that we were unable to examine in the present study are chronic physical illness, access to physical health care, and psychotropic medication. The prevalence of a range of physical illnesses tends to be higher in people with mental disorder[31]; much of this may go undetected, particularly in those with more severe illness, due to poorer assessment and care of physical illness.[31-34] Antipsychotic medications may contribute to mortality risk through their influence on cardiometabolic risk factors.[31,35]

The strengths of this study are its size and the availability of data on diagnoses made during the conscription examination, which enabled us to examine the effect of a clinical diagnosis of different types of mental

disorder on mortality in a nonpsychiatric sample. A further strength is the availability of information on BMI, blood pressure, smoking habits, and alcohol intake at conscription, which allowed us to explore the extent to which these factors explained associations between mental disorder and mortality. Our study also has some weaknesses. The first limitation is that our study is based on men only. The extent to which these findings can be extrapolated to women is uncertain. Several studies[2,3,5-7] have shown that psychiatric patients of both sexes have higher mortality rates than the general population, although these risks are usually, but not always,[6] greater in men than in women. Whether this apparent sex difference reflects differential use of medical care or variations in health behaviors is unclear. Second, although we had data on some behavioral and physiological risk factors at conscription, we had no information on other potentially important mediating factors, such as physical activity or diet.[36] Third, we had no data on risk factors measured at the time of first hospital admission for psychiatric care, other than clinical diagnosis. Because some men were first admitted up to 22 years after conscription, the measurements made at conscription may not always be an accurate reflection of these characteristics at the time of hospital admission. Fourth, it is possible that the extent of mental disorder at the time of conscription was underestimated because referral for psychiatric assessment depended on whether men showed signs or reported symptoms suggestive of mental health problems during the psychological examination; furthermore, men with severely disabling illness were excused from conscription, and our sample excluded men who were adopted or whose records could not be linked to both biological parents. Our findings may therefore underestimate the true strength of the association between mental disorders in the general population of young men and mortality risk. On the other hand, malingering may have led some men to report symptoms falsely in the hope of being excused from military service. Fifth, inpatient psychiatric care in Sweden, as elsewhere, has become increasingly less common.[5] The men in our study who were identified as having mental disorders on the basis of hospital admission, particularly in later-birth cohorts, are therefore likely to be those with more severe illness. Finally, it is worth noting that although the earliest-born men in our sample were 55 years old by the end of follow-up, the latest-born men were at most 36 years old, so their follow-up time was shorter and main causes of death may differ. This, coupled with possible differences between birth cohorts in severity of illness in hospitalized cases, may help explain why mortality associated with hospital admission was greater in later-born men.

Our findings demonstrate that the increased risk of premature death associated with mental disorder is not confined to those with psychotic or substance use disorders or to those whose illness is severe enough to need inpatient care. Neurotic and adjustment disorders, personality disorders, depressive or bipolar disorders, substance use disorders, schizophrenia, and other nonaffective psychotic disorders were associated with an increased risk of dying prematurely, even in men who received such a diagnosis during screening for conscription. Smoking, alcohol intake, intelligence, and indicators of SES in later life may partially mediate the associations between some mental disorders and mortality, although BMI and blood pressure appeared to play little part. If this huge burden of premature mortality is to be reduced, the physical health care of people with mental illness needs to be a greater priority for medical care professionals.

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