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Schizophrenia – a predictor of suicide during the second half of life?

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Abstract

Background—Little is known about the suicide risk of older adults diagnosed with schizophrenia. The purpose of the study is to examine whether older adults diagnosed with schizophrenia have an elevated risk of dying by suicide, examine trends by age, and identify predictors of death by suicide.

Methods—Individual-level register data on all older adults aged 50+ living in Denmark during 1990–2006 (N=2 899 411) were assessed using survival analysis. The impact of predictors was adjusted for a series of socio-demographic and health-related covariates.

Results—In all, 248 suicides were identified among older adults diagnosed with schizophrenia. The suicide rate ratios of men and women aged 50–69 years with a diagnosis of schizophrenia was 7.0 [95%CI: 5.8 – 8.4] and 13.7 [95%CI: 11.3 – 16.6], respectively, when compared to those with no diagnosis. With increasing age a lower rate ratio was found; for men and women aged 70+ it was 2.1 [95%CI: 1.1 – 3.9] and 3.4 [95%CI: 2.0 – 5.8], respectively. Adjusted analyses revealed an elevated risk of suicide for diagnoses of schizophrenia, greater number of hospitalizations, recent admission (for men), recent discharge, previous suicide attempt, recent suicide attempt, comorbidity of mood disorders, personality disorders, and substance abuse (for women).

Conclusions—We found an elevated mortality risk of suicide for both men and women aged 50 years and over diagnosed with schizophrenia. Health care staff should be aware of elevated risk,

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Conflict of Interest

All authors declare that they have no conflicts of interest.

Contributors

AE, WE, PBM, and YC designed and planned the study. AE conducted the literature searches and data management in close collaboration with all authors. AE undertook the statistical analysis and wrote the first draft of the manuscript. All authors contributed substantively to the editing of the manuscript and have approved the final version prior to its submission.

particularly in older women diagnosed with schizophrenia, in relation to chronic disease courses, recent discharge, and suicide attempt.

Keywords

Aged; Elderly; Aged; 80 and over; Self-Injurious Behavior; Geriatric Psychiatry; Mental Disorders

1. Introduction

Older adults, particularly the very old, comprise the fastest growing population segment worldwide (Christensen et al., 2009). The oldest age groups have the highest suicide rate of all age groups and consistent linkage of suicide to mental disorders emphasizes the need for effective psychogeriatric care (Conwell and Thompson, 2008; Erlangsen et al., 2003; World Health Organization, 2000).

Schizophrenia is associated with an excess mortality by suicide (Harris and Barraclough, 1997; Laursen et al., 2007). As many as 8.5% of persons with schizophrenia might die by suicide during their life course (Palmer et al., 2005). Despite inconclusive findings, the suicide frequency is thought to decline with increasing age among persons with schizophrenia (Conwell et al., 1998; Mortensen and Juel, 1993; Nordentoft et al., 2004; Ran et al., 2008). Still, suicide rates above those of the general population were reported for elderly with schizophrenia (Mortensen and Juel, 1993; Ran et al., 2008).

Numerous predictors of suicide have been identified in persons with schizophrenia of all ages; such as: male gender, living alone, not living with family, recent loss, depression, psychiatric comorbidity, previous suicidal behavior or ideation, poor compliance with treatment, current psychiatric hospitalization, first hospitalization for schizophrenia, and recent discharge from psychiatric hospital (Hawton et al., 2005; Heilä et al., 1997; Johns et al., 1986; Karvonen et al., 2007; Large et al., 2011; Mortensen and Juel, 1993; Nordentoft et al., 2004; Qin et al., 2006; Shields et al., 2007).

Although, studies indicate that 7–17% of older adults dying by suicide might have schizophrenia (Conwell et al., 1990; Henriksson et al., 1996), our knowledge predictors of risk in older adults is limited to select subgroups, such as inpatients or community-dwellers, and more frequent outcomes, such as suicidal ideation and behavior (Barak et al., 2004; Cohen et al., 2010; Erlangsen et al., 2006; Montross et al., 2008). It appears that current psychiatric hospitalization is not associated with suicide in older adults diagnosed with schizophrenia (Erlangsen et al., 2006). Comorbid depressive syndrome is frequently identified in older men with schizophrenia who die by suicide; we do not know if it, or other types of disorders, signify as predictor of risk (Heilä et al., 1997). The time shortly after a first hospitalization was linked to excess risk of suicide in older men (Mortensen and Juel, 1993), but we have yet to examine how it applies to older women.

One in 1,000 adults aged 65 and older is considered to have schizophrenia (Zarit and Zarit, 2006). Schizophrenia in older adults tends to be relatively milder and with fewer exacerbations of psychotic symptoms (Jeste et al., 2003). Yet, distinct differences in symptoms are reported between early, late, and very late-onset schizophrenia (Pearlson et al., 1989). It has, for instance, been suggested that an increased incidence rate for first onset of schizophrenia might occur during women's menopause (Häfner et al., 1998).

The growing cohorts of older adults emphasize the need to identify predictors of suicide associated with schizophrenia during the second part of life. The aims of the current study

are: 1) to assess if schizophrenia is associated with an elevated risk of suicide during the second half of life, 2) to examine if the risk varies with age, and 3) to identify specific predictors of suicide in older adults with schizophrenia.

This is to our knowledge the most complete and largest study on risk for suicide in older adults diagnosed with schizophrenia.

2. Materials and methods

The study population consisted of all individuals aged 50 years and over who were living in Denmark during January 1st, 1990 through December 31st, 2006. A unique id-number allows for record linkage of various administrative registries on an individual level (Frank, 2000). Data on socio-demographic variables, psychiatric hospitalizations (since 1970), somatic hospitalizations, public health care usage (since 1992), and prescribed antipsychotics (since 1996) were linked.

2.1 Dynamic cohort study

Persons who turned 50 years of age during the observation period entered the study population on the date of their 50th birthday. Migrants who entered the country were included on the date of entry when fulfilling the age criteria. People migrating out of the country or dying by any causes were censored on the respective date of the event. Causes of death were recorded according to the 8th and 10th revisions of the International Classification of Diseases and Related Health Problems (ICD)(World Health Organisation, 1965; World Health Organisation, 2007). The outcome, death by suicide, was defined as: ICD-8: 950–959 and ICD-10: X60–X84, Y87 or where the manner of death was listed as suicide

2.2 Diagnosis of disorders

Free public health care, including psychiatric hospitalization, is available for all residents in Denmark. For our purposes, all persons diagnosed with schizophrenia, as a main or sub-diagnosis (ICD-8: 295; ICD-10: F20 and F25), during an admission to a psychiatric or somatic hospital were considered as having the disorder from that date onwards. Historical information on psychiatric hospitalizations was included since 1970.

2.3 Analyses

Gender-specific suicide rates were obtained using exact number of person-days under exposure. Rate ratios and confidence intervals (95% CI) were calculated as suggested for large samples of person-time data with a Poisson distribution (Rothman and Greenland, 1998).

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The analyses were carried out using Event-history analysis to calculate the relative suicide risks. Proportional hazard models of the following type were fitted:

$$\ln \mu_i(t) = \gamma(t) + \sum_{jk} \alpha_{jk} x_{ij}(t) y_{ik}(t)$$

where $\mu_i(t)$ denotes the hazard or probability that individual i will die by suicide at time t provided individual i is still alive and living in the country at time t , i.e. has not died by any cause of death or migrated. The baseline is denoted by $\gamma(t)$ and α_{jk} a coefficient that is estimated for specific combinations of level j of variable x and level k of variable y for individual i (Hoem, 1997).

The adjusted analyses were stratified by the following covariates: *age group* (50–69, 70+), *period* (1990–1998, 1999–2006), *living status* (alone, with someone), *retired* (no, early [covering disability pension as well as retired with pension before age 65], retired at age 65 [standard retirement age in Denmark]), *presence of comorbidity* (using the Charlson Comorbidity Index (Charlson et al., 1987; Sundararajan et al., 2004) to identify hospital-diagnosed disorders that are linked with elevated mortality: none, one or more comorbid disorders), *contact with general practitioner* (distribution of contact frequency during past calendar year: none, 0.1–25%, 25.1–50%, 50.1–75%, 75.1–100%), *living in nursing home* (no, yes), *income level* (distribution of yearly household income during past calendar year: none, 0.1–25%, 25.1–50%, 50.1–75%, 75.1–100%), and *current somatic hospitalization* (no, yes).

Following predictors were examined in the multivariate analyses: *diagnosed with schizophrenia* (no, yes), *age at first record of schizophrenia* (based on diagnoses registered after 1970: <40 yrs., 40–59 yrs., ≥60 yrs.), *psychiatric hospitalization* (no, currently hospitalized, previously hospitalized), *number of psychiatric hospitalizations* (1, 2–3, 4–6, ≥7), *time since admission or discharge* (admitted < 3 months, admitted ≥ 3 months, discharged < 3 months, discharged ≥ 3 months), *comorbidity of mood disorders/substance abuse/personality disorders/dementia* (diagnoses given during psychiatric hospitalizations since 1970: no, yes), *previous suicide attempt/within past 365 days* (suicide attempts recorded in hospital registries: no, yes).

Each covariate was assessed in a separate proportional hazard model prior to inclusion in adjusted models. Missing data refers to variables where register data were available only for parts of the study period. An indicator variable was included in the models to capture effects by missing data. The 95% confidence intervals were estimated.

The project was approved by the Danish Data Protection Agency and the Institutional Review Board of the Johns Hopkins School of Public Health. Data management was carried out using SAS (SAS Institute, 2003) and the hazard rates were calculated using the aML software (Lillard and Panis, 2003).

3. Results

The study population consisted of 1 382 390 men and 1 517 021 women aged 50 years and older. Since 1970, a total of 8893 men (0.64%) and 9165 women (0.60%) were diagnosed with schizophrenia during a hospitalization. During the study period, 5,230 men and 2,911 women died by suicide, of whom 125 men (2.4%) and 123 women (4.2%) had been diagnosed with schizophrenia.

Men with schizophrenia aged 50 and over years had a suicide rate of 201 per 100 000 person-years while it was 175 per 100 000 for women. The sex ratio was 1.15.

Excess in suicide mortality was found for persons aged 50–70 as well as those aged 70 years and over who were diagnosed to schizophrenia. However, the rate ratio, was found to decrease with age.

Higher rate ratios were found for 1990–1998 (men only), married, persons living with someone, absence of comorbidity, and persons not living in nursing homes (Table 1a and 1b). These statistical significances were, however, not upheld in the adjusted analyses (table not shown).

The adjusted analysis in Table 2 displayed higher risk of dying by suicide for men (RR: 3.5, 95%CI: 3.0–4.2) and women (RR: 7.9, 95%CI: 6.6–9.5) diagnosed with schizophrenia when compared to persons with no diagnosis of schizophrenia.

The suicide risk of older adult inpatients, i.e. currently hospitalized, with schizophrenia was lower than for other psychiatric inpatients both for men (RR: 8.6, 95%CI: 5.4–13.7 vs. RR: 45.4, 95%CI: 38.7–53.2) and women (RR: 28.6, 95%CI: 17.9–45.7 vs. RR: 79.2, 95%CI: 67.2–93.5). An elevated risk of suicide remained among previously hospitalized when compared to person with no psychiatric diagnoses.

We identified a dose-response relationship between number of psychiatric hospitalizations and risk of suicide in patients with schizophrenia. In absolute terms, 62% of men and 67% of women diagnosed with schizophrenia who died by suicide had been admitted to psychiatric hospital more than six times. The first three months after admission to psychiatric hospital was linked to an elevated risk of suicide for men with schizophrenia when compared to inpatients hospitalized more than three months (RR: 21.9, 95%CI: 13.2–36.5 vs. RR: 2.1, 95%CI: 0.7–6.6). Similarly, risk for suicide was elevated during the first three months after discharge from psychiatric hospital for both men (RR: 24.0, 95%CI: 16.4–35.1 vs. RR: 4.2, 95%CI: 3.4–5.3) and women (RR: 78.3, 95%CI: 55.2–111.1 vs. RR: 11.3, 95%CI: 8.9–14.4).

The risk of suicide in older adults diagnosed with both mood disorders and schizophrenia was twice as high as those with schizophrenia diagnoses only among men (RR: 5.9, 95%CI: 4.4–8.0 vs. RR: 2.8, 95%CI: 2.2–3.5) and women (RR: 11.1, 95%CI: 8.4–14.6 vs. RR: 6.1, 95%CI: 4.8–7.8). Also, co-existing personality disorders or substance abuse (for women) further elevated the risk of suicide in persons with schizophrenia.

Suicide attempts within the past 365 days were linked to a 15-fold increases in risk for men with schizophrenia when compared to those with no recent attempt (RR: 3.5, 95%CI: 2.9–4.3 vs. RR: 54.1, 95%CI: 30.4–96.1). For women, a 22-fold increase in risk was noted among those with schizophrenia who recently had carried out a suicide attempt (RR: 7.7, 95%CI: 6.3–9.5 vs. RR: 176.4, 95%CI: 113.8–273.5).

4. Discussion

In this nationwide cohort study, we found excess suicide mortality for older adults with schizophrenia, which declined with increasing age when compared to other older adults. This has not previously been demonstrated for women. To our surprise, we find a relatively higher risk among women with schizophrenia measured relative to the general population than for their male counterparts. While current inpatients with schizophrenia were at lower risk of suicide than other inpatients, recent admission to psychiatric hospital (for men), recent discharge as well as comorbidity by specific disorders were associated with significantly elevated risk as were those who had attempted suicide.

Our finding of an excess suicide mortality in older adults with schizophrenia confirms previous findings for older men, community-dwellers, and with respect to suicidal ideation (Cohen et al., 2010; Mortensen and Juel, 1993; Ran et al., 2008). In addition, we found that women aged 70 and over with schizophrenia had an increased risk of suicide. This has not previously been established.

The rate ratio of older adults diagnosed with schizophrenia versus those with no diagnosis declined with age for both genders. A previous Danish study focusing on a select patient population, i.e. first-time admitted, identified a U-shaped pattern for the male rate ratio with increasing age while no suicides were found among women aged 70 and above (Mortensen and Juel, 1993). As previously suggested by Mortensen and Juel (1990), an effect similar to the healthy worker effect might explain this; older adults with schizophrenia might represent a select group that survived the high mortality due to both natural and other causes earlier in life (Harris and Barraclough, 1998; Laursen et al., 2007). It is also possible that people adapt to the disorder after having had schizophrenia for several years so that the emotional consequences gradually ceases with time. An alternative or contributing explanation could be that the frequency of depression, a well-established predictor of late life suicide (Conwell and Thompson, 2008), as a comorbid disorder decreases with age.

The absolute numbers of suicides among men and women with schizophrenia aged 50 years and over were almost identical. The sex ratio of suicide in the general population of older adults in Denmark is approximately two men for each woman (Erlangsen et al., 2003), we here found a lower ratio, which indicates an over-representation of female suicides in relation to schizophrenia during the second part of life. More women than men experience a late-onset of schizophrenia; women with late-onset schizophrenia present more positive symptoms than men; and positive symptoms have been linked to suicide risk in people with schizophrenia (Howard et al., 2000; Lindamer et al., 1999; Ran et al., 2005). The higher suicide rate ratios among middle-aged and older women might be explained by a predominance of late-onset schizophrenia. However, a more plausible explanation might be that men with schizophrenia died earlier in their life course (Ran et al., 2004; Ran et al., 2008). A recent Danish study reported consistently higher mortality rates of all causes for men with schizophrenia than women over the entire life course. In the current study, we observed approximately twice as many person-years for women aged 70 years and over with schizophrenia than men. It, thus, seems plausible that fewer men than women with schizophrenia reach older adulthood.

Due to data limitations, we were unable to examine the association between women's menopause and late onset of schizophrenia.

Studies of all age groups have apparently not identified a lower suicide risk among inpatients with schizophrenia in comparison to inpatients with other diagnoses (Hawton et al., 2005; Nordentoft et al., 2004; Qin et al., 2006). It is possible that this is a distinct feature of late life schizophrenia explained by more stable and diminished symptoms during later life.

A majority of those older adults with schizophrenia who died by suicide were hospitalized for psychiatric treatment more than six times, indicating a chronic disease course with several relapses. This is further expressed by the elevated risk associated with co-existing disorders, such as mood disorders, personality disorders, and substance abuse (for women).

Earlier studies have shown that more than half of men and women aged 45–77 years with symptoms of schizophrenia who died by suicide had previously attempted suicide (Heilä et al., 1997). Our findings reinforce the importance of this result by establishing suicide attempt as a risk predictor and add emphasis to the urgent need for immediate intervention towards older adults who initiate suicidal behavior (Erlangsen et al., 2011).

In terms of implications, both recently discharged, history of several hospitalizations, co-existing psychiatric disorders, and suicide attempts represent well-defined high risk groups with respect to interventions. Prevention of suicide in older adults should predominantly be aimed at intervening early in the suicidal process (Conwell and Thompson, 2008). Follow-

up during medical treatment and assessment for depression seem to be successful strategies (Erlangsen et al., 2011). It is possible that older adults with schizophrenia would profit from similar approaches. Also, treatment with clozapine has been found to reduce suicidality better than olanzapine in patients with schizophrenia who were below age 65 (Meltzer et al., 2003).

Limitations should be acknowledged. Only subjects diagnosed during a psychiatric or somatic hospitalization were considered as having schizophrenia. This might lead to an underestimation. The registration of suicides is generally considered to be reliable in Denmark. Nevertheless, it cannot be excluded that causes of deaths among individuals with a diagnosis of schizophrenia might more likely be considered as suicides than deaths among individuals with no diagnosis. Although such bias could lead to an over-estimation of suicides risks in persons with schizophrenia, this ought not to affect our findings of differences in risk with respect to age and gender. Although desirable, information on age at onset, severity, symptoms, treatment and compliance was not available. Future research might address how suicide risks vary in relation to schizophrenia across the entire age span.

A strength is the complete data collection from the entire population of Denmark, which ensures fully representative findings. No persons were excluded due to cognitive impairment, institutional dwelling, or loss of follow-up. This is, to our knowledge, the largest longitudinal study of suicide in older adults diagnosed with schizophrenia fully based on well-established registers with complete linkage of information for each single individual.

In sum, an elevated risk of suicide was identified in older adults with schizophrenia. Particularly, middle-aged and older women diagnosed with schizophrenia were found to have elevated risks of suicide. The rate ratio of suicide in persons with schizophrenia decreased with increasing age. Identified predictors of risk for suicide were: diagnose of schizophrenia, greater number of hospitalizations, recent admission (for men), recent discharge, comorbidity of mood disorders, substance abuse (for women), and personality disorders as well as suicide attempts.

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Table 1

a. Number of suicides, person-years, suicide rates per 100 000, and rate ratios for men aged 50 years and above living in Denmark from 1990 through 2006 with regard to hospital-diagnosis of schizophrenia.

	MEN					
	Schizophrenia			No schizophrenia		
	Suicide	Person-years in study	Suicide rate per 100 000	Suicide	Person-years in study	Suicide rate per 100 000
<u>Age group</u>						
-- 50-69	115	52 836	217.7	3 043	9 735 196	31.3
-- 70+	10	9 328	107.2	2 062	3 997 235	51.6
<u>Period</u>						
-- 1990-1998	47	24 458	192.2	2 995	6 200 683	48.3
-- 1999-2006	78	37 706	206.9	2 110	7 531 748	28.0
<u>Marital status</u>						
-- Never married	66	38 424	171.8	629	1 164 325	54.0
-- Married	22	8 331	264.1	2 577	9 770 556	26.4
-- Divorced	34	13 824	246.0	896	1 514 865	59.1
-- Widowed	3	1 556	192.8	990	1 211 125	81.7
-- Missing data	0	29	0.0	13	71 561	18.2
<u>Living status</u>						
-- Living alone	105	53 552	196.1	2 506	3 514 252	71.3
-- Living with someone	20	8 583	233.0	2 586	10 146 619	25.5
-- Missing data	0	29	0.0	13	71 561	18.2
<u>Retired</u>						
-- No	100	51 112	195.6	3 560	10 613 608	33.5
-- Early	11	5 677	193.8	212	466 120	45.5
-- At age 65	7	4 729	148.0	957	2 517 586	38.0
-- Missing data	7	646	1083.3	376	135 118	278.3
<u>Presence of comorbidity^a</u>						
-- None	108	53 558	201.7	3 798	11 786 405	32.2
-- Comorbidity	17	8 607	197.5	1 307	1 946 027	67.2

a. Number of suicides, person-years, suicide rates per 100 000, and rate ratios for men aged 50 years and above living in Denmark from 1990 through 2006 with regard to hospital-diagnosis of schizophrenia.

	MEN					
	Schizophrenia			No schizophrenia		
	Suicide	Person-years in study	Suicide rate per 100 000	Suicide	Person-years in study	Suicide rate per 100 000
<i>Contact with general practitioner^b</i>						
-- No visits	2	2 948	67.8	230	948 921	24.2
-- 0–25%	3	3 313	90.6	379	1 562 406	24.3
-- 25.1–50%	4	2 774	144.2	416	1 229 213	33.8
-- 50.1–75%	6	3 546	169.2	594	1 229 109	48.3
-- 75.1–100%	7	5 495	127.4	825	982 550	84.0
-- Missing data	103	44 089	233.6	2 661	7 780 231	34.2
<i>Living in nursing home</i>						
-- No	87	41 236	211.0	2 940	9 808 301	30.0
-- Yes	7	6 321	110.7	35	76 947	45.5
-- Missing data	31	14 607	212.2	2 130	3 847 184	55.4
<i>Income level^c</i>						
-- None	1	130	770.9	39	47 237	82.6
-- 0–25%	9	10 509	85.6	1 239	2 739 567	45.2
-- 25.1–50%	47	22 926	205.0	1 268	2 839 978	44.6
-- 50.1–75%	32	14 804	216.2	899	2 904 247	31.0
-- 75.1–100%	4	2 453	163.1	712	2 929 230	24.3
-- Missing data	32	11 342	282.1	948	2 272 173	41.7
<i>Current somatic hospitalization</i>						
-- No	117	61 629	189.8	4 715	13 647 718	34.5
-- Yes	8	535	1494.9	390	84 714	460.4
Total	125	62 164	201.1	5 105	13 732 432	37.2
						5.4 [4.5 – 6.5]

b. Number of suicides, person-years, suicide rates per 100 000, and rate ratios for women aged 50 years and above living in Denmark from 1990 through 2006 with regard to hospital-diagnosis of schizophrenia.

	WOMEN					
	<i>Schizophrenia</i>			<i>No schizophrenia</i>		
	Suicide	Person- years in study	Suicide rate per 100 000	Suicide	Person- years in study	Suicide rate per 100 000
<i>Age group</i>						
-- 50-69	109	49 970	218.1	1 584	9 957 301	15.9
-- 70+	14	20 511	68.3	1 204	6 030 684	20.0
<i>Period</i>						
-- 1990-1998	76	31 078	244.5	1 834	7 417 528	24.7
-- 1999-2006	47	39 403	119.3	954	8 570 458	11.1
<i>Marital status</i>						
-- Never married	31	22 841	135.7	187	939 413	19.9
-- Married	33	13 586	242.9	1 077	8 565 279	12.6
-- Divorced	49	23 865	205.3	518	1 925 996	26.9
-- Widowed	10	10 176	98.3	997	4 504 122	22.1
-- Missing data	0	13	0.0	9	53 175	NA
<i>Living status</i>						
-- Living alone	98	56 837	172.4	1 742	7 064 236	24.7
-- Living with someone	25	13 630	183.4	1 037	8 870 574	11.7
-- Missing data	0	13	0.0	9	53 175	NA
<i>Retired</i>						
-- No	92	58 459	157.4	1 972	12 732 923	15.5
-- Early	11	4 659	236.1	138	575 679	24.0
-- At age 65	12	6 365	188.5	417	2 514 974	16.6
-- Missing data	8	997	802.5	261	164 410	158.7
<i>Presence of comorbidity^a</i>						
-- None	110	60 341	182.3	2 156	13 896 686	15.5
-- Comorbidity	9	6 118	147.1	374	1 170 967	31.9
<i>Contact with general practitioner^b</i>						
-- No visits	2	3 130	63.9	71	859 784	8.3

b. Number of suicides, person-years, suicide rates per 100 000, and rate ratios for women aged 50 years and above living in Denmark from 1990 through 2006 with regard to hospital-diagnosis of schizophrenia.

	WOMEN					
	<i>Schizophrenia</i>			<i>No schizophrenia</i>		
	Suicide	Person-years in study	Suicide rate per 100 000	Suicide	Person-years in study	Suicide rate per 100 000
-- 0-25%	5	5 749	87.0	191	2 070 709	9.2
-- 25.1-50%	4	5 413	73.9	228	1 760 537	13.0
-- 50.1-75%	7	6 528	107.2	287	1 683 524	17.0
-- 75.1-100%	17	9 731	174.7	555	1 435 653	38.7
-- Missing data	88	39 928	220.4	1 456	8 177 778	17.8
<i>Living in nursing home</i>						
-- No	67	44 418	150.8	1 355	11 160 755	12.1
-- Yes	3	6 777	44.3	37	175 053	21.1
-- Missing data	53	19 286	274.8	1 396	4 652 176	30.0
<i>Income level^c</i>						
-- None	1	89	1127.5	16	42 149	38.0
-- 0-25%	17	14 794	114.9	535	3 253 082	16.4
-- 25.1-50%	19	17 760	107.0	598	3 371 304	17.7
-- 50.1-75%	42	21 648	194.0	617	3 390 375	18.2
-- 75.1-100%	10	5 423	184.4	450	3 427 925	13.1
-- Missing data	34	10 767	315.8	572	2 503 150	22.9
<i>Current somatic hospitalization</i>						
-- No	107	69 748	153.4	2 527	15 883 339	15.9
-- Yes	16	733	2183.8	261	104 646	249.4
Total	123	70 481	174.5	2 788	15 987 985	17.4

^a Measured as hospital diagnoses since 1990 denoting presence of one or more disorders listed in the Charlson Comorbidity Index (Charlson et al., 1987; Sundarajan et al., 2004). This validated measure lists disorders associated with an elevated mortality during first year of diagnosis. Diagnoses were recorded in the same manner for persons with a diagnosis of schizophrenia and those without.

^b Measured as distribution of contact frequency with general practitioner during past calendar year.

^c Measured as distribution of yearly household income during past calendar year.

Table 2

Adjusted relative risks for suicide in relation to a diagnosis of schizophrenia among older adults living in Denmark from 1990 through 2006.

	Men		Women	
	Relative risk ^a [CI-95%]	N Suicide	Relative risk ^a [CI-95%]	N Suicide
<i><u>Diagnosed with schizophrenia</u></i>				
No	1.0	5 105	1.0	2 788
Yes	3.5 [3.0 – 4.2]	125	7.9 [6.6 – 9.5]	123
<i><u>Age at first record of schizophrenia</u></i>				
No schizophrenia	1.0	5 105	1.0	2 788
Schizophrenia				
-- < 40 years	3.0 [2.3 – 3.9]	56	6.5 [4.6 – 9.2]	32
-- 40–59 years	4.5 [3.5 – 5.9]	61	9.2 [7.3 – 11.7]	74
-- ≥ 60 years	2.6 [1.3 – 5.3]	8	6.4 [4.0 – 10.4]	17
<i><u>Psychiatric hospitalization</u></i>				
No schizophrenia				
-- No	1.0	3 657	1.0	1 446
-- Currently hospitalized	45.4 [38.7 – 53.2]	157	79.2 [67.2 – 93.5]	160
-- Previously hospitalized	5.7 [5.3 – 6.1]	1 291	10.3 [9.5 – 11.1]	1 182
Schizophrenia				
-- Currently hospitalized	8.6 [5.4 – 13.7]	18	28.6 [17.9 – 45.7]	18
-- Previously hospitalized	5.3 [4.4 – 6.5]	107	15.4 [12.6 – 18.9]	105
<i><u>Number of psychiatric admissions</u></i>				
No schizophrenia, no other disorder	1.0	3 653	1.0	1 444
Schizophrenia				
-- 1	2.9 [1.6 – 5.1]	12	4.4 [2.0 – 9.8]	6
-- 2–3	4.1 [2.7 – 6.3]	21	9.7 [5.9 – 15.9]	16
-- 4–6	5.9 [3.9 – 8.8]	14	17.1 [11.5 – 25.4]	18
-- ≥ 7	7.7 [6.0 – 9.8]	78	26.1 [20.6 – 33.1]	83
<i><u>Time since admission or discharge</u></i>				
No schizophrenia, no other disorder	1.0	3 657	1.0	1 446
Schizophrenia				
-- Admitted < 3 months	21.9 [13.2 – 36.5]	15	30.1 [15.0 – 60.5]	8
-- Admitted ≥ 3 months	2.1 [0.7 – 6.6]	3	27.8 [14.9 – 51.9]	10
-- Discharged < 3 months	24.0 [16.4 – 35.1]	27	78.3 [55.2 – 111.1]	33
-- Discharged ≥ 3 months	4.2 [3.4 – 5.3]	80	11.3 [8.9 – 14.4]	72
<i><u>Comorbidity of mood disorders^b</u></i>				
No schizophrenia	1.0		1.0	
Schizophrenia				
-- No	2.8 [2.2 – 3.5]	81	6.1 [4.8 – 7.8]	70
-- Yes	5.9 [4.4 – 8.0]	44	11.1 [8.4 – 14.6]	53

	Men		Women	
	Relative risk ^a [CI-95%]	N Suicide	Relative risk ^a [CI-95%]	N Suicide
<u>Comorbidity of substance abuse^c</u>				
No schizophrenia	1.0		1.0	
Schizophrenia				
-- No	3.2 [2.5 – 3.9]	86	6.4 [5.2 – 8.0]	89
-- Yes	4.2 [3.0 – 5.7]	39	14.3 [10.2 – 20.0]	34
<u>Comorbidity of personality disorders^d</u>				
No schizophrenia	1.0		1.0	
Schizophrenia				
-- No	3.0 [2.4 – 3.7]	86	6.1 [4.9 – 7.7]	76
-- Yes	5.3 [3.8 – 7.2]	39	11.1 [8.3 – 14.8]	47
<u>Comorbidity of dementia^e</u>				
No schizophrenia	1.0		1.0	
Schizophrenia				
-- No	3.4 [2.8 – 4.1]	114	7.5 [6.2 – 9.1]	112
-- Yes	3.3 [1.8 – 6.0]	11	8.8 [4.9 – 15.9]	11
<u>Previous suicide attempt</u>				
No schizophrenia				
-- No	1.0	4 664	1.0	2 245
-- Yes	17.2 [15.6 – 19.0]	441	38.1 [34.6 – 41.9]	543
Schizophrenia				
-- No	3.3 [2.7 – 4.1]	94	7.9 [6.3 – 9.8]	85
-- Yes	21.9 [15.4 – 31.0]	31	58.7 [42.7 – 80.6]	38
<u>Suicide attempt within past 365 days</u>				
No schizophrenia				
-- No	1.0	4 848	1.0	2 484
-- Yes	58.2 [51.4 – 66.0]	257	101.9 [90.5 – 114.8]	304
Schizophrenia				
-- No	3.5 [2.9 – 4.3]	114	7.7 [6.3 – 9.5]	103
-- Yes	54.1 [30.4 – 96.1]	11	176.4 [113.8 – 273.5]	20

^a Analyses adjusted for: calendar year, age, living status, retirement, chronic comorbidity, frequency of contact with general practitioner during past calendar year, living in nursing home, household income during past calendar year, and current somatic hospitalization (1.0 denotes the baseline group). Initial analyses revealed that models adjusting for both marital status and living status did not converge. Due to a better fit (based on log likelihood), we decided to continue with living status and other adjusting variables.

^b ICD-8: 296, 298.09, 298.19, 300.49, 301.19; ICD-10: F30–F39.

^c ICD-8: 291, 303, 304; ICD-10: F10–F19.

^d ICD-8: 300.19, 301.49, 301.59, 301.69, 301.79–301.84; ICD-10: F60–F69.

^e ICD-8: 290, 293.0, 293.1, 293.4, 293.9, 294.9, 309.6; ICD-10: F00–F04, F06–F09, G30.