



Quality of medical care and excess mortality in psychiatric patients – a nationwide register-based study in Sweden

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3 **Quality of medical care and excess mortality in psychiatric patients**
4 **– a nationwide register-based study in Sweden**
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ARTICLE SUMMARY

Article focus:

- To investigate whether psychiatric patients have higher overall and cause-specific mortality
- To study whether the quality of somatic care for psychiatric patients is different from the care provided to patients with no concurrent mental disorder.

Key messages:

- This study shows a marked increase in excess mortality in mentally ill men and women.
- The findings suggest a lower quality of health care in the treatment of somatic disorders in psychiatric patients regarding the indicators studied.
- Careful medical examination of psychiatric patients together with efforts to promote a healthier life style may be of great importance in order to prevent, detect, and treat somatic disease.

Strengths and limitations:

- The strengths of the study include the population-based design, using national registers with high completeness
- We were unable to study the effects of health-related behaviors such as excessive alcohol consumption or tobacco smoking, which is a limitation.

ABSTRACT

Objective: To assess overall and cause-specific mortality, and the quality of somatic care among psychiatric patients.

Design: A register-based cohort study

Setting: All individuals aged 20-79 in Sweden in 2005.

Participants: In total 6 294 339 individuals.

Primary outcome measure: The individuals were followed for mortality in 2006 and 2007, generating 72 187 deaths. Psychiatric patients were grouped according to their diagnosis in the National Patient Register. Mortality risk of psychiatric patients was compared to that of non-psychiatric patients. Estimates of relative risk of mortality were calculated as incidence rate ratios (IRRs) with 95% confidence intervals (CIs) using Poisson regression analysis. Psychiatric patients were compared with non-psychiatric patients for three health care quality indicators: the proportion of avoidable hospitalisations, case fatality rate after myocardial infarction, and statin use among diabetic patients.

Results: Compared to individuals with no episodes of treatment for mental disorder, psychiatric patients had a substantially increased risk of all studied death-causes as well as death from conditions considered amenable to intervention by the health service, i.e. avoidable mortality. The highest mortality was found among those with another mental disorder, predominantly substance abuse (for women, an IRR of 4.7 (95% CI 4.3 to 5.0), and for men an IRR of 4.8 (95% CI 4.6 to 5.0)).

The analysis of quality of somatic care revealed lower levels of health care quality for psychiatric patients, signalling failures in public health and medical care.

Conclusion: This study shows a marked increase in excess mortality, suggesting a lower quality of somatic health care in psychiatric patients.

INTRODUCTION

Psychiatric patients have been reported to have higher mortality rates and shorter life expectancy compared to the general population.¹⁻⁶ This applies especially to patients with severe psychiatric diseases, such as schizophrenia⁷⁻¹⁰ and bipolar disorder.^{11,12} The highest risks have been found among patients with substance abuse.^{3,5,13,14}

Psychiatric patients have a particularly pronounced risk of suicide.¹⁵⁻¹⁸ Cardiovascular disease is also a major cause of excess deaths, partly due to a higher prevalence of smoking, obesity and hypertension.¹⁹⁻²¹ There are conflicting data on cancer incidence and mortality in psychiatric patients, although most studies suggest that while cancer mortality is higher, incidence is no different from that of the general population.^{22,23} Other potential explanations for the excess mortality are differences in access, provision and quality of somatic health care.²⁴ For instance, it has been shown that people with a diagnosis of a mental disorder have less access to primary health care.²⁵ Lower quality of diabetes care²⁶ and cardiovascular procedures^{19,27} have also been documented. In Sweden, different indicators are often used as measures reflecting health care quality.²⁸

The concept of avoidable mortality was introduced in 1976 as an indicator of quality of health care.²⁹ Avoidable mortality measures deaths that could be argued to have been avoidable either by the health care system or by public health interventions, and has been applied in comparisons between regions, populations and over time. Psychiatric patients have been shown to have higher avoidable mortality rates than the general population,^{13,30} and questions have been raised as to whether the medical care of physical disorders provided to psychiatric patients is less adequate than for the population in general.³¹

The aim of this study was to investigate whether psychiatric patients have higher overall and cause-specific mortality, and whether the quality of somatic care for psychiatric patients is different from the care provided to patients with no concurrent mental disorder.

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Results are reported with regard to age, sex, mental disorder, and comorbid substance abuse disorders.

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METHOD

Study population

The study population comprised individuals alive and registered in Sweden in 2004 and 2005, aged 20-79 i.e. those born between 1926 and 1985. After excluding individuals diagnosed with mental retardation (as defined by the International Classification of Diseases, tenth revision (ICD-10): F70-F79) the study population comprised 6 294 339 individuals. The cohort was followed from January 1, 2006 until December 31, 2007. We used the unique personal identity number assigned to each Swedish citizen or permanent resident to link information from four population-based registers.³²

Types of mental disorder

We identified all individuals recorded with a principal psychiatric diagnostic code as defined by the ICD-10 F04-F99 (i.e. dementia excluded, besides mental retardation) in inpatient care or specialised outpatient care in 2004 or 2005 in the National Patient Register. The National Patient Register covers all inpatient care in Sweden since 1987 (psychiatric inpatient care since 1973) and all specialised outpatient care since 2001. If a patient had more than one discharge or outpatient visit, the principal diagnoses from all discharges and outpatient visits were kept to further categorise patients. Five mutually exclusive exposure groups were created according to a hierarchy of diagnoses: *i*) schizophrenia and other non-affective psychoses (diagnosis codes F20-F29), *ii*) affective disorder (F30-F39), *iii*) anxiety disorder (F40-F48), *iv*) other psychiatric diagnoses, (F04-F99 except for diagnoses above), *v*) persons without inpatient and outpatient care due to mental disorder served as the reference group.

Psychiatric in- or outpatient care due to substance abuse disorder was also studied in a sub-analysis and was divided into categories according to whether the substance abuse was attributed to alcohol (F10), narcotic-related drugs (F11-F19), or both.

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3 As certain mental disorders, e.g. bipolar disorder and schizophrenia are highly comorbid with
4 alcohol and other substance abuse,³³ schizophrenia/other non-affective psychoses, affective or
5 anxiety disorder were analysed with and without a coexisting substance abuse disorder
6 (attributed to either alcohol or narcotics-related drugs). In these analyses, persons without
7 inpatient and outpatient care due to mental disorder served as the reference group.
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14 **Causes of death**

16 The underlying cause of death, coded according to the ICD-10, was obtained from the Causes
17 of Death Register. This register contains information on all deceased Swedish residents since
18 1952 and has a very high coverage. Since 1997 all deceased have been included, though for
19 0.5% there is a lack of medical information.
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22 Causes of death were grouped as follows: ischemic heart disease (IHD) (diagnosis codes I20-
23 I25), cancer (C00-C97), suicide and death with undetermined intent (X60-X84 and Y10-Y34),
24 and external causes of death (suicide excluded) (V01-Y89 (except for X60-X84, Y10-Y34)).
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26 The indicators of avoidable mortality were divided into causes of death reflecting the outcome
27 of medical care, and causes reflecting the effect of the national health policy. The following
28 diseases were included as medical care indicators: typhoid (A01.0), tetanus (A35),
29 tuberculosis (A15-A19 and B90), malignant neoplasm of cervix uteri (C53), Hodgkin's
30 disease (C81), diabetes (E10-E14), chronic rheumatic heart disease (I05-I09), hypertensive
31 disease (I10-I15), stroke (I60-I69), asthma (J45-J46), appendicitis (K35-K38), abdominal
32 hernia (K40-K45), cholelithiasis and cholecystitis (K80-K81 and K83.0), maternal deaths
33 (O00-O99), and osteomyelitis (M86-M87). Malignant neoplasms of the oesophagus (C15),
34 malignant neoplasms of the trachea, bronchus or lung (C34), cirrhosis of the liver (K70 and
35 K73-K74), and motor vehicle accidents (V00-V99) were included as national health policy
36 indicators.
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56 **Health care quality indicators**

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3 In analyses of indicators presumably reflecting aspects of health care quality, the age-span
4 was restricted to individuals aged 40-79, because the studied outcomes are rare in younger
5 individuals. The indicator regarding avoidable hospitalisation is based on the assumption that
6 unnecessary hospitalisation can be avoided if patients with selected conditions receive proper
7 outpatient care. This indicator includes hospitalisations for some chronic conditions (anaemia,
8 asthma, diabetic complications, heart failure, hypertension, chronic obstructive lung disease,
9 and angina pectoris), and hospitalisations for some acute conditions (bleeding ulcers,
10 diarrhoea, epileptic seizures, inflammatory diseases of the female pelvic organs, pyelitis, and
11 ear, nose and throat infection). The indicator regarding 28-day case fatality rate after
12 myocardial infarction is an internationally established indicator of how well the health care
13 system handles acute care after myocardial infarction. As a third indicator, the proportion on
14 treatment with lipid lowering drugs was measured among patients receiving diabetes drugs.
15 This treatment ought to be especially important for diabetes patients, due to the many risk
16 factors in this population. All three indicators have been described elsewhere.²⁸
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34 **Statistical analysis**

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36 Poisson regression analyses, adjusted for age, were used to evaluate the association between
37 mental disorder, mortality, and indicators of quality of health care. As a measure of the
38 relative occurrence of death we used the incidence rate ratio (IRR). We assessed person-years
39 at risk by adding up the years the individuals were alive and living in Sweden during the
40 follow-up period. SAS Genmod procedure was used to calculate IRRs with 95% confidence
41 intervals (CI). SAS Enterprise Guide 4.2 (SAS Institute Inc. Cary, NC, USA) was used. Age-
42 standardised percentages were calculated when analysing differences regarding health care
43 quality.
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RESULTS

Cohort characteristics for the 6 294 339 individuals, (3 141 454 women and 3 152 885 men) are presented in table 1. In total, 101 500 women and 90 946 men were treated for mental disorder in 2004 or 2005. About 11% of mentally ill women had a diagnosis of schizophrenia and other non-affective psychoses, 37% affective disorders, 32% anxiety disorder, and 20% other psychiatric diagnoses, and for men 13%, 26%, 23%, and 37% respectively. Almost three quarters of the men (73%) included in the group for other mental disorders were treated for substance abuse.

Among all psychiatric patients, 5 498 (2.9% in all, 2% in women, and 4% in men respectively) died during the follow-up period, compared to 66 689 (1.1% in all, 0.9% in women, and 1.3% in men) among persons without episodes of treatment for mental disorder.

The IRRs for different causes of death and by mental disorder for both sexes are shown in table 2. When compared to the general population, mortality was considerably higher among all categories of mental disorder and for all causes of death. The highest excess mortality was found among individuals in the category comprised of having another mental disorder, predominantly substance abuse, (for women, an IRR of 4.7 (95 % CI 4.3 to 5.0), and for men an IRR of 4.8 (95% CI 4.6 to 5.0)).

The IRRs for different causes of death presented in table 3 show that, regardless of mental disorder, those with comorbid substance abuse disorders had the highest mortality risk.

Women treated for both alcohol-related and drug-related substance abuse had the highest risk for premature death, except for cancer and avoidable mortality (table 4). Except for cancer, men treated for both alcohol-related and drug-related substance abuse had the highest risk for premature death in all studied causes of death.

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3 Separate analyses of different age groups 20-44, 45-64, and 65-79, showed that the younger
4 the patient, the more pronounced increased risk for premature death (data not shown). This
5 was true for all categories of mental disorder and for all studied causes of death, except for
6 suicide.
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11 The majority of patients (78% of women and 77% of men) with affective and anxiety
12 disorders had been treated in outpatient care only. For the other disorders, around half of the
13 patients had been treated in outpatient care only. Mortality rates were higher among those
14 hospitalised than those treated in outpatient care. This was true for all categories of mental
15 disorders and for all causes of death (data not shown).
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23 The different health care quality indicators are presented in table 5. The percentage of
24 avoidable admissions was higher among people treated for mental disorder, for women
25 spanning from 2.4% to 4.1% (compared to 1.1% for those without episodes of treatment for
26 mental disorder), and for men spanning from 3.4% to 5.4% (compared to 1.6%). Psychiatric
27 patients had a higher 28-day case fatality rate for myocardial infarction, especially those
28 treated for schizophrenia and other non-affective psychoses (women 53.5% (42.0-65.0) and
29 men 51.4% (40.4-62.3)), compared to 26.5% of women (25.7-27.3) and 28.1% (27.5-28.6) of
30 men not treated for mental disorder. The indicator on lipid lowering drug therapy shows that
31 psychiatric patients with diabetes were given lipid lowering drugs to a lesser extent than
32 diabetic patients without a concurrent mental disorder; this was particularly evident among
33 both women and men with schizophrenia and other non-affective psychoses.
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DISCUSSION

Our study of more than 6 million women and men shows that psychiatric patients had a substantially increased risk of death compared to individuals with no episodes of treatment for mental disorder, regardless of cause of death. Overall, people with schizophrenia and other non-affective psychoses, and people treated for substance abuse disorder had the highest risk for premature death. Psychiatric patients also had higher rates of potentially avoidable hospitalisations, higher case fatality rate after myocardial infarction, and lower use of lipid lowering therapy in diabetes.

The strengths of the study include the population-based design, using national registers with high completeness. The validity in the Causes of Death Register is very high, where information of cause of death is lacking in only 0.5% of the deceased.³⁴ The National Patient Register has close to complete coverage of all inpatient care. However in 2005 around 40% of psychiatric outpatient visits were not included, hence some patients who were treated in outpatient care are classified as unexposed, as there is no record of their outpatient visit. We were unable to study the effects of health-related behaviours such as excessive alcohol consumption or tobacco smoking, which is a limitation.

We found that psychiatric patients were at higher risk of premature death from IHD, particularly among those treated for schizophrenia and other non-affective psychoses. This has previously been shown in other settings,^{10,11,19,20} and recently a study showed that the excess cardiovascular mortality among schizophrenia patients has increased over the past 25 years.⁷ We also found an elevated risk for cancer mortality, although to a lesser extent, in particular in patients treated for schizophrenia and other non-affective psychoses and substance abuse disorders. Studies evaluating cancer incidence and mortality at the same time have shown that, while individuals with mental disorder did not show any increased incidence rate for many types of cancer, they did have higher cancer mortality, which might be

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3 explained by delays in detection,^{23,35} disparities in screening for cancer,²² and treatment
4 compliance.³⁶
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7 Psychiatric patients had an elevated risk of premature death from conditions considered
8 amenable to intervention by the health service, i.e. avoidable mortality, compared to those not
9 treated in psychiatric care. In particular, those treated for schizophrenia with comorbid
10 substance abuse disorder had a higher risk, which has been shown by others.^{13,30}
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13 In line with previous studies, we found psychiatric patients to have significantly higher
14 suicide risk, in particular those treated for schizophrenia and other non-affective psychosis,
15 and affective disorder, and especially those treated with a comorbid substance abuse
16 disorder.¹⁷
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19 Mentally ill patients also had substantially increased risk of deaths from external causes when
20 suicide was excluded. Studies have shown that people with mental illness are at greater risk of
21 accidental and violent death, particularly when alcohol and drug comorbidities are involved.³⁷
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24 As mentioned earlier, our results showed that mentally ill individuals with a coexisting
25 substance abuse disorder have significantly higher risk for premature death. When we
26 excluded those with a coexisting substance abuse disorder, the increased mortality risk
27 remained for all diagnosis groups except for schizophrenia and other non-affective psychosis,
28 but with lower estimates (data not shown).
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31 Consistent with previous research, substance abuse disorders strongly contributed to
32 premature death among both female and male psychiatric patients, especially for those with
33 both alcohol and drug abuse.
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36 When studying a set of indicators aimed to reflect the outcome of health care quality, we
37 found that patients with a mental disorder had higher rates of potentially avoidable
38 hospitalisations. Under some circumstances hospitalization is necessary and well motivated,
39 but for most studied diseases, it is a failure. A recent study on avoidable hospitalisation
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3 demonstrated that the quality of physical health care received by patients with schizophrenia
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5 was poorer than that of the general population, signalling failures in public health and medical
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7 care³³.
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10 The indicator of 28-day case fatality rate after myocardial infarction showed worse outcome
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12 for those with a mental disorder. In a Danish study,¹⁹ less somatic hospitalisation than needed,
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14 and less use of invasive heart disease procedures among persons with severe mental disorder
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16 than among the general population were suggested as additional reasons for their excess
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18 mortality in IHD.
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21 Another finding was the low percentage of lipid lowering drugs given to diabetic patients with
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23 a concurrent mental disorder. As drug therapy against lipid disorders is particularly important
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25 in diabetic patients,³⁸ this is a clear indication of inequality in health care.
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28 Disparities in access to and utilisation of health care, as well as the quality of health care
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30 provision may contribute to inequalities in health.³⁹ One reason for these disparities could be
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32 that a person with mental disorder may not be able to effectively communicate and express
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34 concerns because of cognitive disturbance. Also, psychiatrists and other mental health
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36 providers may prioritise psychiatric issues and neglect physical problems.⁴⁰ There is also
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38 some evidence of inequalities in case recognition and quality of medical care for psychiatric
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40 patients, where general practitioners might minimise the clinical significance of physical
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42 complaints when assessing and treating patients with a mental disorder; a process known as
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44 diagnostic overshadowing.⁴¹ As there is excess mortality across a wide range of mental
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46 disorders, somatic care should be improved for all psychiatric patients, regardless of the
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48 severity of the mental disorder.
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52 In addition to inequalities in utilisation and quality of health care, there are many factors that
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54 contribute to poor physical health in people with a mental disorder, including health-related
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56 behaviours and medication side-effects. The increased morbidity and mortality seen in this
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3 population are largely due to a higher prevalence of modifiable risk factors, many of which
4 are related to health-related behaviours. The use of alcohol and illicit drugs is more common
5 among psychiatric patients. It is also known that psychiatric patients smoke to a larger
6 extent,^{3,42} which could be an explanation for the increased mortality in IHD and cancer.
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8 Regardless of the kind of mental disorder, we found psychiatric patients to have an increased
9 risk of dying in smoking-related cancer (data not shown). An unhealthy diet may also elevate
10 the risk of various somatic diseases and thus increase the risk of death. The effects of these
11 health-related behaviours have all been proposed as possible causative factors for excess
12 mortality.⁴³ Also, medications used to treat severe mental disorder may increase the risk of
13 diabetes and cardiovascular disease, as most mood stabilisers are associated with weight
14 gain.^{12,44} However, these factors make careful monitoring of the physical health status of
15 patients with mental disorders even more important.

30 **Conclusion**

31 This study shows a marked increase in excess mortality in mentally ill men and women. This
32 was especially evident in individuals with a comorbid substance abuse disorder. The findings
33 also suggest a lower quality of health care in the treatment of somatic disorders in psychiatric
34 patients. Careful medical examination of psychiatric patients together with efforts to promote
35 a healthier life style may be of great importance in order to prevent, detect, and treat somatic
36 disease.
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COMPETING INTERESTS

There are no competing interests.

CONTRIBUTORSHIP STATEMENT

EB, GWR and RL originated the idea. EB analyzed the data and wrote the manuscript draft.

All authors contributed the interpretation of the results and to the writing of the final manuscript.

DATA SHARING

There is no additional data available.

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Table 1. Cohort characteristics

	Women					Men					
	Schizophrenia and other non-affective psychoses	Affective disorder	Anxiety disorder	Other mental disorder	No mental disorder	Schizophrenia and other non-affective psychoses	Affective disorder	Anxiety disorder	Other mental disorder	No mental disorder	
N	11 165	37 245	32 690	20 400	3 039 954	11 993	23 762	21 209	33 982	3 061 939	
%	0.2	0.6	0.5	0.3	48.3	0.2	0.4	0.3	0.5	48.6	
Mean age (SD)	50.1 (13.6)	46.1 (15.6)	42.4 (14.3)	43.8 (16.4)	48.1 (16.0)	45.8 (13.0)	46.9 (14.9)	42.0 (13.4)	47.2 (15.2)	47.2 (15.6)	
Person-years	21 923	73 620	64 788	40 039	6 017 464	23 463	46 604	41 790	65 925	6 042 510	
Causes of death											
All-cause mortality	344 (3.1 %)	669 (1.8 %)	413 (1.3 %)	638 (3.1 %)	27 421 (0.9 %)	459 (3.8 %)	764 (3.2 %)	389 (1.8 %)	1 822 (5.4 %)	39 268 (1.3 %)	
Avoidable mortality: Medical Care Indicators	34 (0.3 %)	68 (0.2 %)	36 (0.1 %)	54 (0.3 %)	3 125 (0.1 %)	30 (0.3 %)	78 (0.3 %)	28 (0.1 %)	140 (0.4 %)	3 904 (0.1 %)	
Avoidable mortality: National Health Policy Indicators	22 (0.2 %)	57 (0.2 %)	43 (0.1 %)	89 (0.4 %)	2 859 (0.1 %)	34 (0.3 %)	41 (0.2 %)	38 (0.2 %)	226 (0.7 %)	4 062 (0.1 %)	
Ischemic heart disease	42 (0.4 %)	68 (0.2 %)	47 (0.1 %)	72 (0.4 %)	3 279 (0.1 %)	79 (0.7 %)	117 (0.5 %)	68 (0.3 %)	280 (0.8 %)	7 878 (0.3 %)	
Cancer (all types)	83 (0.7 %)	163 (0.4 %)	129 (0.4 %)	111 (0.5 %)	12 369 (0.4 %)	65 (0.5 %)	136 (0.6 %)	71 (0.3 %)	247 (0.7 %)	13 636 (0.4 %)	
Suicide	42 (0.4 %)	117 (0.3 %)	71 (0.2 %)	73 (0.4 %)	439 (0.0 %)	79 (0.7 %)	167 (0.7 %)	69 (0.3 %)	174 (0.5 %)	1 259 (0.0 %)	
Deaths from external causes (suicide excluded)	15 (0.1 %)	44 (0.1 %)	27 (0.1 %)	47 (0.2 %)	652 (0.0 %)	39 (0.3 %)	67 (0.3 %)	48 (0.2 %)	232 (0.7 %)	1 867 (0.1 %)	
Health care quality indicators*											
Avoidable inpatient medical care	8 413	22 833	17 078	11 171	1 961 968	7 864	15 502	11 126	22 762	1 931 860	
Number treated in 2006	234	521	409	445	22 433	235	474	341	1 189	29 159	
Myocardial infarction - 28-day case fatality											
AMI in 2006 or 2007	77	164	134	118	10 993	105	244	140	410	23 786	
Dead within 28 days	36	62	45	53	3 108	50	88	42	171	6 467	
Lipid lowering drug therapy											
Number receiving diabetes drug therapy in 2006	722	1 200	726	596	80 453	744	1 185	680	1 744	116 270	
Of these, number who were given lipid lowering drugs in 2006	292	618	385	280	45 193	318	631	367	743	65 440	

* Individuals aged 40-79

Table 2. Relative risk of death in psychiatric patients compared with a population with no episode of treatment for mental disorder (incidence rate ratios* with 95% confidence intervals)

Mental disorder group	All-cause mortality	Ischemic heart disease	Cancer (all types)	Avoidable mortality: Medical Care Indicators	Avoidable mortality: National Health Policy Indicators	Suicide	Death from external causes (suicide excluded)
Females							
No mental disorder	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)
Schizophrenia and other non-affective psychoses	3.8 (3.4-4.2)	4.1 (3.1-5.6)	1.9 (1.5-2.4)	3.5 (2.5-4.9)	2.1 (1.4-3.2)	24.9 (18.1-34.2)	6.7 (4.0-11.1)
Affective disorder	2.4 (2.2-2.6)	2.1 (1.7-2.7)	1.3 (1.1-1.5)	2.2 (1.7-2.8)	1.9 (1.5-2.5)	22.3 (18.1-27.3)	6.1 (4.5-8.3)
Anxiety disorder	2.6 (2.3-2.8)	2.9 (2.1-3.8)	1.7 (1.4-2.0)	2.2 (1.6-3.0)	2.4 (1.8-3.2)	16.0 (12.5-20.6)	5.3 (3.6-7.8)
Other mental disorder (including substance abuse disorder)	4.7 (4.3-5.0)	4.6 (3.6-5.8)	1.8 (1.5-2.2)	3.5 (2.7-4.6)	6.2 (5.0-7.6)	26.7 (20.8-34.3)	12.6 (9.4-17.0)
Males							
No mental disorder	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)
Schizophrenia and other non-affective psychoses	4.6 (4.2-5.0)	4.3 (3.4-5.3)	1.9 (1.5-2.5)	3.4 (2.4-4.9)	3.0 (2.1-4.1)	16.1 (12.9-20.3)	6.2 (4.5-8.6)
Affective disorder	2.8 (2.7-3.1)	2.2 (1.9-2.7)	1.5 (1.2-1.7)	3.0 (2.4-3.8)	1.4 (1.1-2.0)	17.2 (14.6-20.2)	4.9 (3.8-6.2)
Anxiety disorder	2.8 (2.5-3.0)	2.7 (2.1-3.5)	1.5 (1.2-2.0)	2.3 (1.6-3.4)	2.3 (1.7-3.2)	8.3 (6.5-10.6)	4.5 (3.4-6.1)
Other mental disorder (including substance abuse disorder)	4.8 (4.6-5.0)	3.7 (3.3-4.2)	1.9 (1.6-2.1)	3.9 (3.3-4.6)	5.5 (4.8-6.3)	12.6 (10.8-14.8)	11.8 (10.3-13.6)

* Adjusted for age

Table 3. Associations of mental disorder and substance abuse in relation to mortality (incidence rate ratios* with 95% confidence intervals)

Mental disorder group	N	All-cause mortality	Ischemic heart disease	Cancer (all types)	Avoidable mortality: Medical Care Indicators	Avoidable mortality: National Health Policy Indicators	Suicide	Death from
Females								
No mental disorder	3 039 954	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	
Schizophrenia and other non-affective psychoses with substance abuse disorder	502	10.8 (7.1-16.6)	5.7 (0.8-40.4)	5.2 (2.2-12.6)	-	21.5 (8.9-51.8)	44.6 (14.3-138.8)	
Schizophrenia and other non-affective psychoses without substance abuse disorder	10 663	3.6 (3.2-4.0)	4.1 (3.0-5.6)	1.8 (1.5-2.3)	3.5 (2.5-5.0)	1.7 (1.0-2.7)	24.2 (17.4-33.6)	
Affective disorder with substance abuse disorder	1 919	6.4 (4.9-8.3)	3.5 (1.1-10.9)	2.7 (1.5-4.8)	3.4 (1.1-10.6)	6.5 (3.1-13.6)	61.1 (37.1-100.6)	
Affective disorder without substance abuse disorder	35 326	2.3 (2.1-2.5)	2.1 (1.6-2.7)	1.2 (1.1-1.4)	2.2 (1.7-2.8)	1.8 (1.3-2.3)	20.3 (16.3-25.2)	
Anxiety disorder with substance abuse disorder	1 551	7.3 (5.4-9.8)	10.9 (4.9-24.3)	2.0 (0.9-4.4)	1.7 (0.2-12.2)	6.8 (2.8-16.4)	63.1 (36.3-109.7)	
Anxiety disorder without substance abuse disorder	31 139	2.4 (2.2-2.7)	2.6 (1.9-3.5)	1.7 (1.4-2.0)	2.2 (1.6-3.0)	2.2 (1.6-3.0)	13.8 (10.5-18.2)	
Other mental disorder with substance abuse disorder	387	17.0 (10.4-27.7)	-	-	11.3 (1.6-80.4)	-	171.6 (85.1-346.0)	
Other mental disorder without substance abuse disorder	10 773	2.6 (2.3-3.0)	2.9 (2.0-4.1)	1.4 (1.1-1.8)	2.6 (1.8-3.8)	0.9 (0.4-1.8)	10.0 (5.9-17.0)	
Substance abuse disorder without a psychiatric diagnosis	9 240	7.9 (7.1-8.7)	8.4 (6.2-11.4)	2.4 (1.9-3.1)	5.3 (3.6-7.8)	13.4 (10.7-16.7)	39.8 (29.8-53.2)	
Males								
No mental disorder	3 061 939	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	
Schizophrenia and other non-affective psychoses with substance abuse disorder	1 088	12.5 (9.8-15.9)	4.9 (1.9-13.2)	3.8 (1.7-8.4)	5.3 (1.3-21.1)	11 (5.2-23.1)	41.3 (25.6-66.7)	
Schizophrenia and other non-affective psychoses without substance abuse disorder	10 905	4.2 (3.8-4.6)	4.3 (3.4-5.3)	1.8 (1.4-2.4)	3.4 (2.3-4.9)	2.5 (1.7-3.6)	13.9 (10.7-17.9)	
Affective disorder with substance abuse disorder	2 237	6.7 (5.6-8.1)	5.4 (3.4-8.6)	1.6 (0.9-3.0)	5.8 (3.0-11.2)	5.3 (2.9-9.5)	43.7 (31.8-60.2)	
Affective disorder without substance abuse disorder	21 525	2.6 (2.4-2.8)	2.0 (1.6-2.4)	1.5 (1.2-1.7)	2.8 (2.2-3.6)	1.1 (0.8-1.6)	14.5 (12.1-17.4)	
Anxiety disorder with substance abuse disorder	1 900	9.7 (7.9-11.8)	7.7 (4.5-13.2)	2.5 (1.2-4.9)	2.5 (0.6-10.2)	8.9 (4.9-16.1)	27.7 (17.8-43.1)	
Anxiety disorder without substance abuse disorder	19 309	2.2 (2.0-2.5)	2.4 (1.8-3.1)	1.5 (1.2-1.9)	2.3 (1.6-3.4)	1.8 (1.2-2.6)	6.5 (4.9-8.6)	
Other mental disorder with substance abuse disorder	380	9.8 (6.7-14.4)	21.0 (11.3-39.0)	2.3 (0.6-9.1)	8.7 (2.2-35.0)	-	47.6 (22.6-100.1)	
Other mental disorder without substance abuse disorder	9 298	2.5 (2.2-2.8)	1.7 (1.3-2.2)	1.4 (1.1-1.8)	3.5 (2.7-4.7)	1.2 (0.7-2.0)	5.4 (3.5-8.4)	
Substance abuse disorder without a psychiatric diagnosis	24 304	6.1 (5.8-6.4)	4.8 (4.2-5.5)	2.1 (1.8-2.4)	4.0 (3.3-5.0)	7.7 (6.7-8.8)	14.8 (12.5-17.6)	

* Adjusted for age

Table 4. Relative risk of mortality in psychiatric patients with substance abuse disorder (IRR with 95% confidence intervals)

	N	All-cause mortality	Ischemic heart disease	Cancer (all types)	Avoidable mortality: Medical Care Indicators	Avoidable mortality: National Health Policy Indicators	Suicide	Death from external causes (suicide excluded)
Females								
No substance abuse disorder	3 127 855	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)
Substance abuse disorder, alcohol	8 185	7.7 (6.9-8.5)	4.1 (0.6-29.3)	2.3 (1.8-3.0)	4.8 (3.2-7.2)	13.8 (11.1-17.2)	29.5 (22.1-39.4)	22.6 (16.0-32.0)
Substance abuse disorder, drug abuse	4 589	6.6 (5.5-8.0)	4.7 (2.3-9.4)	2.7 (1.8-4.1)	3.9 (1.9-8.2)	6.1 (3.5-10.8)	36.9 (25.8-52.8)	22.9 (13.9-37.6)
Substance abuse disorder, both alcohol and drug abuse	825	11.2 (8.0-15.7)	8.7 (6.4-11.8)	2.6 (1.0-6.9)	3.7 (0.5-26.5)	7.8 (2.5-24.1)	54.4 (28.1-105.1)	65.8 (32.7-132.4)
Males								
No substance abuse disorder	3 122 976	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)
Substance abuse disorder, alcohol	20 429	5.5 (5.3-5.9)	4.8 (4.2-5.5)	2.0(1.7-2.4)	3.8 (3.1-4.7)	7.5 (6.6-8.7)	12.5 (10.4-14.9)	12.8 (10.8-15.0)
Substance abuse disorder, drug abuse	7 753	9.4 (8.4-10.6)	5.8 (3.9-8.7)	2.7 (1.7-4.1)	4.9 (2.6-9.1)	4.1 (2.4-7.0)	22.4 (17.7-28.4)	22.5 (18.0-28.3)
Substance abuse disorder, both alcohol and drug abuse	1 727	14.5 (12.2-17.2)	6.8 (3.7-12.7)	2.5 (1.2-5.2)	8.7 (3.9-19.4)	16.0 (10.0-25.4)	35.2 (24.2-51.2)	29.3 (19.6-43.9)

* Adjusted for age

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Table 5. Age-standardised percentage (with 95% confidence intervals) as measures of health care quality indicators for individuals aged 40-79, 2006

Mental disorder group	N	Avoidable inpatient medical care % (95% CI)	Myocardial infarction - 28-day case fatality % (95% CI)	Lipid lowering drug therapy % (95% CI)
Females				
No mental disorder	1 961 968	1.1 (1.1-1.1)	26.5 (25.7-27.3)	56.1 (55.7-56.4)
Schizophrenia and other non-affective psychoses	8 413	2.9 (2.6-3.3)	53.5 (42.0-65.0)	40.9 (36.8-45.1)
Affective disorder	22 833	2.4 (2.2-2.6)	34.8 (26.5-43.2)	51.9 (49.0-54.8)
Anxiety disorder	17 078	3.0 (2.7-3.3)	36.1 (28.8-43.4)	54.9 (50.9-58.8)
Other mental disorder (including substance abuse disorder)	11 171	4.1 (3.7-4.5)	45.0 (35.8-54.3)	49.0 (44.8-53.1)
Males				
No mental disorder	1 931 860	1.6 (1.5-1.6)	28.1 (27.5-28.6)	56.2 (55.9-56.5)
Schizophrenia and other non-affective psychoses	7 864	3.8 (3.3-4.4)	51.4 (40.4-62.3)	41.9 (37.2-46.5)
Affective disorder	15 502	3.4 (3.1-3.7)	39.2 (32.6-45.7)	53.8 (50.8-56.8)
Anxiety disorder	11 126	4.4 (3.9-4.9)	32.5 (23.1-42.0)	56.4 (51.9-60.8)
Other mental disorder (including substance abuse disorder)	22 762	5.4 (5.1-5.7)	43.9 (38.6-49.1)	44.2 (41.7-46.7)

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bmjopen-2011-000778 - Quality of medical care and excess mortality in
 psychiatric patients - a nationwide register-based study in Sweden
 STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

	Item No	Recommendation
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract Page 1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found Page 3
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Page 4
Objectives	3	State specific objectives, including any prespecified hypotheses Page 5
Methods		
Study design	4	Present key elements of study design early in the paper Page 6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Page 6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up Page 6
		(b) For matched studies, give matching criteria and number of exposed and unexposed N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Page 6 - 8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group Page 6 - 8
Bias	9	Describe any efforts to address potential sources of bias N/A
Study size	10	Explain how the study size was arrived at Page 6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why N/A
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding Page 8 - 9
		(b) Describe any methods used to examine subgroups and interactions N/A
		(c) Explain how missing data were addressed N/A
		(d) If applicable, explain how loss to follow-up was addressed N/A

(e) Describe any sensitivity analyses

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed Page 10 and page 20
		(b) Give reasons for non-participation at each stage N/A
		(c) Consider use of a flow diagram N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders Page 20
		(b) Indicate number of participants with missing data for each variable of interest N/A
		(c) Summarise follow-up time (eg, average and total amount) Page 20
Outcome data	15*	Report numbers of outcome events or summary measures over time Page 10 and page 20
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included Page 10-11 and page 21-23
		(b) Report category boundaries when continuous variables were categorized N/A
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses Page 11 and page 24
Discussion		
Key results	18	Summarise key results with reference to study objectives Page 2 and page 12 – 16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias Page 2 and page 12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Page 12 – 16
Generalisability	21	Discuss the generalisability (external validity) of the study results Page 15
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based Page 16

*Give information separately for exposed and unexposed groups.



Quality of medical care and excess mortality in psychiatric patients – a nationwide register-based study in Sweden

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Quality of medical care and excess mortality in psychiatric patients – a nationwide register-based study in Sweden

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ARTICLE SUMMARY

Article focus:

- To investigate whether psychiatric patients have higher overall and cause-specific mortality
- To study whether the quality of somatic care for psychiatric patients is different from the care provided to patients with no concurrent mental disorder.

Key messages:

- This study shows a marked increase in excess mortality in mentally ill men and women.
- The findings suggest a lower quality of health care in the treatment of somatic disorders in psychiatric patients regarding the indicators studied.
- Careful medical examination of psychiatric patients together with efforts to promote a healthier life style may be of great importance in order to prevent, detect, and treat somatic disease.

Strengths and limitations:

- The strengths of the study include the population-based design, using national registers with high completeness
- We were unable to study the effects of health-related behaviors such as excessive alcohol consumption or tobacco smoking, which is a limitation.

ABSTRACT

Objective: To assess overall and cause-specific mortality, and the quality of somatic care among psychiatric patients.

Design: A register-based cohort study

Setting: All individuals aged 20-79 in Sweden in 2005.

Participants: In total 6 294 339 individuals.

Primary outcome measure: The individuals were followed for mortality in 2006 and 2007, generating 72 187 deaths. Psychiatric patients were grouped according to their diagnosis in the National Patient Register. Mortality risk of psychiatric patients was compared to that of non-psychiatric patients. Estimates of relative risk of mortality were calculated as incidence rate ratios (IRRs) with 95% confidence intervals (CIs) using Poisson regression analysis. Psychiatric patients were compared with non-psychiatric patients for three health care quality indicators: the proportion of avoidable hospitalisations, case fatality rate after myocardial infarction, and statin use among diabetic patients.

Results: Compared to individuals with no episodes of treatment for mental disorder, psychiatric patients had a substantially increased risk of all studied death-causes as well as death from conditions considered amenable to intervention by the health service, i.e. avoidable mortality. The highest mortality was found among those with another mental disorder, predominantly substance abuse (for women, an IRR of 4.7 (95% CI 4.3 to 5.0), and for men an IRR of 4.8 (95% CI 4.6 to 5.0)).

The analysis of quality of somatic care revealed lower levels of health care quality for psychiatric patients, signalling failures in public health and medical care.

Conclusion: This study shows a marked increase in excess mortality, suggesting a lower quality of somatic health care in psychiatric patients.

INTRODUCTION

Psychiatric patients have been reported to have higher mortality rates and shorter life expectancy compared to the general population.¹⁻⁶ This applies especially to patients with severe psychiatric diseases, such as schizophrenia⁷⁻¹⁰ and bipolar disorder.^{11,12}

The highest risks have been found among patients with substance abuse.^{3,5,13,14}

Psychiatric patients have a particularly pronounced risk of suicide.¹⁵⁻¹⁸ Cardiovascular disease is also a major cause of excess deaths, partly due to a higher prevalence of smoking, obesity and hypertension.¹⁹⁻²¹ There are conflicting data on cancer incidence and mortality in psychiatric patients, although most studies suggest that while cancer mortality is higher, incidence is no different from that of the general population.^{22,23}

Other potential explanations for the excess mortality are differences in access, provision and quality of somatic health care.²⁴ For instance, it has been shown that people with a diagnosis of a mental disorder have less access to primary health care.²⁵

Lower quality of diabetes care²⁶ and cardiovascular procedures^{19,27,28} have also been documented. In Sweden, different indicators are often used as measures reflecting health care quality.²⁹

The concept of avoidable mortality was introduced in 1976 as an indicator of quality of health care.³⁰ Avoidable mortality measures deaths that could be argued to have been avoidable either by the health care system or by public health interventions, and has been applied in comparisons between regions, populations and over time.

Psychiatric patients have been shown to have higher avoidable mortality rates than the general population,^{13,31} and questions have been raised as to whether the medical care of physical disorders provided to psychiatric patients is less adequate than for the population in general.³²

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The aim of this study was to investigate whether psychiatric patients have higher overall and cause-specific mortality, and whether the quality of somatic care for psychiatric patients is different from the care provided to patients with no concurrent mental disorder.

Results are reported with regard to age, sex, mental disorder, and comorbid substance abuse disorders.

For peer review only

METHOD

Study population

The study population comprised individuals alive and registered in Sweden in 2004 and 2005, aged 20-79 i.e. those born between 1926 and 1985. After excluding individuals diagnosed with mental retardation (as defined by the International Classification of Diseases, tenth revision (ICD-10): F70-F79) the study population comprised 6 294 339 individuals. The cohort was followed from January 1, 2006 until December 31, 2007. We used the unique personal identity number assigned to each Swedish citizen or permanent resident to link information from four population-based registers.³³

Types of mental disorder

We identified all individuals recorded with a principal psychiatric diagnostic code as defined by the ICD-10 F04-F99 (i.e. dementia excluded, besides mental retardation) in inpatient care or specialised outpatient care in 2004 or 2005 in the National Patient Register. The National Patient Register covers all inpatient care in Sweden since 1987 (psychiatric inpatient care since 1973, where both alcohol and drugs services are included) and all specialised outpatient care since 2001. If a patient had more than one discharge or outpatient visit, the principal diagnoses from all discharges and outpatient visits were kept to further categorise patients. Five mutually exclusive exposure groups were created according to a hierarchy of diagnoses: *i*) schizophrenia and other non-affective psychoses (diagnosis codes F20-F29), *ii*) affective disorder (F30-F39), *iii*) anxiety disorder (F40-F48), *iv*) other psychiatric diagnoses, (F04-F99 except for diagnoses above), *v*) persons without inpatient and outpatient care due to mental disorder served as the reference group.

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Psychiatric in- or outpatient care due to substance abuse disorder was also studied in a sub-analysis and was divided into categories according to whether the substance abuse was attributed to alcohol (F10), narcotic-related drugs (F11-F19), or both.

As certain mental disorders, e.g. bipolar disorder and schizophrenia are highly comorbid with alcohol and other substance abuse,³⁴ schizophrenia/other non-affective psychoses, affective or anxiety disorder were analysed with and without a coexisting substance abuse disorder (attributed to either alcohol or narcotics-related drugs). In these analyses, persons without inpatient and outpatient care due to mental disorder served as the reference group.

Causes of death

The underlying cause of death, coded according to the ICD-10, was obtained from the Causes of Death Register. This register contains information on all deceased Swedish residents since 1952 and has a very high coverage. Since 1997 all deceased have been included, though for 0.5% there is a lack of medical information.

Causes of death were grouped as follows: ischemic heart disease (IHD) (diagnosis codes I20-I25), cancer (C00-C97), suicide and death with undetermined intent (X60-X84 and Y10-Y34), and external causes of death (suicide excluded) (V01-Y89 (except for X60-X84, Y10-Y34)). The indicators of avoidable mortality were divided into causes of death reflecting the outcome of medical care, and causes reflecting the effect of the national health policy. The following diseases were included as medical care indicators: typhoid (A01.0), tetanus (A35), tuberculosis (A15-A19 and B90), malignant neoplasm of cervix uteri (C53), Hodgkin's disease (C81), diabetes (E10-E14), chronic rheumatic heart disease (I05-I09), hypertensive disease (I10-I15), stroke (I60-I69), asthma (J45-J46), appendicitis (K35-K38), abdominal hernia (K40-K45), cholelithiasis and cholecystitis (K80-K81 and K83.0), maternal deaths (O00-

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7 O99), and osteomyelitis (M86-M87). Malignant neoplasms of the oesophagus (C15),
8 malignant neoplasms of the trachea, bronchus or lung (C34), cirrhosis of the liver
9 (K70 and K73-K74), and motor vehicle accidents (V00-V99) were included as
10 national health policy indicators.
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12 13 14 **Health care quality indicators**

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16 In analyses of indicators presumably reflecting aspects of health care quality, the age-
17 span was restricted to individuals aged 40-79, because the studied outcomes are rare
18 in younger individuals. The indicator regarding avoidable hospitalisation is based on
19 the assumption that unnecessary hospitalisation can be avoided if patients with
20 selected conditions receive proper outpatient care. This indicator includes
21 hospitalisations for some chronic conditions (anaemia, asthma, diabetic
22 complications, heart failure, hypertension, chronic obstructive lung disease, and
23 angina pectoris), and hospitalisations for some acute conditions (bleeding ulcers,
24 diarrhoea, epileptic seizures, inflammatory diseases of the female pelvic organs,
25 pyelitis, and ear, nose and throat infection). The indicator regarding 28-day case
26 fatality rate after myocardial infarction is an internationally established indicator of
27 how well the health care system handles acute care after myocardial infarction. As a
28 third indicator, the proportion on treatment with lipid lowering drugs was measured
29 among patients receiving diabetes drugs. This treatment ought to be especially
30 important for diabetes patients, due to the many risk factors in this population. All
31 three indicators have been described elsewhere.²⁹
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47 **Statistical analysis**

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49 Poisson regression analyses, adjusted for age, were used to evaluate the association
50 between mental disorder, mortality, and indicators of quality of health care. As a
51 measure of the relative occurrence of death we used the incidence rate ratio (IRR).
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7 We assessed person-years at risk by adding up the years the individuals were alive
8 and living in Sweden during the follow-up period. SAS Genmod procedure was used
9 to calculate IRRs with 95% confidence intervals (CI). SAS Enterprise Guide 4.2
10 (SAS Institute Inc. Cary, NC, USA) was used. Age-standardised percentages were
11 calculated when analysing differences regarding health care quality.
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RESULTS

Cohort characteristics for the 6 294 339 individuals, (3 141 454 women and 3 152 885 men) are presented in table 1. In total, 101 500 women and 90 946 men were treated for mental disorder in 2004 or 2005. About 11% of mentally ill women had a diagnosis of schizophrenia and other non-affective psychoses, 37% affective disorders, 32% anxiety disorder, and 20% other psychiatric diagnoses, and for men 13%, 26%, 23%, and 37% respectively. Almost three quarters of the men (73%) included in the group for other mental disorders were treated for substance abuse.

Among all psychiatric patients, 5 498 (2.9% in all, 2% in women, and 4% in men respectively) died during the follow-up period, compared to 66 689 (1.1% in all, 0.9% in women, and 1.3% in men) among persons without episodes of treatment for mental disorder.

The IRRs for different causes of death and by mental disorder for both sexes are shown in table 2. When compared to the general population, mortality was considerably higher among all categories of mental disorder and for all causes of death. The highest excess mortality was found among individuals in the category comprised of having another mental disorder, predominantly substance abuse, (for women, an IRR of 4.7 (95 % CI 4.3 to 5.0), and for men an IRR of 4.8 (95% CI 4.6 to 5.0)).

The IRRs for different causes of death presented in table 3 show that, regardless of mental disorder, those with comorbid substance abuse disorders had the highest mortality risk.

Women treated for both alcohol-related and drug-related substance abuse had the highest risk for premature death, except for cancer and avoidable mortality (table 4).

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7 Except for cancer, men treated for both alcohol-related and drug-related substance
8 abuse had the highest risk for premature death in all studied causes of death.

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10 Separate analyses of different age groups 20-44, 45-64, and 65-79, showed that the
11 younger the patient, the more pronounced increased risk for premature death (data not
12 shown). This was true for all categories of mental disorder and for all studied causes
13 of death, except for suicide.

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15 The majority of patients (78% of women and 77% of men) with affective and anxiety
16 disorders had been treated in outpatient care only. For the other disorders, around half
17 of the patients had been treated in outpatient care only. Mortality rates were higher
18 among those hospitalised than those treated in outpatient care. This was true for all
19 categories of mental disorders and for all causes of death (data not shown).

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21 The different health care quality indicators are presented in table 5. The percentage of
22 avoidable admissions was higher among people treated for mental disorder, for
23 women spanning from 2.4% to 4.1% (compared to 1.1% for those without episodes of
24 treatment for mental disorder), and for men spanning from 3.4% to 5.4% (compared
25 to 1.6%). Psychiatric patients had a higher 28-day case fatality rate for myocardial
26 infarction, especially those treated for schizophrenia and other non-affective
27 psychoses (women 53.5% (42.0-65.0) and men 51.4% (40.4-62.3)), compared to
28 26.5% of women (25.7-27.3) and 28.1% (27.5-28.6) of men not treated for mental
29 disorder. The indicator on lipid lowering drug therapy shows that psychiatric patients
30 with diabetes were given lipid lowering drugs to a lesser extent than diabetic patients
31 without a concurrent mental disorder; this was particularly evident among both
32 women and men with schizophrenia and other non-affective psychoses.
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DISCUSSION

Our study of more than 6 million women and men shows that psychiatric patients had a substantially increased risk of death compared to individuals with no episodes of treatment for mental disorder, regardless of cause of death. Overall, people with schizophrenia and other non-affective psychoses, and people treated for substance abuse disorder had the highest risk for premature death. Psychiatric patients also had higher rates of potentially avoidable hospitalisations, higher case fatality rate after myocardial infarction, and lower use of lipid lowering therapy in diabetes.

The strengths of the study include the population-based design, using national registers with high completeness. The validity in the Causes of Death Register is very high, where information of cause of death is lacking in only 0.5% of the deceased.³⁵

The National Patient Register has close to complete coverage of all inpatient care. However in 2005 around 40% of psychiatric outpatient visits were not included, hence some patients who were treated in outpatient care are classified as unexposed,

as there is no record of their outpatient visit. Also, as the National Patient Register does not cover primary care we were not able to study all levels of psychiatric care. Hence, patients treated for mental health problems solely in primary care are classified as unexposed. Assuming a similar effect for patients in primary care as for psychiatric patients in our study selected by a more strict definition of mental health problems, i.e. patients who have seen a psychiatrist, this misclassification will dilute our results towards the null. We were unable to study the effects of health-related behaviours such as excessive alcohol consumption or tobacco smoking, which is a limitation.

We found that psychiatric patients were at higher risk of premature death from IHD, particularly among those treated for schizophrenia and other non-affective psychoses.

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7 This has previously been shown in other settings,^{10,11,19,20} and recently a study
8 showed that the excess cardiovascular mortality among schizophrenia patients has
9 increased over the past 25 years.⁷ We also found an elevated risk for cancer mortality,
10 although to a lesser extent, in particular in patients treated for schizophrenia and other
11 non-affective psychoses and substance abuse disorders. Studies evaluating cancer
12 incidence and mortality at the same time have shown that, while individuals with
13 mental disorder did not show any increased incidence rate for many types of cancer,
14 they did have higher cancer mortality, which might be explained by delays in
15 detection,^{23,36} disparities in screening for cancer,²² and treatment compliance.³⁷

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24 Psychiatric patients had an elevated risk of premature death from conditions
25 considered amenable to intervention by the health service, i.e. avoidable mortality,
26 compared to those not treated in psychiatric care. In particular, those treated for
27 schizophrenia with comorbid substance abuse disorder had a higher risk, which has
28 been shown by others.^{13,31}

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In line with previous studies, we found psychiatric patients to have significantly
higher suicide risk, in particular those treated for schizophrenia and other non-
affective psychosis, and affective disorder, and especially those treated with a
comorbid substance abuse disorder.¹⁷

Mentally ill patients also had substantially increased risk of deaths from external
causes when suicide was excluded. Studies have shown that people with mental
disorder are at greater risk of accidental and violent death, particularly when alcohol
and drug comorbidities are involved.³⁸ As mentioned earlier, our results showed that
mentally ill individuals with a coexisting substance abuse disorder have significantly
higher risk for premature death. When we excluded those with a coexisting substance
abuse disorder, the increased mortality risk remained for all diagnosis groups except

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7 for schizophrenia and other non-affective psychosis, but with lower estimates (data
8 not shown).

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11 Consistent with previous research, substance abuse disorders strongly contributed to
12 premature death among both female and male psychiatric patients, especially for
13 those with both alcohol and drug abuse.
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16 When studying a set of indicators aimed to reflect the outcome of health care quality,
17 we found that patients with a mental disorder had higher rates of potentially avoidable
18 hospitalisations. Under some circumstances hospitalization is necessary and well
19 motivated, but for most studied diseases, it is a failure. A recent study on avoidable
20 hospitalisation demonstrated that the quality of physical health care received by
21 patients with schizophrenia was poorer than that of the general population, signalling
22 failures in public health and medical care³⁴.
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30 The indicator of 28-day case fatality rate after myocardial infarction showed worse
31 outcome for those with a mental disorder. In a Danish study,¹⁹ less somatic
32 hospitalisation than needed, and less use of invasive heart disease procedures among
33 persons with severe mental disorder than among the general population were
34 suggested as additional reasons for their excess mortality in IHD.
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40 Another finding was the low percentage of lipid lowering drugs given to diabetic
41 patients with a concurrent mental disorder. As drug therapy against lipid disorders is
42 particularly important in diabetic patients,³⁹ this is a clear indication of inequality in
43 health care.
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47 Disparities in access to and utilisation of health care, as well as the quality of health
48 care provision may contribute to inequalities in health.⁴⁰ One reason for these
49 disparities could be that a person with mental disorder may not be able to effectively
50 communicate and express concerns because of cognitive disturbance. Also,
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7 psychiatrists and other mental health providers may prioritise psychiatric issues and
8 neglect physical problems.⁴¹ There is also some evidence of inequalities in case
9 recognition and quality of medical care for psychiatric patients, where general
10 practitioners might minimise the clinical significance of physical complaints when
11 assessing and treating patients with a mental disorder; a process known as diagnostic
12 overshadowing.⁴² As there is excess mortality across a wide range of mental
13 disorders, somatic care should be improved for all psychiatric patients, regardless of
14 the severity of the mental disorder.

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22 In addition to inequalities in utilisation and quality of health care, there are many
23 factors that contribute to poor physical health in people with a mental disorder,
24 including health-related behaviours and medication side-effects. The increased
25 morbidity and mortality seen in this population are largely due to a higher prevalence
26 of modifiable risk factors, many of which are related to health-related behaviours.
27 The use of alcohol and illicit drugs is more common among psychiatric patients. It is
28 also known that psychiatric patients smoke to a larger extent,^{3,43} which could be an
29 explanation for the increased mortality in IHD and cancer. Regardless of the kind of
30 mental disorder, we found psychiatric patients to have an increased risk of dying in
31 smoking-related cancer (data not shown). An unhealthy diet may also elevate the risk
32 of various somatic diseases and thus increase the risk of death. The effects of these
33 health-related behaviours have all been proposed as possible causative factors for
34 excess mortality.⁴⁴ Also, medications used to treat severe mental disorder may
35 increase the risk of diabetes and cardiovascular disease, as most mood stabilisers are
36 associated with weight gain.^{12,45} However, these factors make careful monitoring of
37 the physical health status of patients with mental disorders even more important.

38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 **Conclusion**

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7 This study shows a marked increase in excess mortality in mentally ill men and
8 women. This was especially evident in individuals with a comorbid substance abuse
9 disorder. The findings also suggest a lower quality of health care in the treatment of
10 somatic disorders in psychiatric patients. Careful medical examination of psychiatric
11 patients together with efforts to promote a healthier life style may be of great
12 importance in order to prevent, detect, and treat somatic disease.
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22

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25 Swedish Research Council.
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30 **COMPETING INTERESTS**

31 There are no competing interests.
32

33 **CONTRIBUTORSHIP STATEMENT**

34 EB, GWR and RL originated the idea. EB analyzed the data and wrote the manuscript
35 draft. All authors contributed the interpretation of the results and to the writing of the
36 final manuscript.
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Table 1. Cohort characteristics

	Women					Men					N
	Schizophrenia and other non-affective psychoses	Affective disorder	Anxiety disorder	Other mental disorder	No mental disorder	Schizophrenia and other non-affective psychoses	Affective disorder	Anxiety disorder	Other mental disorder	No mental disorder	
N	11 165	37 245	32 690	20 400	3 039 954	11 993	23 762	21 209	33 982	3 061 939	6 294 339
%	0.2	0.6	0.5	0.3	48.3	0.2	0.4	0.3	0.5	48.6	
Mean age (SD)	50.1 (13.6)	46.1 (15.6)	42.4 (14.3)	43.8 (16.4)	48.1 (16.0)	45.8 (13.0)	46.9 (14.9)	42.0 (13.4)	47.2 (15.2)	47.2 (15.6)	47.6 (15.8)
Person-years	21 923	73 620	64 788	40 039	6 017 464	23 463	46 604	41 790	65 925	6 042 510	12 438 126
Causes of death											
All-cause mortality	344 (3.1 %)	669 (1.8 %)	413 (1.3 %)	638 (3.1 %)	27 421 (0.9 %)	459 (3.8 %)	764 (3.2 %)	389 (1.8 %)	1 822 (5.4 %)	39 268 (1.3 %)	72 187 (1.1 %)
Avoidable mortality: Medical Care Indicators	34 (0.3 %)	68 (0.2 %)	36 (0.1 %)	54 (0.3 %)	3 125 (0.1 %)	30 (0.3 %)	78 (0.3 %)	28 (0.1 %)	140 (0.4 %)	3 904 (0.1 %)	7 497 (0.1 %)
Avoidable mortality: National Health Policy Indicators	22 (0.2 %)	57 (0.2 %)	43 (0.1 %)	89 (0.4 %)	2 859 (0.1 %)	34 (0.3 %)	41 (0.2 %)	38 (0.2 %)	226 (0.7 %)	4 062 (0.1 %)	7 471 (0.1 %)
Ischemic heart disease	42 (0.4 %)	68 (0.2 %)	47 (0.1 %)	72 (0.4 %)	3 279 (0.1 %)	79 (0.7 %)	117 (0.5 %)	68 (0.3 %)	280 (0.8 %)	7 878 (0.3 %)	11 930 (0.2 %)
Cancer (all types)	83 (0.7 %)	163 (0.4 %)	129 (0.4 %)	111 (0.5 %)	12 369 (0.4 %)	65 (0.5 %)	136 (0.6 %)	71 (0.3 %)	247 (0.7 %)	13 636 (0.4 %)	27 010 (0.4 %)
Suicide	42 (0.4 %)	117 (0.3 %)	71 (0.2 %)	73 (0.4 %)	439 (0.0 %)	79 (0.7 %)	167 (0.7 %)	69 (0.3 %)	174 (0.5 %)	1 259 (0.0 %)	2 490 (0.0 %)
Deaths from external causes (suicide excluded)	15 (0.1 %)	44 (0.1 %)	27 (0.1 %)	47 (0.2 %)	652 (0.0 %)	39 (0.3 %)	67 (0.3 %)	48 (0.2 %)	232 (0.7 %)	1 867 (0.1 %)	3 038 (0.0 %)
Health care quality indicators*											
Avoidable inpatient medical care	8 413	22 833	17 078	11 171	1 961 968	7 864	15 502	11 126	22 762	1 931 860	4 010 577
Number treated in 2006	234	521	409	445	22 433	235	474	341	1 189	29 159	55 440
Myocardial infarction - 28-day case fatality											36 171
AMI in 2006 or 2007	77	164	134	118	10 993	105	244	140	410	23 786	10 122
Dead within 28 days	36	62	45	53	3 108	50	88	42	171	6 467	
Lipid lowering drug therapy											
Number receiving diabetes drug therapy in 2006	722	1 200	726	596	80 453	744	1 185	680	1 744	116 270	204 320
Of these, number who were given lipid lowering drugs in 2006	292	618	385	280	45 193	318	631	367	743	65 440	114 267

* Individuals aged 40-79

Table 2. Relative risk of death in psychiatric patients compared with a population with no episode of treatment for mental disorder (incidence rate ratios* with 95% confidence intervals)

Mental disorder group	All-cause mortality	Ischemic heart disease	Cancer (all types)	Avoidable mortality: Medical Care Indicators	Avoidable mortality: National Health Policy Indicators	Suicide	Death from external causes (suicide excluded)
Females							
No mental disorder	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)
Schizophrenia and other non-affective psychoses	3.8 (3.4-4.2)	4.1 (3.1-5.6)	1.9 (1.5-2.4)	3.5 (2.5-4.9)	2.1 (1.4-3.2)	24.9 (18.1-34.2)	6.7 (4.0-11.1)
Affective disorder	2.4 (2.2-2.6)	2.1 (1.7-2.7)	1.3 (1.1-1.5)	2.2 (1.7-2.8)	1.9 (1.5-2.5)	22.3 (18.1-27.3)	6.1 (4.5-8.3)
Anxiety disorder	2.6 (2.3-2.8)	2.9 (2.1-3.8)	1.7 (1.4-2.0)	2.2 (1.6-3.0)	2.4 (1.8-3.2)	16.0 (12.5-20.6)	5.3 (3.6-7.8)
Other mental disorder (including substance abuse disorder)	4.7 (4.3-5.0)	4.6 (3.6-5.8)	1.8 (1.5-2.2)	3.5 (2.7-4.6)	6.2 (5.0-7.6)	26.7 (20.8-34.3)	12.6 (9.4-17.0)
Males							
No mental disorder	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)
Schizophrenia and other non-affective psychoses	4.6 (4.2-5.0)	4.3 (3.4-5.3)	1.9 (1.5-2.5)	3.4 (2.4-4.9)	3.0 (2.1-4.1)	16.1 (12.9-20.3)	6.2 (4.5-8.6)
Affective disorder	2.8 (2.7-3.1)	2.2 (1.9-2.7)	1.5 (1.2-1.7)	3.0 (2.4-3.8)	1.4 (1.1-2.0)	17.2 (14.6-20.2)	4.9 (3.8-6.2)
Anxiety disorder	2.8 (2.5-3.0)	2.7 (2.1-3.5)	1.5 (1.2-2.0)	2.3 (1.6-3.4)	2.3 (1.7-3.2)	8.3 (6.5-10.6)	4.5 (3.4-6.1)
Other mental disorder (including substance abuse disorder)	4.8 (4.6-5.0)	3.7 (3.3-4.2)	1.9 (1.6-2.1)	3.9 (3.3-4.6)	5.5 (4.8-6.3)	12.6 (10.8-14.8)	11.8 (10.3-13.6)

* Adjusted for age

Table 3. Associations of mental disorder and substance abuse in relation to mortality (incidence rate ratios* with 95% confidence intervals)

Mental disorder group	N	All-cause mortality	Ischemic heart disease	Cancer (all types)	Avoidable mortality: Medical Care Indicators	Avoidable mortality: National Health Policy Indicators	Suicide	Death from external causes (suicide excluded)
Females								
No mental disorder	3 039 954	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)
Schizophrenia and other non-affective psychoses with substance abuse disorder	502	10.8 (7.1-16.6)	5.7 (0.8-40.4)	5.2 (2.2-12.6)	-	21.5 (8.9-51.8)	44.6 (14.3-138.8)	43.1 (13.8-134.1)
Schizophrenia and other non-affective psychoses without substance abuse disorder	10 663	3.6 (3.2-4.0)	4.1 (3.0-5.6)	1.8 (1.5-2.3)	3.5 (2.5-5.0)	1.7 (1.0-2.7)	24.2 (17.4-33.6)	5.5 (3.1-9.8)
Affective disorder with substance abuse disorder	1 919	6.4 (4.9-8.3)	3.5 (1.1-10.9)	2.7 (1.5-4.8)	3.4 (1.1-10.6)	6.5 (3.1-13.6)	61.1 (37.1-100.6)	24.1 (11.4-50.8)
Affective disorder without substance abuse disorder	35 326	2.3 (2.1-2.5)	2.1 (1.6-2.7)	1.2 (1.1-1.4)	2.2 (1.7-2.8)	1.8 (1.3-2.3)	20.3 (16.3-25.2)	5.4 (3.9-7.5)
Anxiety disorder with substance abuse disorder	1 551	7.3 (5.4-9.8)	10.9 (4.9-24.3)	2.0 (0.9-4.4)	1.7 (0.2-12.2)	6.8 (2.8-16.4)	63.1 (36.3-109.7)	22.9 (9.5-55.4)
Anxiety disorder without substance abuse disorder	31 139	2.4 (2.2-2.7)	2.6 (1.9-3.5)	1.7 (1.4-2.0)	2.2 (1.6-3.0)	2.2 (1.6-3.0)	13.8 (10.5-18.2)	4.5 (3.0-6.9)
Other mental disorder with substance abuse disorder	387	17.0 (10.4-27.7)	-	-	11.3 (1.6-80.4)	-	171.6 (85.1-346.0)	21.6 (3.0-153.5)
Other mental disorder without substance abuse disorder	10 773	2.6 (2.3-3.0)	2.9 (2.0-4.1)	1.4 (1.1-1.8)	2.6 (1.8-3.8)	0.9 (0.4-1.8)	10.0 (5.9-17.0)	1.8 (0.7-4.9)
Substance abuse disorder without a psychiatric diagnosis	9 240	7.9 (7.1-8.7)	8.4 (6.2-11.4)	2.4 (1.9-3.1)	5.3 (3.6-7.8)	13.4 (10.7-16.7)	39.8 (29.8-53.2)	28.1 (20.5-38.5)
Males								
No mental disorder	3 061 939	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)
Schizophrenia and other non-affective psychoses with substance abuse disorder	1 088	12.5 (9.8-15.9)	4.9 (1.9-13.2)	3.8 (1.7-8.4)	5.3 (1.3-21.1)	11 (5.2-23.1)	41.3 (25.6-66.7)	22.3 (12.3-40.3)
Schizophrenia and other non-affective psychoses without substance abuse disorder	10 905	4.2 (3.8-4.6)	4.3 (3.4-5.3)	1.8 (1.4-2.4)	3.4 (2.3-4.9)	2.5 (1.7-3.6)	13.9 (10.7-17.9)	4.9 (3.4-7.1)
Affective disorder with substance abuse disorder	2 237	6.7 (5.6-8.1)	5.4 (3.4-8.6)	1.6 (0.9-3.0)	5.8 (3.0-11.2)	5.3 (2.9-9.5)	43.7 (31.8-60.2)	11.3 (6.5-19.4)
Affective disorder without substance abuse disorder	21 525	2.6 (2.4-2.8)	2.0 (1.6-2.4)	1.5 (1.2-1.7)	2.8 (2.2-3.6)	1.1 (0.8-1.6)	14.5 (12.1-17.4)	4.3 (3.3-5.6)
Anxiety disorder with substance abuse disorder	1 900	9.7 (7.9-11.8)	7.7 (4.5-13.2)	2.5 (1.2-4.9)	2.5 (0.6-10.2)	8.9 (4.9-16.1)	27.7 (17.8-43.1)	24.8 (16.3-37.8)
Anxiety disorder without substance abuse disorder	19 309	2.2 (2.0-2.5)	2.4 (1.8-3.1)	1.5 (1.2-1.9)	2.3 (1.6-3.4)	1.8 (1.2-2.6)	6.5 (4.9-8.6)	2.7 (1.8-4.0)
Other mental disorder with substance abuse disorder	380	9.8 (6.7-14.4)	21.0 (11.3-39.0)	2.3 (0.6-9.1)	8.7 (2.2-35.0)	-	47.6 (22.6-100.1)	10.6 (2.7-42.5)
Other mental disorder without substance abuse disorder	9 298	2.5 (2.2-2.8)	1.7 (1.3-2.2)	1.4 (1.1-1.8)	3.5 (2.7-4.7)	1.2 (0.7-2.0)	5.4 (3.5-8.4)	2.3 (1.4-3.9)
Substance abuse disorder without a psychiatric diagnosis	24 304	6.1 (5.8-6.4)	4.8 (4.2-5.5)	2.1 (1.8-2.4)	4.0 (3.3-5.0)	7.7 (6.7-8.8)	14.8 (12.5-17.6)	16.1 (14.0-18.6)

* Adjusted for age

Table 4. Relative risk of mortality in psychiatric patients with substance abuse disorder (IRR with 95% confidence intervals)

	N	All-cause mortality	Ischemic heart disease	Cancer (all types)	Avoidable mortality: Medical Care Indicators	Avoidable mortality: National Health Policy Indicators	Suicide	Death from external causes (suicide excluded)
Females								
No substance abuse disorder	3 127 855	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)
Substance abuse disorder, alcohol	8 185	7.7 (6.9-8.5)	4.1 (0.6-29.3)	2.3 (1.8-3.0)	4.8 (3.2-7.2)	13.8 (11.1-17.2)	29.5 (22.1-39.4)	22.6 (16.0-32.0)
Substance abuse disorder, drug abuse	4 589	6.6 (5.5-8.0)	4.7 (2.3-9.4)	2.7 (1.8-4.1)	3.9 (1.9-8.2)	6.1 (3.5-10.8)	36.9 (25.8-52.8)	22.9 (13.9-37.6)
Substance abuse disorder, both alcohol and drug abuse	825	11.2 (8.0-15.7)	8.7 (6.4-11.8)	2.6 (1.0-6.9)	3.7 (0.5-26.5)	7.8 (2.5-24.1)	54.4 (28.1-105.1)	65.8 (32.7-132.4)
Males								
No substance abuse disorder	3 122 976	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)	1 (REF)
Substance abuse disorder, alcohol	20 429	5.5 (5.3-5.9)	4.8 (4.2-5.5)	2.0(1.7-2.4)	3.8 (3.1-4.7)	7.5 (6.6-8.7)	12.5 (10.4-14.9)	12.8 (10.8-15.0)
Substance abuse disorder, drug abuse	7 753	9.4 (8.4-10.6)	5.8 (3.9-8.7)	2.7 (1.7-4.1)	4.9 (2.6-9.1)	4.1 (2.4-7.0)	22.4 (17.7-28.4)	22.5 (18.0-28.3)
Substance abuse disorder, both alcohol and drug abuse	1 727	14.5 (12.2-17.2)	6.8 (3.7-12.7)	2.5 (1.2-5.2)	8.7 (3.9-19.4)	16.0 (10.0-25.4)	35.2 (24.2-51.2)	29.3 (19.6-43.9)

* Adjusted for age

Table 5. Age-standardised percentage (with 95% confidence intervals) as measures of health care quality indicators for individuals aged 40-79, 2006

Mental disorder group	N	Avoidable inpatient medical care % (95% CI)	Myocardial infarction - 28-day case fatality % (95% CI)	Lipid lowering drug therapy % (95% CI)
Females				
No mental disorder	1 961 968	1.1 (1.1-1.1)	26.5 (25.7-27.3)	56.1 (55.7-56.4)
Schizophrenia and other non-affective psychoses	8 413	2.9 (2.6-3.3)	53.5 (42.0-65.0)	40.9 (36.8-45.1)
Affective disorder	22 833	2.4 (2.2-2.6)	34.8 (26.5-43.2)	51.9 (49.0-54.8)
Anxiety disorder	17 078	3.0 (2.7-3.3)	36.1 (28.8-43.4)	54.9 (50.9-58.8)
Other mental disorder (including substance abuse disorder)	11 171	4.1 (3.7-4.5)	45.0 (35.8-54.3)	49.0 (44.8-53.1)
Males				
No mental disorder	1 931 860	1.6 (1.5-1.6)	28.1 (27.5-28.6)	56.2 (55.9-56.5)
Schizophrenia and other non-affective psychoses	7 864	3.8 (3.3-4.4)	51.4 (40.4-62.3)	41.9 (37.2-46.5)
Affective disorder	15 502	3.4 (3.1-3.7)	39.2 (32.6-45.7)	53.8 (50.8-56.8)
Anxiety disorder	11 126	4.4 (3.9-4.9)	32.5 (23.1-42.0)	56.4 (51.9-60.8)
Other mental disorder (including substance abuse disorder)	22 762	5.4 (5.1-5.7)	43.9 (38.6-49.1)	44.2 (41.7-46.7)

bmjopen-2011-000778 - Quality of medical care and excess mortality in
 psychiatric patients - a nationwide register-based study in Sweden
 STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

	Item No	Recommendation
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract Page 1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found Page 3
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Page 4
Objectives	3	State specific objectives, including any prespecified hypotheses Page 5
Methods		
Study design	4	Present key elements of study design early in the paper Page 6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Page 6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up Page 6
		(b) For matched studies, give matching criteria and number of exposed and unexposed N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Page 6 - 8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group Page 6 - 8
Bias	9	Describe any efforts to address potential sources of bias N/A
Study size	10	Explain how the study size was arrived at Page 6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why N/A
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding Page 8 - 9
		(b) Describe any methods used to examine subgroups and interactions N/A
		(c) Explain how missing data were addressed N/A
		(d) If applicable, explain how loss to follow-up was addressed N/A

(e) Describe any sensitivity analyses

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed Page 10 and page 20 (b) Give reasons for non-participation at each stage N/A (c) Consider use of a flow diagram N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders Page 20 (b) Indicate number of participants with missing data for each variable of interest N/A (c) Summarise follow-up time (eg, average and total amount) Page 20
Outcome data	15*	Report numbers of outcome events or summary measures over time Page 10 and page 20
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included Page 10-11 and page 21-23 (b) Report category boundaries when continuous variables were categorized N/A (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses Page 11 and page 24
Discussion		
Key results	18	Summarise key results with reference to study objectives Page 2 and page 12 – 16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias Page 2 and page 12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Page 12 – 16
Generalisability	21	Discuss the generalisability (external validity) of the study results Page 15
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based Page 16

*Give information separately for exposed and unexposed groups.