



Contents lists available at ScienceDirect

Journal of Psychiatric Research

journal homepage: www.elsevier.com/locate/psychires

The impact of psychiatric illness on suicide: Differences by diagnosis of disorders and by sex and age of subjects

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ARTICLE INFO

Article history:

Received 7 January 2011

Received in revised form

1 May 2011

Accepted 1 June 2011

Keywords:

Suicide

Psychiatric disorders

Incidence rate ratio

Population attributable risk

Population study

Epidemiology

ABSTRACT

People with a psychiatric illness are at high risk for suicide; however, variation of the risk by patients' sex and age and by specific diagnosis needs to be explored in a more detail. This large population study systematically assesses suicide incidence rate ratio (IRR) and population attributable risk (PAR) associated with various psychiatric disorders by comparing 21,169 suicides in Denmark over a 17-year period with sex-age-time-matched population controls. The study shows that suicide risk is significantly increased for persons with a hospitalized psychiatric disorder and the associated risk varies significantly by diagnosis and by sex and age of subjects. Further adjustment for personal socioeconomic differences eliminates the IRRs associated with various disorders only to a limited extend. Recurrent depression and borderline personality disorder increase suicide risk the strongest while dementia increases the risk the least for both males and females. The influence of various disorders generally weakens with increasing age; however, there are important exceptions. Schizophrenia affects people aged ≤ 35 years the strongest in terms of both IRR and PAR. Recurrent depression increases suicide risk particularly strong in all age groups and the associated PAR increases steadily with age. Borderline personality disorder has a strong effect in young people, especially those ≤ 35 years. Alcohol use disorder accounts the highest PAR of suicides in males of 36–60 years old. For the elderly above 60 years old, reaction to stress and adjustment disorder increases the risk for suicide the most in both sexes. These findings suggest that approaches to psychiatric suicide prevention should be varied according to diagnosis and sex and age of subjects.

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1. Objectives of the study

Suicide in people with psychiatric illness is a major health concern in many countries. Evidence, from both clinical and population-based studies, has consistently demonstrated that patients with various psychiatric disorders are at an excess mortality of suicide (Harris and Barraclough, 1997) and that a history of psychiatric illness is the strongest risk factor for suicide in the general population (Cheng, 1995; Foster et al., 1997; Hawgood and De Leo, 2008; Oldham, 2006; Osborn et al., 2008; Saha et al., 2007). Our previous studies, based on data from Danish national population registers, have confirmed these findings and further indicated a significant gender difference in suicide risk associated with a history of hospitalized psychiatric illness (Qin et al., 2000; Qin and Nordentoft, 2005; Qin et al., 2003). Meanwhile, it has been evident that suicide risk in relation to psychiatric illness differs according to diagnosis, e.g., from schizophrenia, depression

to substance use disorders (Borcusa and Iacono, 2007; Harris and Barraclough, 1997; Qin and Nordentoft, 2005).

In general, the impact of psychiatric illness on suicide differentiates by important factors such as specific diagnosis of disorders, sex and age of patients. Systematic studies taking these factors into consideration could provide valuable insights for making strategies to reduce suicidal behavior among this high risk population. In the present study I extend our early research to investigate in a more detail suicide risk in relation to psychiatric illness according to specific diagnosis of disorders and by sex and age of subjects. I also want to assess diagnosis-specific population attributable risk (PAR) – a measurement that takes into account both the effect size on suicide and the prevalence of exposure in the population.

2. Materials and methods

2.1. Settings

This study is based on the entire 5.2 million population of Denmark (Pedersen et al., 2006), a country where hospital treatment is free of charge for all residents. Individual data were

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retrieved from several Danish longitudinal registers including the Cause-of-Death Register (Juel and Helweg-Larsen, 1999), the Danish Psychiatric Central Register (Munk-Jorgensen and Mortensen, 1997), and the Integrated Database for Labour Market Research (so-called IDA Database) (Danmarks Statistik, 1991). Details about these registers were described elsewhere in our previous studies (Qin et al., 2003).

Briefly, the Cause-of-Death Register (Juel and Helweg-Larsen, 1999), records cause and date of all deaths in Denmark with computerized data available from 1969 and onwards. The Danish Psychiatric Central Register (Munk-Jorgensen and Mortensen, 1997) covers all psychiatric facilities in Denmark and cumulatively records all admission and discharge information with computerized data since 1969. Diagnoses of illness and causes of death in Danish medical registers are coded according to the 8th edition of the International Classification of Diseases (ICD-8) until the end of 1993 and according to the 10th edition (ICD-10) thereafter. In general, diagnoses of psychiatric illness are made by psychiatrists but are not systematically validated against research diagnostic criteria according to ICD-10/DSM IV (Munk-Jorgensen and Mortensen, 1997). Before the data are transferred to the Danish Psychiatric Central Register, the data undergo intensive validation from psychiatric hospitals, departments, outpatient clinics, and community psychiatrists (Munk-Jorgensen and Mortensen, 1997). Mortality data, collected by the Danish National Board of Health, is based upon information from the death certificates which are filled in by physicians (Juel and Helweg-Larsen, 1999). In case the cause of a death is uncertain, the police will require a forensic medical examination. In accordance to previous studies on suicide in Denmark, I included only suicide cases for which the coroner's verdict was "suicide" by contrast to some studies from other countries that include cases of undetermined cause.

The IDA Database (Danmarks Statistik, 1991) contains longitudinal information on labor market conditions and socio-demographic information for all residents in Denmark from 1980 and onwards. Personal data on socioeconomic status for a given calendar year are complete only for persons who are living in Denmark on December 31st of that year. The personal identifier (the so-called CPR-number), assigned to all Danes at birth and to new residents of Denmark (Pedersen et al., 2006), was used as a key to retrieve and merge individual data from different register databases.

2.2. Study subjects

From the Cause-of-Death Register, all definite suicides in Denmark from the year 1981–1997 were identified (codes E950–959 in ICD-8 or X60–84 in ICD-10). Subjects who were not residing in Denmark on December 31 of the preceding year were not included because their socioeconomic data in the IDA database were incomplete. The final cases comprise 13,681 male and 7488 female suicides which accounts for 99.64% of the total suicide deaths in Denmark during the study period.

Through a nested case–control design (Clayton and Hills, 1993), up to 20 live controls per suicide case, matched for sex, age and date of suicide, were recruited from the general population in Denmark. To make the selection process manageable and to minimise the computational burden, controls were randomly drawn from a 5% representative sample of the national population. If more than 20 eligible controls were available for a suicide case, 20 controls were randomly chosen from that group. In a few cases of suicide involving people older than 93 years, it was not possible to find 20 controls, then all available controls were included. With this risk set

sampling procedure, 273,371 male and 149,757 female population controls were enrolled into the study.

2.3. Data on psychiatric disorders and confounders

Personal data on psychiatric illness from April 1, 1969 to the date of suicide or index match date of controls were retrieved from the Danish Psychiatric Central Register. In order to minimize the complexity of co-morbidity handling, I considered only the main diagnosis at the most recent psychiatric hospitalization prior to the time of suicide or matching. The disorders were categorized into 13 diagnostic groups, as shown in the panel (Table 1), primarily according to the ICD-10 chapter heading groups about psychiatric illnesses. Conversion from ICD-8 codes to ICD-10 codes was made according to the WHO recommendation (World Health Organization, 1994) in combination with the Danish Disease Classification System (Sundhedsstyrelsen [The Danish National Board of Health], 1988). ICD-9 was never used in the Danish medical system.

Personal information on marital status (living as a single, cohabitating or being married), income level (categorized into quartiles according to the sex-age-specific income levels in the population) and place of residence (the Capital and its suburbs, provincial cities or the rest area of the country) was considered for adjustment because these variables were highly associated with both suicide and mental illness in Denmark (Byrne et al., 2003; Kessing et al., 2003; Mortensen et al., 2003; Qin et al., 2003). Data on these variables were retrieved from the IDA database based on the records in the preceding year of suicide.

2.4. Statistical analysis

The risks of suicide associated with various psychiatric disorders were computed using conditional logistic regression with the PhReg procedure in SAS version 9 (SAS Institute Inc., NY). Because the comparison controls were randomly sampled from individuals at risk for suicide at the time, i.e., risk set sampling, the estimated odds ratios in this study are unbiased estimates of incidence rate ratios (IRR) (King and Zeng, 2002). The estimates were calculated separately for males and females because our early study (Qin et al., 2003) indicated that the influence of psychiatric history on suicide differed significantly by sex. Crude IRRs were adjusted for age and

Table 1

ICD codes used for categorization of diagnostic group of psychiatric disorders.

Diagnostic groups	Codes in ICD-8, 1969–1993	Codes in ICD-10, 1994–1997
Schizophrenia	295	F20, F25
Other schizophrenia spectrum disorders	297, 298.2, 298.3, 298.8, 298.9, 301.0, 301.2	F21–F24, F26–F29, F60.0, F60.1
Bipolar disorders	296.1, 296.3	F30, F31
Recurrent depression	296.2, 296.8, 296.9	F33
Other affective disorders	296.0, 298.0, 298.1, 300.4, 301.1	F32, F34–F39
Borderline personality disorders	301.3, 301.83	F60.3
Other personality disorders	301.4–301.7, 301.8 (excl. 301.83), 301.9	F60.2, F60.4–F60.9, F61
Reaction to severe stress or adjustment disorders	307	F43
Other anxiety disorders	300.0, 300.2, 300.3	F40, F41, F42
Substance use disorders	304, 294	F11–F19
Alcohol use disorders	303, 291	F10
Dementia	290, 293.0, 293.1, 293.4, 293.9	F00–F03
Other psychiatric disorders	codes not listed above	codes not listed above

calendar time through matching. Adjusted IRRs were further adjusted for marital status, income and place of residence. Differences in risk estimates between diagnostic groups were tested with Wald test. Interaction by age was additionally examined through the likelihood ratio test. Population attributable risk (PAR) – a measure indicating that the proportion of suicides would be prevented if the risk associated with a specific exposure could be reduced to the level of reference group – was calculated based upon the adjusted IRR from the joint analysis and the distribution of exposure in the cases (Bruzzi et al., 1985).

2.5. Ethical consideration

The study used data from existing registers and did not involve personal contact to study subjects. Approval for data access was obtained from the Danish Data Protection Agency.

3. Results

In the study population, 37% of male and 57% of female suicide cases had a recorded history of hospitalization because of psychiatric illness (Table 2). By age group, the prevalence was 38.7%, 43.6% and 25.7%, respectively, for male suicides aged ≤ 35 years, 36–60 years and >60 years, whilst it was 57.1%, 65.1% and 46.8%, respectively, for female suicides of the corresponding age groups (Table 3). The most commonly diagnosed disorder was schizophrenia for suicides ≤ 35 years old and recurrent depression for victims above 60 years old. For those between 36 and 60 years old, alcohol use disorder was most commonly diagnosed in males while other personality disorder was the most common in females. Details of distribution by diagnostic groups are shown in the Table 2 and Table 3.

Conditional logistic regression analysis demonstrated that suicide risk was significantly increased for people with a history of hospitalization because of any type of psychiatric disorders (Table 2). Further adjustment for personal socioeconomic status eliminated the IRRs associated with various disorders only to a limited extend. For male subjects, the increased risk was substantially high for individuals diagnosed with a recurrent depression, borderline personality disorder, other affective disorder, and reaction to stress and adjustment disorder. For female subjects, the risk was substantially high for those diagnosed with borderline personality disorders, bipolar disorders, recurrent depression, and substance or alcohol use disorders. Dementia increased the risk for suicide at the lowest level for both males and females.

At the same time, suicide risks associated with various psychiatric disorders exhibited great variation by age of subjects (Table 3; Test of age interaction: $\chi^2 = 317.6$, $p < 0.001$ for males, $\chi^2 = 300.1$, $p < 0.001$ for females). In general, the risks associated with various disorders declined with the increase of age, although there were some exceptions (Table 3). For people ≤ 35 years old, recurrent depression and schizophrenia increased the risk for suicide the most in both males and females. For adults of 36–60 years old, recurrent depression elevated suicide risk the strongest in males whereas borderline personality disorders elevated the risk the strongest in females. For the elderly aged 60 years or above, the highest risk for suicide was associated with a diagnosis of reaction to stress and adjustment disorders.

When Transforming the exposure prevalence and the associated IRR into population attributable risk (PAR), the results (Table 4) indicate that a hospitalized psychiatric illness accounted for 36.1%, 39.2%, and 22.3%, respectively, of male suicides aged ≤ 35 years, 35–60 years, and >60 years respectively, and 32.5% of the total

Table 2

Distribution of psychiatric disorders diagnosed during the most recent hospitalization and associated risk for subsequent suicide completion in males and females, respectively.

Psychiatric Disorders	Distribution (%)		Risk for suicide	
	Cases	Controls	Crude IRR	Adjusted IRR
Male subjects	<i>N</i> = 13681	<i>N</i> = 273371		
No admission history	8622 (63.0)	261939 (95.8)	1	1
Schizophrenia	494 (3.6)	948 (0.4)	16.6 (14.8–18.5)	9.5 (8.4–10.7)
Other schizophrenic disorders	351 (2.6)	661 (0.2)	16.6 (14.5–19.0)	11.7 (10.2–13.4)
Bipolar disorders	147 (1.1)	308 (0.1)	14.5 (11.8–17.7)	11.5 (9.3–14.2)
Recurrent depression	562 (4.1)	745 (0.3)	22.7 (20.3–25.5)	21.4 (19.0–24.0)
Other affective disorders	533 (3.9)	884 (0.3)	18.9 (16.9–21.2)	15.9 (14.2–17.9)
Borderline personality disorders	129 (0.9)	171 (0.1)	23.4 (18.5–29.6)	16.6 (13.0–21.2)
Other personality disorders	547 (4.0)	1526 (0.5)	11.7 (10.6–13.0)	8.3 (7.5–9.2)
Reaction to stress/adjustment disorders	583 (4.2)	991 (0.4)	19.0 (17.1–21.2)	15.5 (13.9–17.3)
Other anxiety disorders	63 (0.5)	248 (0.1)	8.3 (6.3–11.0)	7.2 (5.4–9.6)
Alcohol use disorders	935 (6.8)	2438 (0.9)	12.8 (11.8–13.8)	8.2 (7.5–8.9)
Drug use disorders	238 (1.7)	432 (0.2)	17.4 (14.7–20.5)	10.7 (9.0–12.7)
Dementia	97 (0.7)	552 (0.2)	4.9 (3.9–6.1)	3.4 (2.7–4.3)
Other psychiatric disorders	380 (2.8)	1528 (0.5)	7.7 (6.9–8.7)	5.8 (5.2–6.6)
Female subjects	<i>N</i> = 7488	<i>N</i> = 149757		
No admission history	3231 (43.1)	141199 (94.3)	1	1
Schizophrenia	272 (3.6)	450 (0.3)	26.1 (22.3–30.7)	19.3 (16.3–22.7)
Other schizophrenic disorders	290 (3.8)	659 (0.4)	20.6 (17.8–23.9)	17.5 (15.0–20.3)
Bipolar disorders	170 (2.3)	256 (0.2)	30.1 (24.6–36.9)	26.5 (21.5–32.5)
Recurrent depression	754 (10.1)	1073 (0.7)	30.6 (27.6–34.0)	29.7 (26.7–33.0)
Other affective disorders	570 (7.6)	1216 (0.8)	21.6 (19.4–24.2)	19.9 (17.8–22.2)
Borderline personality disorders	128 (1.7)	75 (0.1)	72.5 (53.7–97.8)	55.5 (40.9–75.3)
Other personality disorders	609 (8.1)	1300 (0.9)	22.3 (20.1–24.9)	19.0 (17.0–21.2)
Reaction to stress/adjustment disorders	416 (5.6)	719 (0.5)	26.5 (23.2–30.1)	22.8 (19.9–26.0)
Other anxiety disorders	110 (1.5)	500 (0.3)	10.5 (8.5–13.1)	9.8 (7.9–12.2)
Alcohol use disorders	289 (3.9)	454 (0.3)	30.3 (26.1–35.8)	24.1 (20.5–28.4)
Drug use disorders	180 (2.4)	251 (0.2)	30.1 (24.6–37.0)	26.1 (21.2–32.1)
Dementia	67 (0.9)	343 (0.2)	5.8 (4.3–7.7)	5.7 (4.3–7.5)
Other psychiatric disorders	402 (5.4)	1262 (0.8)	13.7 (12.3–15.3)	12.9 (11.4–14.6)

Note: Crude IRRs were adjusted for age and calendar time through matching. Adjusted IRRs were further adjusted for marital status, income, and place of residence.

Table 3
Distribution of psychiatric disorders diagnosed during the recent psychiatric hospitalization and associated risk for subsequent suicide completion, by sex and age groups.

Psychiatric Disorders	Number: cases/controls			Adjusted IRR		
	Subjects ≤35 years old	Subjects 36–60 years old	Subjects >60 years old	Subjects ≤35 years old	Subjects 36–60 years old	Subjects >60 years old
Male subjects	3140/62800	6366/127320	4175/83251			
No admission history	1926/60830	3593/120710	3103/80399	1	1	1
Schizophrenia	257/268	220/539	17/141	29.9 (16.3–24.4)	8.4 (7.0–10.0)	1.5 (0.9–2.5)
Other schizophrenic disorders	101/108	181/355	69/197	19.7 (14.6–26.5)	12.6 (10.4–15.2)	6.7 (5.0–8.9)
Bipolar disorders	23/34	93/161	31/113	20.8 (11.8–36.7)	14.5 (11.0–19.0)	5.9 (3.9–8.9)
Recurrent depression	51/31	270/319	241/395	50.4 (31.1–81.9)	26.0 (21.9–31.0)	15.3 (12.9–18.2)
Other affective disorders	56/58	272/489	205/337	26.5 (17.7–39.7)	15.4 (13.1–18.1)	14.2 (11.9–17.1)
Borderline personality disorders	70/83	58/80	1/8	19.2 (13.5–27.4)	17.4 (12.1–24.9)	– ^a
Other personality disorders	155/326	328/1006	64/194	10.8 (8.7–13.5)	7.9 (6.9–9.1)	7.3 (5.4–9.8)
Reaction to stress/adjustment disorders	125/183	347/696	111/112	19.6 (15.2–25.3)	13.1 (11.4–15.1)	24.7 (18.8–32.5)
Other anxiety disorders	11/37	37/151	15/60	8.1 (4.0–16.5)	7.5 (5.2–11.0)	6.0 (3.3–10.7)
Alcohol use disorders	153/241	661/1793	121/404	15.4 (12.2–19.5)	7.9 (7.1–8.8)	5.9 (4.8–7.4)
Drug use disorders	112/150	92/205	34/77	11.8 (8.9–15.6)	10.3 (7.9–13.5)	9.4 (6.2–14.4)
Dementia	3/3	40/118	54/431	– ^a	7.2 (5.0–10.5)	2.3 (1.7–3.2)
Other psychiatric disorders	97/448	174/698	109/382	5.1 (4.0–6.5)	6.4 (5.3–7.6)	6.2 (4.9–7.7)
Female subjects	1002/20040	3557/71140	2929/58577			
No admission history	430/19475	1243/66512	1558/55212	1	1	1
Schizophrenia	90/27	141/250	41/173	136.9 (80.5–232.8)	22.4 (17.7–28.2)	6.5 (4.5–9.2)
Other schizophrenic disorders	53/27	152/328	85/304	95.3 (53.3–170.4)	22.1 (17.8–27.4)	9.4 (7.2–12.1)
Bipolar disorders	15/11	107/139	48/106	47.0 (19.3–114.3)	35.2 (26.9–46.2)	15.4 (10.8–22.0)
Recurrent depression	48/25	324/398	382/650	145.1 (79.5–264.7)	40.3 (34.1–47.6)	20.6 (17.9–23.7)
Other affective disorders	43/53	285/610	242/553	39.1 (24.2–63.1)	22.5 (19.2–26.5)	15.4 (13.1–18.2)
Borderline personality disorders	50/20	75/49	3/6	85.7 (47.3–155.2)	62.0 (42.1–91.5)	– ^a
Other personality disorders	85/120	383/883	141/297	26.6 (18.8–37.6)	20.4 (17.7–23.6)	16.2 (13.1–20.1)
Reaction to stress/adjustment disorders	52/82	247/483	117/154	25.8 (16.9–39.5)	23.3 (19.6–27.7)	24.4 (18.9–31.4)
Other anxiety disorders	8/30	71/371	31/99	17.0 (7.2–39.9)	9.3 (7.1–12.2)	12.0 (7.9–18.3)
Alcohol use disorders	34/22	217/339	38/93	52.5 (28.3–97.6)	27.2 (22.4–33.0)	13.5 (9.1–20.1)
Drug use disorders	38/26	91/122	51/103	55.8 (30.7–101.7)	31.8 (23.7–42.7)	16.5 (11.6–23.5)
Dementia	1/0	17/38	49/305	– ^a	19.8 (10.9–36.1)	4.1 (3.0–5.6)
Other psychiatric disorders	55/122	204/618	143/522	17.8 (12.2–26.0)	16.1 (13.5–19.3)	9.4 (7.7–11.4)

Notes: Adjusted IRRs were adjusted for marital status, income, and place of residence as well as age and calendar time through matching. Test for interaction by age: $\chi^2 = 317.6$, $df = 26$, $p < 0.0001$ for male subjects, $\chi^2 = 300.1$, $df = 26$, $p < 0.0001$ for female subjects.

^a The estimates are not presented because of too few cases or controls with the exposure.

male suicides. The corresponding fractions were 55.7%, 62.3%, 43.3%, and 53.9% of female suicides. The three diagnoses with the highest PAR were alcohol use disorders (6.0%), reaction to stress and adjustment disorders (4.0%) and recurrent depression (3.9%) in males. While they were recurrent depression (9.8%), other personality disorders (7.7%) and other affective disorders (7.2%) in female subjects. For suicide in people ≤35 years old, schizophrenia contributed to the PAR at the largest fraction in both sexes, followed by personality disorders. For middle age adults, the largest fraction of PAR was accounted by alcohol use disorders in males while it was other personality disorders and recurrent depression in females. Recurrent depression contributed the largest PAR of suicides above 60 years old for both sexes.

4. Discussion

4.1. Strengths and limitations

In Denmark, all residents have equal access to psychiatric hospitals and hospital treatment is free of charge, ensuring that all psychiatric admissions are represented in the Danish Psychiatric Central Register. The decision of admitting a patient for hospital treatment is based upon the clinical evaluation from psychiatrists. These advantages enable us to obtain precise information about personal history of hospitalized psychiatric illness and our data are not subject to differences in access to psychiatric care by socio-economic status. At the same time, the longitudinal data on individual psychiatric contacts was retrospectively collected back to

1969. Although the coverage period of psychiatric information is not lifetime for individuals at high ages, the data used for this study should be amongst the ones with the most complete historical data that has been collected systematically and independently of any research purpose.

On the other hand, with the focus on psychiatric illness that required a hospitalization, the data in the present study represent a spectrum of severe psychiatric disorders. Also, it is not possible to assess the influence of psychiatric disorders that are mild and only result in contacts to outpatient clinics or primary health care because such data was not available for the present study. Meanwhile, focusing on the main diagnosis during the recent hospitalization provides a straightforward comparison across diagnoses; however, it also leaves possible influence due to coexisting psychiatric diagnoses unconsidered. In addition, our data on personal psychiatric history covered a long retrospective period in which there were some changes of diagnostic criteria of psychiatric disorders and suicide from ICD-8 to ICD-10 (Pearson-Nelson et al., 2004), it was uncertain how this could affect our data on any specific diagnosis. With the risk set sampling method for comparison controls, however, this would have limited influence on our results to reflect the general impact of various psychiatric disorders on risk for subsequent suicide completion.

4.2. Findings and explanations

This study, based on longitudinal data covering the entire national population of Denmark, provides a robust overview on

Table 4

Population attributable risk (PAR) of suicide associated with various psychiatric disorders.

Psychiatric disorders	Subjects ≤ 35 years old	Subjects 36–60 years old	Subjects > 60 years old	Total subjects
<i>Male subjects</i>				
Schizophrenia	7.8	3.0	0.1	3.2
Other schizophrenic disorders	3.1	2.6	1.4	2.3
Bipolar disorders	0.7	1.4	0.6	1.0
Recurrent depression	1.6	4.1	5.4	3.9
Other affective disorders	1.7	4.0	4.6	3.7
Borderline personality disorders	2.1	0.9	–	0.1
Other personality disorders	4.5	4.5	1.3	3.5
Reaction to stress/adjustment disorders	3.8	5.0	2.6	4.0
Other anxiety disorders	0.3	0.5	0.3	0.4
Alcohol use disorders	4.6	9.1	2.4	6.0
Drug use disorders	3.3	1.3	0.7	1.6
Dementia	–	0.5	0.7	0.5
Other psychiatric disorders	2.5	2.3	2.2	2.3
Total	36.1	39.2	22.3	32.5
<i>Female subjects</i>				
Schizophrenia	8.9	3.8	1.2	3.4
Other schizophrenic disorders	5.2	4.1	2.6	3.7
Bipolar disorders	1.5	2.9	1.5	2.2
Recurrent depression	4.7	8.9	12.4	9.8
Other affective disorders	4.2	7.7	7.7	7.2
Borderline personality disorders	4.9	2.1	–	1.7
Other personality disorders	8.2	10.2	4.5	7.7
Reaction to stress/adjustment disorders	5.0	6.6	3.8	5.3
Other anxiety disorders	0.8	1.8	1.0	1.3
Alcohol use disorders	3.3	5.9	1.2	3.7
Drug use disorders	3.7	2.5	1.6	2.3
Dementia	–	0.4	1.3	0.7
Other psychiatric disorders	5.2	5.4	4.4	4.9
Total	55.7	62.3	43.3	53.9

Note: PARs were calculated based upon the adjusted IRR from the joint analysis and the distribution of exposure in the cases.

suicide risk in relation to hospitalized psychiatric illness across diagnoses of disorder and by sex and age of subjects. It demonstrates that suicide risk is significantly increased for people with any type of psychiatric disorders, and that the increased risk varies significantly by diagnosis, sex and age group and could not be explained by differences in socioeconomic status. At the same time, most psychiatric disorders tend to have a stronger effect on suicide in young people than the elderly, but there are important exceptions.

4.2.1. Schizophrenia and spectrum disorders

Suicide is the leading cause of early mortality in people with schizophrenia – the most severe psychiatric illness – with a life-time risk of suicide nearly 5% according to a meta-analysis (Palmer et al., 2005). The present study adds to the existing evidence (Harris and Barraclough, 1997; Osborn et al., 2008) demonstrating a significantly increased risk for suicide associated with schizophrenia – about 10 times for male and 20 times for female subjects after adjustment for the effect of socioeconomic variables. This study moreover pinpoints that schizophrenia affects young people the strongest in terms of both the increased IRR and the PAR for suicide deaths. This disorder increases suicide risk about 30 and 140 times for male and female subjects ≤ 35 years old, respectively, and accounts for 7.8% of male and 8.9% of female suicides of this age group. For individuals at higher ages, the influence of schizophrenia weakens dramatically with a limited effect on elderly suicide. These results are well concordant with the nature of schizophrenia of its early age of onset, its frequent relapse and hospitalizations as well as its chronic course. Being diagnosed with schizophrenia at a young age can inflict a great burden on the patients, causing extensive damage and loss situations in various areas of psychosocial functioning. The weakened influence of schizophrenia on suicide in the elderly is probably due to the stabilization of the illness and to the fact that most loss situations resulted from the

disorder have already occurred in the course of the illness (Mortensen and Juel, 1993; Harris and Barraclough, 1997).

The present study also shows that other schizophrenia spectrum disorders than schizophrenia also increase the risk for suicide, and that their influence is not as intensive in young people as is schizophrenia. Such results may be explained by the fact that this group of disorders comprises mainly persistent delusional disorders and acute or transient psychotic disorders which attacks and therefore likely increases suicide risk for individuals from low to high ages at a comparable strength. On the other hand, these diagnoses may be revised in the further course of the illness and often develop into a diagnosis of schizophrenia. It is therefore not surprising to observe a strong effect of them on suicide.

4.2.2. Affective disorders

The present study demonstrates that, across all psychiatric illnesses, affective disorders, in particularly recurrent depression, carry the highest risk for subsequent suicide for both males and females in almost all age groups, and that their PAR for suicide increases incrementally with the increase of age. It has been reported that suicide accounts for 9%–15% of deaths among persons with affective disorders, although the rate could be as low as 4% among persons with mild affect disorders (Bostwick and Pankratz, 2000). Later-life is a period of particular vulnerability in relation to affective disorders which could contribute to almost three-fourth of all suicide attempts or completions among people older than age 55 (Beautrais, 2002). The findings from the present study are therefore consistent with relevant reports in the literature (Kessler et al., 1999; Harris and Barraclough, 1997) and our early studies (Mortensen et al., 2000; Qin and Nordentoft, 2005; Qin et al., 2003), but provide further insight by uncovering variations of associated suicide risk across bipolar disorder, recurrent depression and other affective disorders as well as their effect differences by sex and age of subjects.

This study highlights a notable influence of recurrent depression on suicide, which, relative to the influence of bipolar disorder and other affective disorders as well as psychiatric illness as a whole, is particularly strong for all patients regardless of sex and age. Although the highly increased IRR associated with recurrent depression weakens with age, its PAR for suicide increases steadily by age, indicating that many people at high ages have suffered from this disorder when ending their life. In clinics, recurrent depression is characterized by recurrent episodes of an all-encompassing low mood accompanied by low self-esteem and loss of interest or pleasure in activities normally considered enjoyable. These disabling conditions can adversely affect a person's family, work and social life, sleeping and eating habits, and general health on one hand; on the other hand, the occurrence and persistence of depression are often strongly correlated with both adverse events and personal characteristics like coping skill and personality traits (Burcusa and Iacono, 2007). The unusually high suicide risk may well be a combined result of these factors.

4.2.3. Personality disorders

In the literature, few large scale population studies have addressed the relationship between suicide completion and personality disorders. This study contributes to the literature demonstrating that personality disorders represent a major risk and contributing factor for suicide death in both males and females. The study is, to my awareness, probably the first population study to report that borderline personality disorder (also called emotionally unstable personality disorder) carries a particularly high risk for suicide in young and middle age adults, at a level of severity comparable to schizophrenia and recurrent depression. Other personality disorders (excluding paranoid and schizoid personality disorders which were grouped into schizophrenia spectrum disorders) increase suicide risk to a less extent compared with borderline personality disorder, but the associated PAR is prominently high, especially for suicides of middle age females, reflecting the general commonness of these disorders in this population.

In general, personality disorder is defined as an enduring pattern of inner experience and behavior that deviate markedly from the culturally expected and accepted range, and includes a variety of conditions and behavior patterns of clinical significance (World Health Organization, 1996; American Psychiatric Association, 1994). A diagnose of personality disorders may be somewhat subjective; however, the inflexible and pervasive behavioral patterns often cause serious personal and social difficulties as well as a general functional impairment. Such experiences and possibly induced conflicts, rejection, isolation, marginalization and stigmatization from the others make suicide a likely choice for patients with the disease (Hawton & van Heeringen, 2009). This notation may well explain the strong influence of personality disorder on suicide observed in the present study.

Borderline personality disorder has a prolonged disturbance of personality function characterized by depth and variability of moods, with onset of symptoms typically occurring during late adolescence or young adulthood (Bradley et al., 2005). Individuals with this disorder can be very sensitive to the way the others treat them, reacting strongly to perceived criticism or hurtfulness. Although empirical research about this disorder is limited, evidence has shown that individuals with borderline personality disorder are at high risk for developing other psychological disorders such as anxiety and depression (Andover et al., 2005). The present study further demonstrates that they are also at a particularly high risk for suicide completion, especially in people at young ages.

4.2.4. Reaction to stress and adjustment disorders and other anxiety disorders

Anxiety disorder is a blanket term covering several different forms of abnormal and pathological fear and anxiety. Reaction to stress and adjustment disorder is one major type of anxiety disorders and is often triggered by a specific stimulus, condition or a traumatic experience (American Psychiatric Association, 1994; World Health Organization, 1996). The present study demonstrates that reaction to stress and adjustment disorder is outperforming many other diagnoses in terms of both increased IRR and contributed PAR for suicide, and more interestingly that, its influence tends to increase with age. For the elderly above 60 years old, it increases suicide risk the strongest among all diagnostic groups with a particularly notable effect on male subjects. Other anxiety disorders (including phobic anxiety disorder, panic and generalized anxiety disorder and obsessive-compulsive disorder) increase the risk for suicide slightly and their PAR for suicide is generally small.

Traditionally, anxiety disorders were not viewed as independent risk factors for suicidal behavior. More recent studies, however, have sought to determine whether these disorders carry their own independent risks of suicide. Based on existing evidence, a recent review suggests that specific anxiety disorders may be independently associated with suicidality, to which they particularly contribute when they are co-morbid with other severe psychiatric disorders (Gradus et al., 2010; Hawgood and De Leo, 2008; Panagioti et al., 2009).

Reaction to stress and adjustment disorders, of which a particular form is post-traumatic stress disorder, is often a short-term condition that occurs when a person is unable to cope with or adjust to a particular source of stress (Goldsmith et al., 2002). Therefore, it is possible that this illness functions as a mediating variable between exposure to a stressful condition and subsequent suicidal behavior (Panagioti et al., 2009). Their particularly strong influence on the elderly suicide may be induced by the bereavement of losing the spouse. On the other hand, many people facing stressful conditions do not develop reaction to stress and adjustment disorder, and even among those with this disorder only a small part of them eventually commit suicide – suggesting a personal vulnerability state that may predispose to suicide in subjects who are exposed to the stress while trapped in an invalidating non-supportive environment.

4.2.5. Alcohol and substance use disorders

The diagnostic group of alcohol and substance use disorders, in accordance to ICD-10, refers to mental and behavioral disorders due to psychoactive substance use (World Health Organization, 1996). It is well-documented that alcohol and substance use disorder, alone or co-morbid with other psychiatric illness, significantly increases the risk for suicide (Oquendo et al., 2010; Schneider, 2009). The findings from the present study are in accordance with the literature, and further indicate that alcohol and substance use disorders outperform many other psychiatric disorders on the risk for suicide, regardless of sex and age group. Substance use disorder has a strong influence on suicide in young people whereas alcohol use disorder has a substantially strong effect in middle age adults.

The role of alcohol intoxication in suicidal behavior is profound. It is reported that alcohol is involved in up to 64% of suicide attempts or completions, and alcohol dependence confers about 7% lifetime risk of suicide (Inskip et al., 1998). When considering only alcohol use disorder as the main cause in the recent hospitalization, this study shows that 6.8% of male and 3.9% of female suicides were admitted for such a diagnosis and the prevalence was even up to 10.4% for male suicides of 36–60 years old. Since alcohol abuse is often co-morbid with other psychiatric disorders, evidence has

indicated a substantial influence of such morbidity, meaning that there is a greater risk for suicide among people who abuse alcohol and suffer from e.g. depressive disorders than among people with major depression or alcoholism alone (Preuss et al., 2006; Goldberg et al., 2001). In the mean time, the present study, in accordance with early reports, shows that abusing illicit drugs was common among young suicides and accounted for more than 3% of the PAR of youth suicides in both sexes. Although abuse of illicit drugs is less common in other age groups, it increases risk for suicide persistently strong in all age groups. Overall, alcohol and substance use disorder, as the second most common disorder after affective disorder, influences suicide tremendously, especially if taking into account its chronic nature and high co-morbidity with other disorders.

4.2.6. Dementia and other psychiatric disorders

By definition, dementia (also called senility) means a progressive and long-term decline in cognitive function due to damage or disease in the body beyond what might be expected from normal aging. It is a more neurological than psychiatric disorder with typical symptoms such as memory loss and other cognitive and functional impairments. Although dementia is far more common in the geriatric population, it may occur in any stage of adulthood. The association between suicide and dementia has been addressed in a number of studies from various approaches; however, the reported results are contradicting (Harris and Barraclough, 1997; Haw et al., 2009). The present study shows a significantly increased risk for suicide completion in persons with a hospitalized dementia, although at the least level compared with other disorders. Meanwhile, dementia has a rather strong effect on suicide in middle age adults. This may be a reflection of age differences in causes resulting in dementia. For instance, Alzheimer's disease is the most frequent cause of dementia in the elderly while other physical or psychiatric problems are more common causes of dementia in young adults (Rossor et al., 2010). On the other hand, being diagnosed with dementia at a young age may be particularly distressful because of the poor prognosis of treatment and especially the induced fears of losing progressively the ability to control and manage own life.

The category of other psychiatric disorders is a broad group of disorders not categorized elsewhere in this study. The major diagnoses include mental retardation, somatoform or other neurotic disorders, and a big portion of unspecified mental problems admitted to psychiatric hospitals for observation including those involving intentional self-harm. The last group is probably the major contributor to the increased risk for suicide that is associated with this broad residual diagnostic group.

5. Conclusion and implications

This study adds to the existing evidence that people with psychiatric illness forms a well-defined high risk group for completed suicide. Although the majority of people with serious psychiatric illness neither attempt nor die by suicide, the risk for suicide is significantly increased for people with virtually any of psychiatric disorders that leads to a hospitalization for treatment. While caution is needed in the generalization of research findings from Denmark to other countries with different health care and social settings, the robust findings from this population study provide substantial knowledge about suicide risk in relation to various psychiatric disorders and may assist health professionals making strategies to reduce suicides in this high risk population.

As recommended (Hawton & van Heeringen, 2009; Qin et al., 2003), adequate assessment of suicide risk and sufficient access to effective treatment should be major strategies for suicide prevention in this heightened risk group of population. The present

study points out that the risks and therefore approaches to prevention and intervention should be varied with different groups of patients. Strategies and targets should be more sex and age specific and relating to specific diagnoses.

Role of funding sources

Dr Qin P is funded by a grant from the Sygekassernes Helsefond in Denmark. The sponsor had no role in design and conduct of the study; collection, management, analysis, and interpretation of the data; and preparation, review, or approval of the manuscript.

Contributors

Dr Qin P is the sole author of this paper.

Conflict of interest

The author declares no conflict of interest.

Acknowledgments

None.

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