AIDS/HIV Infection, Comorbid Psychiatric Illness, and Risk for Subsequent Suicide: A Nationwide Register Linkage Study

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ABSTRACT

Objective: To explore socioeconomic and psychiatric characteristics of persons with acquired immunodeficiency syndrome (AIDS) or human immunodeficiency virus (HIV) infection and to assess the effect of AIDS/HIV infection on risk for subsequent suicide in the context of psychiatric comorbidity and socioeconomic status.

Method: In this study based on the entire population of Denmark, we interlinked 5 national registers to retrieve personal data on AIDS/HIV infection and covariates for 9,900 men who died of suicide during 1986–2006 and 189,037 controls matched for sex and date of birth. Suicide risk associated with AIDS/HIV infection was assessed using a conditional logistic regression model.

Results: People with AIDS/HIV infection, especially those who died of suicide, mostly lived as single people, had low income, and were dwellers of the Capital area of Denmark (Copenhagen and Frederiksberg). While presence of other physical illness was common in these patients, 38.6% of suicide and 29.0% of control patients developed psychiatric illness after being diagnosed with AIDS or HIV infection. Meanwhile, AIDS/HIV infection constituted a significant risk factor for subsequent suicide (adjusted incidence rate ratio [IRR] = 3.84; 95% confidence interval, 2.53–5.81); the risk was substantially higher for persons who were diagnosed for the first time recently, were treated as inpatients, had a recent hospital contact, or had multiple hospital contacts because of the illness. The increased suicide risk associated with AIDS/HIV infection was slightly stronger before the introduction in 1997 of highly active antiretroviral therapy (HAART) (adjusted IRR = 5.55; 95% CI, 3.07–10.06), but remained highly significant in the HAART era (adjusted IRR = 2.77; 95% CI, 1.55–4.94). Moreover, AIDS/HIV infection significantly interacted with psychiatric illness ($P < .0001$), and their comorbidity increased the risk of suicide substantially.

Conclusions: Suicide risk is increased in individuals with AIDS/HIV infection, particularly those with a recent diagnosis, more intensive and frequent hospital care, or comorbid psychiatric illness. The findings call for improvement of clinical capacities to address psychosocial and existential needs in the treatment of patients with AIDS/HIV infection.

J Clin Psychiatry 2012;73(10):1315–1321

Submitted: *March 29, 2012; accepted July 6, 2012.*
Online ahead of print: *September 4, 2012 (doi:10.4088/JCP.12m07814).*
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Acquired immunodeficiency syndrome (AIDS) and human immunodeficiency virus (HIV) infection and associated suicidal behavior are increasing public health concerns worldwide. Since the early 1980s, the number of persons with AIDS/HIV infection has been increasing steadily in many parts of the world.[1] According to estimates from the Joint United Nations Programme on HIV/AIDS (UNAIDS), about 33.3 million people worldwide were living with HIV (95% CI, 31.4 million–35.3 million) in 2009.[2] Because of the absence of a cure for AIDS/HIV and the associated stigma and discrimination, individuals with the disease may become extremely pessimistic toward the illness and their life ahead. Studies have demonstrated that suicide rates in patients with AIDS/HIV infection are more than 10 times higher than the rates in the general population.[3–7] The introduction in 1996 of highly active antiretroviral therapy (HAART) for AIDS and HIV infection has been extremely beneficial to many individuals with the illness, leading to remarkable improvements in their general health and survival time.[8–10] However, only 1 study[5] so far has indicated that HAART may consequently have reduced suicide risk in people living with AIDS or HIV infection on a population level. Nevertheless, the ongoing active spread of HIV in many regions of the world and the evident link this illness has to suicide imply that individuals with AIDS or HIV infection should be regarded as important targets for mental health care and suicide prevention. Large-scale population studies on this topic could provide important insights to inform such prevention strategies.

In this study using interlinked data from Danish national registers, our aims were (1) to explore characteristics of socioeconomic status and psychiatric well-being in persons with AIDS/HIV infection; (2) to assess risk for subsequent suicide in relation to AIDS or HIV infection in the context of psychiatric history, physical comorbidity, and socioeconomic status, as well as the effect difference between the pre-HAART era and the HAART era; and (3) to examine the effect independence between AIDS/HIV infection and comorbid psychiatric illness.

METHOD

Study Design and Participants

This study was based on the entire population of Denmark (5.5 million persons), a country where hospital treatment is free of charge for all residents. Individual data were retrieved from 5 national longitudinal registers and merged using the unique personal identifier given to all Danes at birth and to new residents of Denmark in the Civil Registration System.[11]

From the Cause-of-Death Register,[12] we identified all suicides (codes E950–E959 in *ICD-8* and X60–X84 in *ICD-10*; *ICD-9* was not used in Denmark) and restricted study cases to suicides that occurred from 1986 to 2006 in individuals 23–67 years old. The reason for the restriction is that diagnoses of AIDS and HIV infection were only introduced in Danish medical registries from 1986, and no person

Clinical Points

- People with AIDS/HIV infection have a strongly increased risk for suicide.
- Suicide risk assessment and management should be an integral part of hospitals' and general practitioners' treatment plans for patients with AIDS/HIV infection.
- Continuity of care in transitions between service levels and providers and systematic psychiatric and somatic follow-up of patients after discharge from the hospital are important strategies for suicide prevention in patients with AIDS/HIV infection.

other than those 23–67 years old was recorded with this specific diagnosis in the Danish National Hospital Register.[13] We adopted a nested case-control design[14] to recruit up to 20 live controls per suicide case, matched for sex and date of birth, from a 25% representative sample of the national population in the Danish Civil Registration System.[11] The rationale for sampling up to 20 controls per case was to enable examination of uncommon exposures, such as AIDS/HIV infection, with reasonable statistical power and precision. We considered only individuals who were residing in Denmark on December 31 of the year preceding the suicide (matching date) because they had complete socioeconomic data in the IDA database, a database that contains personal annual information on socioeconomic status for all residents of Denmark.[15] Because only 2 women who died of suicide had a recorded diagnosis of AIDS/HIV infection in the study population, we chose to focus exclusively on men in the present study. The final study subjects included 9,900 male suicide cases and 189,037 male live controls matched to the cases.

Data Assessment

From the Danish National Hospital Register,[13] we retrieved personal history of hospital contacts because of AIDS or HIV infection (codes 079.83 in *ICD-8* and B21–B24 in *ICD-10*) prior to the date of suicide or matching time for controls. For individuals with the illness, we recorded dates of each hospital contact and type of treatment as inpatient or outpatient. Upon these data, we constructed several variables of interest, including (1) treatment as an inpatient or as an outpatient only; (2) time since the first diagnosis of AIDS/HIV infection; (3) length of time between the most recent hospital contact for AIDS/HIV and suicide; and (4) total number of hospital contacts for AIDS/HIV infection. We additionally retrieved personal history of hospitalization for physical illness other than AIDS/HIV infection beginning in 1978, when such data became available in this register. We excluded mental and behavior disorders (codes 290–315 in *ICD-8* and F00–F99 in *ICD-10*) and external causes (covering all accidental and intentional poisonings and injuries, codes 800–999 in *ICD-8* and S00–Y99 in *ICD-10*) from our definition of physical illness.

From the Danish Psychiatric Central Register,[16] we obtained personal data on psychiatric history, as either inpatient or outpatient, prior to the date of suicide or matching time for controls. We also retrieved the date of the first psychiatric contact to see if it occurred before the date of initial diagnosis with AIDS or HIV infection, and, moreover, the presence of the following 4 psychiatric diagnoses: substance misuse disorder (291.9, 294.3, 303, 304 in *ICD-8* and F10–F19 in *ICD-10*), schizophrenia spectrum disorder (295, 297, 298.2–298.9, 299, 301.0, 301.2, 301.83 in *ICD-8* and F20–F29, F60.0, F60.1 in *ICD-10*), affective disorder (296, 298.0, 298.1, 300.4, 301.1 in *ICD-8* and F30–F39 in *ICD-10*), and personality disorder (F60.2–F60.9 in *ICD-8* and 301.3–301.9 in *ICD-10*).

We extracted individual data on socioeconomic status from the IDA database[15] based on records in the year preceding the suicide (matching date). Considered variables included marital status, annual gross income, place of residence, and Danish versus non-Danish citizenship. These variables were chosen in order to capture common socioeconomic characteristics of study subjects and to control for the possible confounding effects of these characteristics on suicide risk.[17]

Statistical Analysis

We constructed contingency tables for the study variables and examined the distribution differences using the Pearson χ^2 test or Fisher exact test. Suicide risks associated with variables under study were estimated using conditional logistic regression through the PHREG procedure, with each case forming a separate stratum. Because we sampled controls from individuals at risk for suicide at the time, ie, incidence density sampling, the estimated odds ratios in this study were unbiased estimates of incidence rate ratios (IRRs).[18] The Wald test was used to determine variation in risk estimates between 2 exposure categories. The interaction between AIDS/HIV infection and psychiatric illness was additionally examined using the likelihood ratio test. Separate analyses were performed to compare the effect of AIDS/HIV infection on risk of suicide in the pre-HAART era (ie, before Denmark started using HAART in 1997) with that in the HAART era (ie, 1997 and onward). All analyses were carried out with SAS software, version 9.2.[19]

Ethical Issues

We obtained approval from the Danish Data Protection Agency for the access to and linkage of personal data in relevant registries.

RESULTS

Description of Overall Cases and Controls

From the national population of Denmark, we identified 9,900 men who died of suicide at the ages of 23 to 67 years from 1986 through 2006 and randomly selected 189,037 population live controls matched on sex and date of birth to suicide cases. Compared with matched controls, suicide cases were more often living as single, with low income, and as residents in the Capital area (Copenhagen and Frederiksberg). History of psychiatric illness was present in 43.81% of suicide

Table 1. Distribution of All 9,900 Men Who Died of Suicide and 189,037 Sex- and Date of Birth–Matched Live Controls and Risk for Suicide (IRRs) Associated With Factors of Interest in the Study

Variable	Suicide Cases		Live Controls		Crude IRR (95% CI)
	n	%	n	%	
Marital status[a]					
Married	3,480	35.2	110,539	58.5	1 (reference)
Living with a cohabitant	1,040	10.5	25,373	13.4	1.56 (1.45–1.68)
Living as a single person	5,380	54.3	53,125	28.1	3.63 (3.47–3.80)
Annual gross income[a,b]					
Highest quartile	1,282	12.9	47,567	25.2	1 (reference)
Third quartile	1,591	16.1	47,245	25.0	1.25 (1.16–1.35)
Second quartile	2,146	21.7	47,273	25.0	1.69 (1.57–1.81)
Lowest quartile	4,881	49.3	46,952	24.8	3.88 (3.64–4.13)
Place of residence[a]					
Areas other than provincial cities or capital area	7,592	76.7	147,169	77.9	1 (reference)
Provincial cities	1,070	10.8	21,630	11.4	0.97 (0.91–1.03)
Capital area[c]	1,238	12.5	20,238	10.7	1.20 (1.13–1.28)
Citizenship					
Danish	9,638	97.3	183,811	97.2	1 (reference)
Non-Danish	262	2.7	5,226	2.8	0.98 (0.86–1.11)
Psychiatric history[a]					
No	5,563	56.2	178,458	94.4	1 (reference)
Yes	4,337	43.8	10,579	5.6	13.42 (12.82–14.05)
Specific psychiatric diagnosis[d]					
Substance misuse disorder[a]	1,595	16.1	3,599	1.9	14.85 (13.89–15.88)
Schizophrenia spectrum disorder[a]	1,088	11.0	2,064	1.1	17.23 (15.90–18.66)
Affective disorder[a]	1,503	15.2	2,170	1.2	22.78 (21.15–24.53)
Personality disorder[a]	1,095	11.1	2,624	1.4	13.67 (12.66–14.76)
Physical illness requiring hospitalization, excluding AIDS/HIV[a]					
No	3,985	40.2	106,212	56.2	1 (reference)
Yes	5,915	59.8	82,825	43.8	1.93 (1.85–2.02)
AIDS/HIV infection[a]					
No	9,856	99.6	188,937	99.9	1 (reference)
Yes	44	0.44	100	0.05	8.73 (6.11–12.46)

[a]Test for distribution differences between cases and controls, $P < .001$.
[b]Income was categorized into quartiles according to the annual sex- and age-specific distribution in the general population.
[c]Refers to the Copenhagen and Frederiksberg communities of Denmark.
[d]Diagnoses were retrieved independently, and the associated IRRs were estimated against the group with no psychiatric history and adjusted for effect of psychiatric diagnosis other than the specific one.
Abbreviations: AIDS = acquired immunodeficiency syndrome, HIV = human immunodeficiency virus, IRR = incidence rate ratio.

cases, which is significantly higher than the corresponding 5.60% of controls. While physical illness was common in both suicide cases and controls, the prevalence was significantly higher in those who died of suicide than in the controls. Meanwhile, 0.44% of suicide cases had a diagnosis of AIDS or HIV infection, while the rate was 0.05% in the controls (Table 1).

As expected, risk of suicide in men 23–67 years old was significantly increased for persons who were living as single people, were recipients of low income, were residents of the Capital, or had had physical illness requiring hospitalization for treatment. The risk was particularly increased for persons with a psychiatric history (crude IRR = 13.42; 95% CI, 12.82–14.05) and for persons with AIDS or HIV infection (crude IRR = 8.73; 95% CI, 6.11–12.46).

Characteristics of Suicide Cases and Controls With AIDS/HIV Infection

Among all 144 individuals with a diagnosis of AIDS or HIV infection (Table 2), persons who committed suicide, compared with those who did not, were more likely to have received hospital treatment for AIDS/HIV as an inpatient rather than as an outpatient only, to have received the diagnosis for the first time within the past 2 years, to have had a hospital contact within the past year, and to have had multiple hospital contacts because of the illness.

When looking at their socioeconomic status, we found that, for both suicide cases and controls with AIDS/HIV infection, the majority lived as single, at the lowest quartile income level, as dwellers of the Capital area, and with comorbid physical illness other than AIDS/HIV infection. Although there were no statistically significant differences between suicide cases and controls with AIDS/HIV infection with respect to these socioeconomic disadvantages and presence of other physical illness, these disadvantages were substantially more common in suicide cases with than without AIDS/HIV infection and also in controls with than without the illness.

We also noted that, while prevalence of psychiatric illness, as well as of each specific diagnosis, was comparably high in those who died of suicide with and without a diagnosis of AIDS/HIV infection (40.9% and 43.8% respectively, $P = .6977$), significantly more controls with AIDS/HIV than controls without the illness had a psychiatric history by the matching date (32.0% vs 5.6%, $P < .0001$). Most strikingly, of individuals with both AIDS/HIV and psychiatric illness, the great majority (94.4% of those who died of suicide and 90.6% of controls) actually developed the psychiatric illness after they were diagnosed with AIDS or HIV infection.

Associated Risk for Subsequent Suicide Completion

AIDS/HIV infection constituted a significant risk factor for subsequent suicide, with an IRR of 8.73 (95% CI, 6.11–12.46) in the crude analysis, 4.81 (95% CI, 3.14–7.37) adjusted for psychiatric history and specific psychiatric diagnoses, and 3.84 (95% CI, 2.53–5.81) when further adjusted for marital status, annual gross income, place of residence, citizenship, and presence of other physical illness (Table 3).

In an additional analysis examining if the effect of AIDS/HIV infection on suicide risk differed by the introduction of HAART in 1997, we found a marginally stronger effect in the period before HAART was introduced—the associated

Table 2. Characteristics of 44 Men Who Died of Suicide and 100 Male Controls With AIDS/HIV Infection[a]

	Suicide Cases		Live Controls	
Variable	n	%	n	%
Details about AIDS/HIV infection				
Type of treatment[b]				
Inpatient	36	81.8	57	57.0
Outpatient only	8	18.2	43	43.0
Time of first diagnosis[c]				
Within 2 years	19	43.2	28	28.0
Between 2–5 years	16	36.4	26	26.0
5 years ago	9	20.4	46	46.0
Time from recent hospital contact[b]				
Within 1 year	27	61.4	36	36.0
1 year ago	17	38.6	64	64.0
No. of hospital contacts[c]				
1–3	24	54.5	73	73.0
>3	20	45.5	27	27.0
Socioeconomic status				
Marital status				
Married	3	6.8	15	15.0
Living with a cohabitant	1	2.3	6	6.0
Living as a single	40	90.9	79	79.0
Annual income[d]				
Highest quartile	2	4.5	13	13.0
Third quartile	3	6.8	10	10.0
Second quartile	5	11.4	20	20.0
Lowest quartile	34	77.3	57	57.0
Place of residence				
Areas other than provincial cities or capital area	11	25.0	28	28.0
Provincial cities	2	4.5	7	7.0
Capital area[e]	31	70.5	65	65.0
Citizenship				
Danish	37	84.1	87	87.0
Non-Danish	7	15.9	13	13.0
Physical and psychiatric illness history				
Physical illness requiring hospitalization, excluding AIDS/HIV infection				
No recorded history of physical illness	9	20.5	21	21.0
Physical illness other than AIDS/HIV	35	79.5	79	79.0
Psychiatric history				
No recorded psychiatric history	26	59.1	68	68.0
Psychiatric history before AIDS/HIV infection	1	2.3	3	3.0
Psychiatric history after AIDS/HIV infection	17	38.6	29	29.0
Psychiatric diagnoses				
Substance misuse disorder	7	15.9	14	14.0
Schizophrenia spectrum disorder	5	11.4	11	11.0
Affective disorder	3	6.8	5	5.0
Personality disorder	7	15.9	7	7.0

[a]$P < .01$ for tests of distribution differences between suicides with AIDS/HIV and suicides without AIDS/HIV in all socioeconomic variables and presence of other physical illness, and between controls with AIDS/HIV and controls without AIDS/HIV in all socioeconomic variables, presence of other physical illness, and psychiatric history, as well as the 4 specific psychiatric diagnoses.
[b]Test of distribution differences between suicides and controls with AIDS/HIV: $P < .01$.
[c]Test of distribution differences between suicides and controls with AIDS/HIV: $P < .05$.
[d]Income was categorized into quartiles according to the annual sex- and age-specific distribution in the general population.
[e]Refers to Copenhagen and Frederiksberg communities.
Abbreviations: AIDS = acquired immunodeficiency syndrome, HIV = human immunodeficiency virus.

IRR was 11.82 (95% CI, 6.95–20.11) in the pre-HAART era and 6.92 (95% CI, 4.25–11.26) in the HAART era in the crude analysis (test for differences: $\chi^2 = 2.12$, $P = .1454$) and 5.55 (95% CI, 3.07–10.06) and 2.77 (95% CI, 1.55–4.94), respectively, in the analysis adjusted for all covariates as socioeconomic status, other physical illness, and psychiatric history, as well as the 4 specific psychiatric diagnoses (test for differences: $\chi^2 = 2.71$, $P = .0994$).

Also, as shown in Table 3, we detected a significantly stronger effect on suicide risk of AIDS or HIV infection that led to inpatient treatment rather than only outpatient treatment (test for effect differences: $\chi^2 = 7.64$, $P = .0057$). The risk of suicide was particularly high in the first 2 years after diagnosis of AIDS/HIV infection ($\chi^2 = 8.37$, $P = .0152$). Having a recent hospital contact within 1 year increased suicide risk substantially as compared to having a recent contact ≥ 1 year ago ($\chi^2 = 7.77$, $P = .0053$). Multiple hospital contacts (more than 3) had a moderately stronger effect compared with the effect of fewer hospital contacts for AIDS/HIV infection ($\chi^2 = 4.65$, $P = .0311$). These observations were sustained when the data were adjusted for effect differences of covariates under study.

Moreover, we observed a significant interaction between AIDS/HIV infection and psychiatric illness on suicide risk ($\chi^2 = 33.56$, $P < .0001$) and therefore estimated the independent effects of AIDS/HIV infection, psychiatric illness, and their comorbidity. As shown in Table 4, AIDS/HIV infection alone and psychiatric illness alone increased the risk for suicide at a comparable magnitude in both crude and adjusted models. Comorbid AIDS/HIV infection and psychiatric illness tended to increase suicide risk slightly more than did either illness alone.

DISCUSSION

Key Findings and Possible Explanations

In this population study, we found that the majority of patients with AIDS/HIV infection, especially those who subsequently died of suicide, were living single, at the lowest quartile income level, as dwellers of the Capital area, and with other physical illness and that a large proportion of these patients developed a psychiatric illness after being diagnosed with AIDS or HIV infection. We also found that AIDS/HIV infection constituted a strong risk factor for subsequent suicide. The associated risk was substantially higher for persons who had been treated as an inpatient, received the diagnosis for the first time within the past 2 years, had a recent hospital treatment, or had had multiple hospital contacts because of the illness. The increased risk associated with AIDS/HIV was slightly higher before the introduction of HAART but remained highly significant in the HAART era. Meanwhile, we detected a strong interaction between AIDS/HIV and psychiatric illness, in that AIDS/HIV and psychiatric illness independently increased the risk of suicide at a comparable strength, and comorbidity of the 2 illnesses tended to have a slightly stronger effect than the presence of either illness alone.

Table 3. Suicide Risk Associated With AIDS/HIV Infection in Danish Men[a]

	Crude IRR (95% CI)[b]	Adjusted IRR Model I (95% CI)[c]	Adjusted IRR Model II (95% CI)[d]
AIDS/HIV infection			
No	1 (reference)	1 (reference)	1 (reference)
Yes	8.73 (6.11–12.46)[e]	4.81 (3.14–7.37)[e]	3.84 (2.53–5.81)[e]
Type of treatment			
No AIDS/HIV infection	1 (reference)	1 (reference)	1 (reference)
Inpatient treatment	12.47 (8.21–18.93)[e]	8.04 (4.86–13.29)[e]	5.90 (3.63–9.58)[e]
Outpatient treatment only	3.71 (1.74–7.88)[e]	1.51 (0.65–3.54)	1.33 (0.57–3.12)
Time of first diagnosis			
No AIDS/HIV infection	1 (reference)	1 (reference)	1 (reference)
Within 2 years	13.70 (7.61–24.70)[e]	11.48 (5.87–22.46)[e]	8.10 (4.21–15.61)[e]
Between 2–5 years	12.35 (6.62–23.03)[e]	4.89 (2.34–10.20)[e]	4.38 (2.12–9.04)[e]
≥ 5 years ago	3.83 (1.87–7.82)[e]	1.70 (0.74–3.88)	1.35 (0.60–3.05)
Time from recent hospital contact			
No AIDS/HIV infection	1 (reference)	1 (reference)	1 (reference)
Within 1 year	14.96 (9.04–24.74)[e]	12.48 (6.97–22.36)[e]	8.53 (4.82–15.09)[e]
At least 1 year ago	5.27 (3.09–9.00)[e]	2.02 (1.09–3.74)[f]	1.78 (0.97–3.28)
No. of total hospital contacts			
No AIDS/HIV infection	1 (reference)	1 (reference)	1 (reference)
1–3	6.51 (4.10–10.34)[e]	3.63 (2.11–6.23)[e]	3.00 (1.77–5.08)[e]
> 3	14.68 (8.24–26.19)[e]	8.20 (3.99–16.85)[e]	6.07 (3.02–12.18)[e]

[a]Tests for effect differences (based on crude analyses): inpatient vs outpatient only ($\chi^2 = 7.64$, $P = .0057$), first diagnosis within 2 years, 2–5 years vs ≥ 5 years ago ($\chi^2 = 8.37$, $P = .0152$), recent hospital contact within 1 year vs 1 year ago ($\chi^2 = 7.77$, $P = .0053$), 1–3 hospital contacts vs > 3 contacts ($\chi^2 = 4.65$, $P = .0311$).
[b]Crude model was adjusted only for age through matching.
[c]Adjusted model I was also adjusted for personal psychiatric history and specific diagnoses of substance misuse disorder, schizophrenia spectrum disorder, affective disorder, and personality disorder.
[d]Adjusted model II was further adjusted for marital status, annual gross income, place of residence, citizenship, and presence of physical illness other than AIDS/HIV infection.
[e]$P < .001$.
[f]$P < .05$.
Abbreviations: AIDS = acquired immunodeficiency syndrome, HIV = human immunodeficiency virus, IRR = incidence rate ratio.

Through the interlinked personal data from Danish population registers, this study provides firm insights into important characteristics of both suicide cases and population controls with a diagnosis of AIDS or HIV infection. Among those with AIDS/HIV infection, the insignificant differences found in this study between those who died of suicide and controls on common socioeconomic disadvantages are somewhat different from our primary hypothesis that individuals with AIDS/HIV infection who committed suicide would be more likely to be exposed to these risk factors. Instead, our data indicate that, at least in Denmark, these socioeconomic characteristics—despite many individual differences—tend to be shared by individuals with AIDS/HIV infection as a group.

Our observation of an 8.73-fold increased suicide risk associated with AIDS/HIV infection is comparable to the reported effect size in early population studies from, for example, the United States,[4] Switzerland,[5] and Spain.[10] Several studies have indicated that individuals with AIDS/HIV infection are more inclined to report symptoms of fatigue, anxiety, and depression than the general population.[20–22] They are also more likely to experience strong feelings of helplessness, hopelessness, loneliness, and despair.[23–25] As the disease progresses, people with AIDS/HIV are more likely to develop severe infections and cancer[26–28] and more prone to other physical illness requiring hospital treatment, as shown in the present study. Such physical comorbidity may induce painful and disabling symptoms, have detrimental effects on quality of life, and increase worries for the future and fear of dying and loss of control, thus making suicide an increasingly more likely choice.

Our study adds to the literature demonstrating that a large proportion of persons with AIDS/HIV infection developed a psychiatric illness in the time after having received the diagnosis of AIDS/HIV infection and that there was a significant interaction between AIDS/HIV and psychiatric illness on suicide risk. These findings are in concordance with early studies reporting a strong influence of HIV infection on risk for developing psychiatric disorders,[20,21] which are, in turn, the strongest risk factor for suicide found across a variety of populations and studies.[17,29] While onset of psychiatric disorder can exist long before contact with psychiatric services, we should note that our data on psychiatric history date from 1969[16]—almost 20 years before the diagnosis of AIDS/HIV infection was first reported in Denmark in 1986. This makes the identified first hospital contact for psychiatric illness after the diagnosis of AIDS/HIV infection more likely to be a new case with psychiatric illness. Our results therefore suggest that psychiatric illness is likely to stand in the pathway between AIDS/HIV infection and subsequent suicide and has a strong mediating role to link the 2 events. The strong independent effect of AIDS/HIV infection alone, as detected in the present study, could also derive some contribution from psychiatric disorders or impairment not severe enough to result in hospital treatment.

To our awareness, this study is the first to report risk of suicide associated with detailed data on hospital contacts for AIDS or HIV infection. Our findings regarding substantial effects on suicide risk of being an inpatient, new patient, recently treated patient, or frequently treated patient indicate not only that severity or clinical stage of the illness plays an important role in the decision to take one's own life, but also that the hardship of accepting the diagnosis and coping with the illness may contribute strongly to the increased risk. This suggestion is further supported by our observation that, compared with a weakened effect of a diagnosis received longer ago, the IRR for suicide associated with a recent first-time diagnosis (within 2 years) remained markedly high even after the data were adjusted for psychiatric history, specific psychiatric disorders, presence of other physical illness, and important socioeconomic factors.

Consistent with a recent report from Switzerland,[5] our findings suggest a slightly reduced effect of AIDS/HIV infection on suicide risk after the introduction of HAART. In places where HAART is widely used for treating AIDS or HIV infection, the significant improvement in patients' general health

Table 4. Independent Effect of AIDS/HIV Infection and Psychiatric Illness on Risk for Suicide[a]

	Suicide Cases, n (%)	Live Controls, n (%)	IRR (95% CI)	
			Crude[b]	Adjusted[c]
Neither AIDS/HIV infection nor psychiatric illness	5,537 (55.93)	178,390 (94.37)	1 (reference)	1 (reference)
AIDS/HIV infection only	26 (0.26)	68 (0.04)	13.01 (8.21–20.62)	9.02 (5.65–14.41)
Psychiatric illness only	4,319 (43.63)	10,547 (5.58)	13.47 (12.86–14.10)	9.15 (8.69–9.62)
Both AIDS/HIV infection and psychiatric illness	18 (0.18)	32 (0.02)	18.72 (10.42–33.65)	11.32 (6.26–20.48)

[a]Test of interaction between AIDS/HIV and psychiatric history from the crude analysis: $\chi^2 = 33.56$, $P < .0001$.
[b]Crude IRRs were adjusted only for age through matching.
[c]Adjusted IRRs were further adjusted for marital status, annual gross income, place of residence, citizenship, and presence of physical illness other than AIDS/HIV infection.
Abbreviations: AIDS = acquired immunodeficiency syndrome, HIV = human immunodeficiency virus, IRR = incidence rate ratio.

and survival prognosis attained from this treatment may thus be further strengthened by a consequent reduction of suicide risk in this high-risk group.

Limitations and Strengths

The rich findings of the present study should be interpreted in light of several limitations. First, our study was limited to men because too few women who died of suicide had a recorded hospital contact for AIDS or HIV infection, making our findings applicable to only the male population. Second, as a proxy for psychiatric illness, we used history of hospital contacts to psychiatric services, which may reflect relatively serious disorders[30] and underestimate the full extent to which psychiatric disorders and episodes may be associated with AIDS/HIV infection and suicide risk in this population. Because we identified only 44 men who died of suicide and had AIDS/HIV infection in the study population, the findings should ideally be further tested by studies with even larger sample sizes, in populations characterized by male gender such as military veterans, in places where AIDS/HIV is more prevalent and/or suicide rates are even higher, or in countries with different cultural views on suicide and/or AIDS.

On the other hand, this study is, to our knowledge, the first to address suicide risk in relation to AIDS/HIV infection with interlinked individual-level data covering an entire national population. The full coverage of the eligible population in Denmark and the precise data collected systematically ensure that our findings are not subject to change due to possible biases often induced by recall of information and selection of access to health care. Although there are large geographic disparities in prevalence of AIDS/HIV infection and treatment provided to patients, our findings should have good generalizability, especially in developed regions or countries. Confirmatory studies are needed to clarify whether our findings have validity in low-income countries, but there is no obvious reason to expect that individuals with AIDS/HIV in low-income countries would be less exposed to the factors our study has shown to be associated with an increased risk for suicide.

Clinical Implications

The rich insights and firm findings from this study should have strong implications for formulating strategies to reduce suicide risk in this high-risk population. First, there is a need to integrate suicide prevention with hospital treatment for patients with AIDS or HIV infection. Patients with the illness not only form a well-defined group at high risk for suicide, but also retain frequent contacts to hospitals or their general practitioners, which provides windows for both risk assessment and prevention opportunity. Clinicians treating persons with AIDS/HIV infection should be aware of signs pointing to suicidal behavior, especially when these individuals are inpatients, new patients, recently treated patients, or frequently treated patients. Developing this awareness may require that these clinicians receive additional training in suicide risk assessment and management. Moreover, because psychiatric disorder is quite likely mediating suicide risk in this population, systematic psychiatric assessment is imperative to secure early and effective intervention and management for mental health problems. Toward this end, closer collaboration is needed between clinicians and clinical units with responsibility for somatic and mental health. Also needed are efforts to strengthen the continuity of care in transitions between care levels and systems, as well as more systematic psychiatric and somatic follow-up of patients after discharge from hospital. We believe that any effort in treating psychiatric illnesses or episodes in patients with AIDS/HIV infection would have a positive effect on reducing the patient's risk for suicide. Additionally, our findings regarding the socioeconomic disadvantages shared by individuals with AIDS/HIV infection indicate the need for improvement of clinical capacities to address psychosocial and existential needs in the treatment of patients with AIDS/HIV infection. Public campaigns against the stigma of AIDS are also essential to improve detection of individuals possibly infected with HIV and to reduce the burden of the illness for those living with AIDS or HIV infection.

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Author contributions: Dr Jia searched the literature and prepared the first draft of the report. Dr Qin designed the study, compiled the data, did the analysis, and finalized the report. Drs Jia and Mehlum participated in all discussions about the study design and interpretation of data and made critical revision of the manuscript for important intellectual content. Dr Qin had full access to the data in the study, takes responsibility for

the integrity of the data and the accuracy of the data analysis, and had final responsibility for the decision to submit for publication.
Potential conflicts of interest: None reported.
Funding/support: The study was funded by the Danish Sygekassernes Helsefonden (Danish Health Insurance Research Fund) (2009B063).
Role of sponsor: The study sponsor had no involvement in design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; or the decision to submit the article for publication.

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