

## ONLINE FIRST

# National Study of Suicide in All People With a Criminal Justice History

Roger T. Webb, PhD; Ping Qin, PhD; Hanne Stevens, MSc; Preben B. Mortensen, DrMedSc; Louis Appleby, MD; Jenny Shaw, PhD

**Context:** Previous research has focused on suicide among male prisoners and ex-prisoners, but little is known about risk in the wider offender population.

**Objective:** To examine suicide risk over 3 decades among all people processed by a national criminal justice system.

**Design:** Nested case-control study.

**Setting:** The whole Danish population.

**Participants:** Interlinked national registers identified all adult suicides during 1981 to 2006 according to any criminal justice system contact since 1980. Exposure was defined according to history of criminal justice adjudication, up to and including each subject's last judicial verdict before suicide (or date of matching for controls). There were 27 219 suicides and 524 899 controls matched on age, sex, and time, ie, controls were alive when their matched case died.

**Main Outcome Measure:** Suicide.

**Results:** More than a third of all male cases had a criminal justice history, but relative risk against the general

population was higher for women than men. Independent effects linked with criminal justice exposure persisted with confounder adjustment. Suicide risk was markedly elevated with custodial sentencing, but the strongest effects were with sentencing to psychiatric treatment and with charges conditionally withdrawn. Risk was raised even in people with a criminal justice history but without custodial sentences or guilty verdicts. It was especially high with recent or frequent contact and in people charged with violent offenses.

**Conclusions:** We examined a section of society in which major health and social problems frequently coexist including offending, psychopathology, and suicidal behavior. The need for developing more far-reaching national suicide prevention strategies is indicated. In particular, improved mental health service provision is needed for all people in contact with the criminal justice system, including those not found guilty and those not given custodial sentences. Our findings also suggest that public services should be better coordinated to tackle co-occurring health and social problems more effectively.

*Arch Gen Psychiatry.* 2011;68(6):591-599.

Published online February 7, 2011.

doi:10.1001/archgenpsychiatry.2011.7

**Author Affiliations:** Centre for Suicide Prevention, University of Manchester, Manchester, England (Drs Webb, Appleby, and Shaw); and National Centre for Register-based Research, University of Aarhus, Aarhus, Denmark (Drs Qin and Mortensen and Ms Stevens).

**T**HE US NATIONAL STRATEGY for Suicide Prevention emphasizes the importance of reducing suicide rates among prisoners.<sup>1</sup> Most published research on suicide and the criminal justice system relates to people in custody<sup>2,3</sup> or the postrelease period.<sup>4-6</sup> A national study reported a 9-fold higher risk among US jail inmates compared with the general population in the mid-1980s<sup>7</sup> and another from England and Wales, a 5-fold higher risk among male prisoners during 1978 to 2003.<sup>8</sup> Investigations of suicide among offenders who are not imprisoned are comparatively rare, but elevated risk in this population has also been found.<sup>9-13</sup> Some have suggested that com-

munity offenders could be even more vulnerable than prisoners.<sup>11</sup> There has been speculation as to modification of which penal system risk factors might achieve the largest reduction in risk, although prison conditions may not wholly explain the excess risk seen in this population.<sup>14,15</sup> Alternatively, higher risk could reflect raised levels of psychopathology and social adversity in the communities served by prisons.<sup>16</sup> The link between offending and elevated suicide risk constitutes a major public health concern if considered from this wider perspective of all people passing through the criminal justice system.

We examined suicide during 1981 to 2006 in all persons processed by the Danish criminal justice system since 1980. We

hypothesized elevated risk across this population, including those imprisoned and also those given only non-custodial sentences and not guilty verdicts. We further predicted especially high risk in people sentenced for psychiatric treatment, those experiencing recent or frequent contact, and those with at least 1 contact for sexual or violent offense charges. Few studies have been adequately powered for precise sex-specific effect estimation<sup>4,17</sup> and so we analyzed men and women separately. Finally, we aimed to estimate the prevalence of serious mental illness in this population<sup>18-21</sup> and to assess confounding by clinical and social risk factors.<sup>22,23</sup>

## METHODS

### NATIONAL REGISTERS, OUTCOME, AND EXPOSURES

The Danish Data Protection Agency granted their prior approval for the study. Longitudinal national registers were interlinked using unique civil registration numbers.<sup>24</sup> The Causes of Death Register<sup>25</sup> recorded all suicides in individuals 15 years and older between January 1, 1981, and December 13, 2006, using the *International Classification of Diseases, Eighth Revision (ICD-8)* (ICD-8 codes E950-959) for 1981 to 1993<sup>26</sup> and the Tenth Revision (ICD-10 codes X60-X84) for 1994 to 2006.<sup>27</sup> Denmark may classify suicide more completely than some other western European countries, such as the United Kingdom.<sup>28,29</sup> Therefore, in line with Danish convention, our case definition included only suicide verdicts, with undetermined deaths excluded. Exposure to the criminal justice system per se was defined as being processed for any criminal charge since January 1, 1980. These data were extracted from the National Criminal Register.<sup>30,31</sup> All charges are registered whether or not they progress to court, including alleged violations of the penal code, the traffic act, and various special acts, with the latter encompassing possession of illegal substances and weapons. All fines are recorded with the exception of traffic offense fines, for which a triviality limit applies; this stood at kr 1500 as of May 2010 (\$265). Minor transgressions, for illegal parking or public transportation fare evasion, for example, are not registered because they result only in noncriminal levies.

Exposure was examined initially according to any criminal justice system contact since 1980. Our consistent use of the term *last contact* means the last occasion when a criminal justice verdict was reached, and these data did not indicate whether people were still serving custodial or community sentences when suicide occurred. Exposure status was stratified by years since last contact, total number of contacts, and offense type according to routine reporting by Statistics Denmark: sexual, violent, property, traffic, and other types. Violent offenses included homicide, attempted homicide, assault, robbery, and violent threats. Negligent homicide caused by traffic accident is a penal offense in Denmark, and this was also included in the violent offense category. We could not examine homicide-suicide<sup>32,33</sup> because our exposure data were derived entirely from antecedent criminal justice records; the precipitating or simultaneous homicidal act was not recorded on the death certificates of these cases, which, in any case, are exceptionally rare.

Seven verdict types were also assessed: custodial sentence, suspended sentence, fined, charges conditionally withdrawn, psychiatric treatment, acquitted, and all other verdicts. This miscellaneous category consisted mostly of cases with evidence too weak for progression to trial, ie, no charge, charges waived or warning, and a very small number of repeals of sentence and military punishments. In these cases, along with acquittals, a

not guilty decision is made. In Denmark, charges conditionally withdrawn are somewhat akin to suspended sentences and are most frequently applied to juveniles or persons already serving a sentence with psychiatric treatment. Additionally, we examined 2 broad exposure groups, (1) noncustodial verdicts only and (2) not guilty verdicts only, from the first registered criminal justice system contact to the last one before suicide (or matching date for controls). Although a single judicial verdict can represent multiple offenses, figures reported by Statistics Denmark for 2006 indicated that 73% of all penal code cases had just 1 criminal charge.<sup>34</sup> If several charges were considered in the same judicial case, our analyses assessed only the most serious one.

## COVARIATES

The Psychiatric Central Register identified all admissions since 1969 and all outpatient episodes from 1995.<sup>35</sup> This is a complete national record of secondary care treatment because there are no private psychiatric hospitals in Denmark and all treatment is provided free of charge. The other potential confounders were civil status (married, cohabiting, single, living with family); being a parent; area of residence (central/suburban Copenhagen, other large cities, elsewhere); taxable income level in quartiles; highest educational attainment (primary school, secondary school, vocational training, degree/higher degree); and born outside Denmark or non-Danish citizenship. These social risk factors were obtained via the Central Population Register<sup>24</sup> and the Integrated Database for Labour Market Research (IDA).<sup>36</sup> Civil status, income level, and educational attainment were derived from the IDA database according to the most recent annual record prior to suicide, while place of residence and being a parent were taken from the Central Population Register on cases' dates of death. At the outset, we restricted selection of cases and controls to people living in Denmark on December 31 in the year preceding suicide, to ensure completeness of the social risk factors extracted from the IDA database. We thereby excluded a relatively small number of cases in the national cohort, but the data set contained 27 219 (99.6%) of all 27 316 adult suicide cases. In the case-control study, the covariates were 100% complete except for educational attainment. This was unknown for 21.8% of cases and 13.0% of controls, with missing data more common for older people and those of non-Danish origin. Subjects with an unknown attainment level were categorized separately in the regression models with a dummy variable indicating missing data.

## STUDY DESIGN AND STATISTICAL ANALYSES

Using the nested case-control design,<sup>37</sup> the 27 219 cases were matched on date of birth and sex to 524 899 controls who were alive on the date that their matched case died. Date of birth matching adjusted for both age and cohort effects. The controls were selected from a 25.0% random sample of the national population cohort. Sampling up to 25 controls per case enabled examination of rare exposures. Because the registry data were collected prospectively, measurement procedures were identical between cases and controls. We calculated exposure prevalence and estimated relative risks as exposure odds ratios (ORs) in conditional logistic regression models that took account of the matched design.<sup>37</sup> Incidence density sampling ensured that the ORs (and their confidence intervals [CIs]) were virtually equivalent to hazard ratios (and their CIs) that would be generated by survival analyses of the entire cohort.<sup>37</sup> We consistently applied a generic reference category for OR estimation, ie, persons with no registered criminal justice system contact since 1980. We generated adjusted regression models

**Table 1. Prevalence of Criminal Justice History by Verdict Category and ORs for Suicide<sup>a</sup>**

Criminal Justice History	No. (%)		OR (95% CI)	Adjusted OR (95% CI) <sup>c</sup>
	Suicides <sup>b</sup>	Controls <sup>b</sup>		
<b>Men</b>				
Broad categories <sup>d</sup>				
No criminal justice history	11 772 (65.2)	262 769 (75.4)	1 [Reference]	1 [Reference]
Any verdict	6291 (34.8)	85 711 (24.6)	2.27 (2.19-2.35)	
Noncustodial only	4299 (23.8)	72 244 (20.7)	1.82 (1.75-1.90)	
Not guilty only	443 (2.5)	5168 (1.5)	2.37 (2.14-2.62)	
Specific categories				
Custodial sentence	1992 (11.0)	13 467 (3.9)	4.81 (4.56-5.08)	3.79 (3.44-4.18)
Suspended sentence	1274 (7.1)	9311 (2.7)	4.81 (4.51-5.14)	3.12 (2.66-3.67)
Fined	4836 (26.8)	72 963 (20.9)	2.05 (1.97-2.13)	1.44 (1.37-1.51)
Charges withdrawn	381 (2.1)	2649 (0.8)	5.33 (4.76-5.97)	2.26 (1.51-3.37)
Psychiatric treatment	161 (0.9)	377 (0.1)	13.51 (11.19-16.30)	11.37 (8.05-16.06)
Acquitted	226 (1.3)	1956 (0.6)	3.84 (3.34-4.43)	2.25 (1.57-3.24)
Any other verdict	1927 (10.7)	16 189 (4.6)	3.85 (3.65-4.07)	2.38 (2.14-2.64)
<b>Women</b>				
Broad categories <sup>d</sup>				
No criminal justice history	7985 (87.2)	167 359 (94.9)	1 [Reference]	1 [Reference]
Any verdict	1171 (12.8)	9060 (5.1)	3.31 (3.09-3.54)	
Noncustodial only	1017 (11.1)	8585 (4.9)	3.03 (2.81-3.25)	
Not guilty only	230 (2.5)	1664 (0.9)	3.28 (2.85-3.78)	
Specific categories				
Custodial sentence	154 (1.7)	475 (0.3)	8.88 (7.37-10.70)	6.45 (4.82-8.63)
Suspended sentence	188 (2.1)	763 (0.4)	6.95 (5.89-8.19)	3.30 (2.41-4.51)
Fined	778 (8.5)	6609 (3.7)	3.05 (2.81-3.31)	2.29 (2.08-2.52)
Charges withdrawn	41 (0.4)	105 (0.06)	11.34 (7.86-16.34)	5.00 (2.22-11.22)
Psychiatric treatment	29 (0.3)	30 (0.02)	25.65 (15.35-42.86)	13.15 (6.32-27.40)
Acquitted	34 (0.4)	171 (0.1)	5.50 (3.79-7.97)	2.76 (1.44-5.32)
Any other verdict	431 (4.7)	2299 (1.3)	4.64 (4.16-5.16)	3.29 (2.85-3.81)

Abbreviations: CI, confidence interval; OR, odds ratio.

<sup>a</sup>All adult suicide cases during 1981 to 2006; all criminal justice system contacts since 1980.

<sup>b</sup>Men: 18 063 suicide cases and 348 480 matched controls. Women: 9156 suicide cases and 176 419 matched controls.

<sup>c</sup>Adjusted for any other category of criminal justice verdict since 1980.

<sup>d</sup>Effects for each of these 3 broad categories were derived from separate logistic regression models, each one using the category "no criminal justice history" as the generic reference category.

iteratively to assess the strength of confounding by clinical vs social risk factors. To examine potential effect modification, we fitted statistical interactions and formally evaluated these with Wald tests. Finally, we estimated adjusted population attributable fractions.<sup>38</sup> All analyses were performed using Stata software version 10 (StataCorp, College Station, Texas).

## RESULTS

### PREVALENCE OF CRIMINAL JUSTICE SYSTEM CONTACT

There were 18 063 male and 9156 female adult suicides during 1981 to 2006. Exposure prevalence is shown in **Table 1**. More than a third of all male suicides (34.8%) had a criminal justice history compared with 12.8% of female cases. Among suicide cases, the most common specific verdict category was being fined (men, 26.8%; women, 8.5%) and the least common was being sentenced for psychiatric treatment (men, 0.9%; women, 0.3%). Within each verdict category, exposure prevalence was much higher in men than women for cases and controls, and it was also consistently higher for cases than controls in both sexes.

### RELATIVE RISKS WITH ANY CRIMINAL JUSTICE HISTORY AND BY VERDICT CATEGORY

Table 1 also shows OR estimates. Any criminal justice history was linked with a more than 2-fold higher suicide risk in men and a greater than 3-fold increase in women, with a highly significant sex interaction indicated ( $\chi^2=91.2$ ;  $P<.001$ ). For each specific verdict category, the association was consistently stronger in women. Men and women with a custodial sentencing history had high relative risks, but strong effects were also seen in people with suspended sentences, charges conditionally withdrawn, acquittals, and "other" verdicts, while sentencing for psychiatric treatment had the highest relative risk of all. Although effect sizes were smaller among people with a criminal justice history who had never received a custodial sentence or a guilty verdict, they were nonetheless precise and highly significant. Most (56.7%) of the 6291 male suicides with any criminal justice history had multiple verdicts, compared with 37.7% of all 1171 female cases. Table 1 also shows the verdict-specific effects adjusted for history of any other type of judicial verdict. An independent effect remained in both sexes specific to each verdict type.

**Table 2. Prevalence of Secondary Care–Treated Psychiatric Illness by Criminal Justice History: Suicides During 2000 to 2006 Only<sup>a</sup>**

Criminal Justice History	Suicides <sup>b</sup>			Controls <sup>b</sup>		
	All Subjects, No.	Psychiatric Care, No.	Prevalence, %	All Subjects, No.	Psychiatric Care, No.	Prevalence, %
<b>Men</b>						
Inpatient or outpatient care						
No criminal justice history	1611	560	34.8	37 974	1849	4.9
Any contact	1728	830	48.0	27 388	2594	9.5
Custodial sentence	493	265	53.8	3738	873	23.4
Noncustodial only	1235	565	45.7	23 650	1721	7.3
<b>Women</b>						
Inpatient or outpatient care						
No criminal justice history	947	553	58.4	21 546	1674	7.8
Any contact	314	235	74.8	2967	419	14.1
Custodial sentence	47	35	74.5	115	40	34.8
Noncustodial only	267	200	74.9	2852	379	13.3

<sup>a</sup>All inpatient admissions since 1969 and all outpatient care since 1995; all criminal justice system contacts since 1980.

<sup>b</sup>Men: 3339 suicide cases and 65 362 matched controls. Women: 1261 suicide cases and 24 513 matched controls.

**Table 3. ORs for Suicide Risk With Any Criminal Justice History With Various Levels of Adjustment for Clinical and Social Risk Factors**

	OR (95% CI)			
	Unadjusted	Adjusted for Psychiatric Admission Only <sup>a</sup>	Adjusted for Social Risk Factors Only <sup>b</sup>	Adjusted for Psychiatric Admission and for Social Risk Factors <sup>c</sup>
Men	2.27 (2.19-2.35)	1.71 (1.65-1.78)	1.85 (1.78-1.92)	1.56 (1.50-1.62)
Women	3.31 (3.09-3.54)	2.05 (1.89-2.23)	2.66 (2.47-2.85)	1.92 (1.77-2.08)

Abbreviations: CI, confidence interval; OR, odds ratio.

<sup>a</sup>Adjusted for any psychiatric admission since 1969.

<sup>b</sup>Adjusted for demographics and socioeconomic status.

<sup>c</sup>Adjusted for any psychiatric admission and for demographics and socioeconomic status.

Completely registered criminal justice history since 1980 was available only for persons born in 1965 or later: 1914 male (10.6%) and 470 female (5.1%) cases. We fitted an interaction term by birth in 1964 and earlier vs 1965 and later. The effect size was significantly greater for males born later (OR, 2.64; 95% CI, 2.39-2.92) than earlier (OR, 2.22; 95% CI, 2.13-2.30; interaction:  $\chi^2=10.4$ ;  $P=.001$ ). A similar pattern was seen in women (born 1965 or later: OR, 3.73; 95% CI, 2.98-4.68; born pre-1965: OR, 3.27; 95% CI, 3.04-3.51), although this interaction term was nonsignificant ( $\chi^2=1.2$ ;  $P=.27$ ).

#### PREVALENCE OF SECONDARY CARE–TREATED MENTAL ILLNESS

**Table 2** gives the prevalence of previous inpatient or outpatient psychiatric care according to criminal justice history, sex, and case-control status. For these analyses, we restricted the data set to include only suicides (and their matched controls) that occurred during 2000 to 2006, thereby ensuring that there were at least 5 years of complete outpatient history for each subject. Almost half of male suicides with a criminal justice history had received secondary care psychiatric treatment compared with three-quarters of women with such history. In both sexes, those sentenced to receive psychiatric treat-

ment and those with charges conditionally withdrawn had a particularly high prevalence of secondary care–treated mental illness (these results are not shown in Table 2). Table 2 also shows a large differential in prevalence of serious mental illness among controls according to whether the criminal justice outcome had been custodial. This differential was much smaller among the cases.

#### ADJUSTMENT FOR CLINICAL AND SOCIAL RISK FACTORS

**Table 3** presents main-effects covariate adjustment for psychiatric treatment, socioeconomic status, and sociodemographics. History of psychiatric admission strongly confounded the link between criminal justice exposure and elevated suicide risk in both sexes, and additional adjustment for social risk factors reduced the effect sizes further. With comprehensive adjustment, the strong crude effects seen in women were attenuated to a greater degree than in men. Thus, in the final model, the adjusted female estimates were not substantially greater than the equivalent adjusted male ones, although the sex interaction term remained highly significant ( $\chi^2=32.0$ ;  $P<.001$ ). We also made the same adjustments with exposure to specific verdict types (results not shown in Table 3). The greatest attenuation seen was with sentencing to psychiatric

**Table 4. ORs Stratified by Offense Type**

Offense Type	No. (%)		OR (95% CI)	Adjusted OR (95% CI) <sup>b</sup>
	Suicides <sup>a</sup>	Controls <sup>a</sup>		
<b>Men</b>				
Offense type <sup>c</sup>				
Sexual	134 (0.7)	1138 (0.3)	3.75 (3.12-4.49)	1.46 (1.20-1.79)
Violent	1110 (6.1)	8278 (2.4)	4.62 (4.31-4.95)	1.81 (1.67-1.95)
Property	2768 (15.3)	24 498 (7.0)	3.75 (3.58-3.94)	1.69 (1.60-1.79)
Traffic	4341 (24.0)	63 810 (18.3)	2.13 (2.04-2.21)	1.65 (1.58-1.72)
All other offenses	1674 (9.3)	18 260 (5.2)	2.94 (2.78-3.11)	1.60 (1.50-1.71)
<b>Women</b>				
Offense type <sup>c</sup>				
Sexual	1 (0.01)	14 (0.01)		
Violent	85 (0.9)	280 (0.2)	8.40 (6.57-10.75)	2.08 (1.54-2.81)
Property	688 (7.5)	3851 (2.2)	4.48 (4.10-4.88)	1.95 (1.76-2.18)
Traffic	495 (5.4)	4637 (2.6)	2.80 (2.54-3.09)	2.19 (1.95-2.46)
All other offenses	202 (2.2)	1222 (0.7)	4.41 (3.78-5.14)	1.99 (1.65-2.40)

Abbreviations: CI, confidence interval; OR, odds ratio.

<sup>a</sup>Men: 18 063 suicide cases and 348 480 matched controls. Women: 9156 suicide cases and 176 419 matched controls.

<sup>b</sup>Adjusted for any psychiatric admission since 1969 and for social risk factors.

<sup>c</sup>Any criminal justice system contact for these specific offense types since 1980. Subjects with more than 1 offense type recorded in their criminal justice history appear in multiple offense categories in these analyses.

treatment followed by charges conditionally withdrawn. From the ORs shown in Table 1 and Table 3, we assessed the population impact of any criminal justice system contact on suicide risk by estimating the population attributable fraction with and without the confounders in the final model: men, unadjusted 19.5%, adjusted 12.5%; women, unadjusted 8.9%, adjusted 6.1%.

We conducted further analyses to compare the strength of confounding by inpatient-treated mental illness vs that treated in either secondary care setting, with the data set again restricted to suicides during 2000 to 2006. In both sexes, the adjusted ORs were virtually equivalent, regardless as to which of these 2 alternatives was fitted as the covariate (eg, men, unadjusted: OR, 1.95; 95% CI, 1.81-2.10; adjusted for inpatient care: OR, 1.61; 95% CI, 1.49-1.74; adjusted for inpatient or outpatient care: OR, 1.58; 95% CI, 1.46-1.71).

#### RELATIVE RISKS BY OFFENSE TYPE, RECENCY AND FREQUENCY OF CONTACT, AND AGE

Among cases and controls, the most common offense types were traffic violations and property crimes (**Table 4**). However, the largest relative risks were with violent offenses, particularly so in women, and the smallest were with traffic violations. Overall, women with a criminal justice history of violent offense charges had a greater than 8-fold higher risk than their general population peers. Male relative risk in relation to sexual offenses was comparable with that seen with property crimes. In women, only 1 suicide case had a criminal justice history for a sexual offense charge and a meaningful relative risk was therefore inestimable. Adjusted relative risks by offense type, also given in Table 4, demonstrate the strong combined confounding effect of clinical and social risk factors. These ranged from 1.46 to 1.81 in men and from 1.95 to 2.19 in women, with the large variation in crude effect sizes largely disappearing with adjustment.

**Table 5** shows that for both sexes there was a clear trend of rising risk with increasing recency, with risk highest if the last criminal justice system contact was within 3 months of suicide. There was also a strong trend in rising risk with increasing number of contacts, with an especially steep gradient seen in women.

Finally, we calculated age-specific effects, because there was strong evidence of effect modification by age (men:  $\chi^2=110.8$ ;  $P<.001$ ; women:  $\chi^2=18.9$ ;  $P<.001$ ). The strongest effect was at 25 to 34 years of age (men: OR, 3.31; 95% CI, 3.03-3.61; women: OR, 4.65; 95% CI, 3.87-5.58), followed by at younger than 25 years (men: OR, 2.80; 95% CI, 2.48-3.15; women: OR, 4.26; 95% CI, 3.13-5.80). The smallest elevation in risk was at 35 years or older (men: OR, 2.03; 95% CI, 1.94-2.11; women: OR, 3.09; 95% CI, 2.86-3.33).

#### COMMENT

#### SUMMARY OF MAIN FINDINGS

By examining longitudinal registry data over 3 decades, we conducted, to our knowledge, the largest and most comprehensive investigation of this topic to date. Our findings, including the sizeable population attributable fraction values, suggest that criminal justice history per se may be an important addition to the list of general population risk factors for suicide. To our knowledge, no previous study has examined this population in a complete national cohort while accounting for important risk factors for suicide, including mental illness and social adversity. These analyses generated the important finding that higher risk was not explained by these confounders. More than a third of all Danish adult male suicides had some contact with the criminal justice system. Although exposure prevalence was far lower in female cases, the relative risk vs the general population was consis-

**Table 5. ORs Stratified by Time Since Last Contact With the Justice System and by Total Number of Contacts**

Recency and Frequency of Contact	No. (%)		OR (95% CI)
	Suicides <sup>a</sup>	Controls <sup>a</sup>	
<b>Male</b>			
Time since last contact			
Within 3 mo	637 (3.5)	4052 (1.2)	4.95 (4.53-5.40)
>3 mo, within 6 mo	464 (2.6)	3759 (1.1)	3.90 (3.53-4.31)
>6 mo, within 1 y	730 (4.0)	6737 (1.9)	3.38 (3.12-3.66)
>1 y, within 5 y	2474 (13.7)	33 969 (9.7)	2.22 (2.12-2.33)
>5 y, within 10 y	1192 (6.6)	21 120 (6.1)	1.69 (1.59-1.81)
>10 y	794 (4.4)	16 074 (4.6)	1.44 (1.33-1.56)
Total No. of contacts			
1	2724 (15.1)	46 487 (13.3)	1.74 (1.66-1.82)
2	1235 (6.8)	16 650 (4.8)	2.51 (2.35-2.68)
3	644 (3.6)	8061 (2.3)	2.83 (2.60-3.09)
4	391 (2.2)	4514 (1.3)	3.16 (2.84-3.52)
5-9	826 (4.6)	7259 (2.1)	4.31 (3.99-4.67)
≥10	471 (2.6)	2740 (0.8)	7.04 (6.34-7.82)
<b>Female</b>			
Time since last contact			
Within 3 mo	75 (0.8)	296 (0.2)	6.39 (4.95-8.26)
>3 mo, within 6 mo	67 (0.7)	306 (0.2)	5.72 (4.38-7.48)
>6 mo, within 1 y	124 (1.4)	571 (0.3)	5.43 (4.46-6.62)
>1 y, within 5 y	493 (5.4)	3309 (1.9)	3.74 (3.38-4.13)
>5 y, within 10 y	242 (2.6)	2516 (1.4)	2.43 (2.12-2.78)
>10 y	170 (1.9)	2062 (1.2)	2.11 (1.79-2.48)
Total No. of contacts			
1	729 (8.0)	7102 (4.0)	2.60 (2.40-2.82)
2	209 (2.3)	1181 (0.7)	4.82 (4.14-5.62)
3	88 (1.0)	344 (0.2)	7.21 (5.68-9.15)
4	38 (0.4)	136 (0.08)	7.80 (5.41-11.24)
5-9	77 (0.8)	236 (0.1)	9.50 (7.31-12.34)
≥10	30 (0.3)	61 (0.03)	14.12 (9.06-21.99)

Abbreviations: CI, confidence interval; OR, odds ratio.

<sup>a</sup>Men: 18 063 suicide cases and 348 480 matched controls. Women: 9156 suicide cases and 176 419 matched controls.

tently higher for women. Risk was elevated with custodial sentencing, but the strongest associations were with sentencing to psychiatric treatment and with charges conditionally withdrawn. Risk was, however, higher in all groups with criminal justice history, even among people who had never received a custodial sentence or a guilty verdict. Prevalence of psychiatric admission was high in exposed cases, especially so in women. Further stratification of exposure indicated markedly elevated risk among people with recent criminal justice system contact, those with multiple contacts, and those with a history of violent offense charges. In both sexes, relative risk was higher at a younger age, ie, younger than 35 years.

#### COMPARISON WITH EXISTING EVIDENCE

Other studies of prisoners and ex-prisoners have shown a higher relative risk vs the general population in females than in males.<sup>3,4,8,17</sup> One recent study reported a reduction in excess risk, after adjustment for opiate dependency, among young male prisoners in Scotland.<sup>39</sup> However, evidence for suicide risk in noncustodial offender groups is comparatively sparse, mostly from several European studies conducted during the 1990s. A 10-fold higher risk of suicide was found in a cohort of males serving community sentences in Dorset, England.<sup>9</sup> In a

case-control study conducted in 1 English health district, an OR of around 6 for suicide with a past criminal charge or police arrest was reported.<sup>10</sup> Using national data for England and Wales, 9- to 13-fold increases in risk of suicide/self-inflicted death were found in both prisoners and community offenders.<sup>11</sup> Finally, in 1 Swedish county, a 13-fold increase in all-cause mortality risk was reported among community offenders with mental disorders, which was “mostly due to suicide.”<sup>12</sup> We could find no published evidence for suicide risk across the entire criminal justice pathway.

Previous research suggests some possible reasons for higher risk for the broad offense types that we examined. High prevalence of mental illness has been reported in sexual offenders in forensic psychiatry settings and in prisons in the United States<sup>40</sup> and in Germany,<sup>41</sup> for example. Other studies have indicated that suicides linked with alleged or proven child sexual offending are often precipitated by legal proceedings and wider disclosure of the abuse.<sup>42,43</sup> We expected to find a particularly high suicide risk in people adjudicated for sexual offenses. We could not examine risk in women because there were too few exposed cases, but in men, the relative risk with sexual offense charges was somewhat lower than with violent charges and was equal to that seen for property crimes. This finding concurs with a comparison of suicide risk be-

tween these 3 offense types in a cohort of male prisoners in New South Wales, Australia.<sup>44</sup>

The association between inflicting violence on others and taking one's own life has been studied extensively from multiple perspectives.<sup>45,46</sup> We can speculate as to why suicide risk is particularly high among violent offenders. Intense feelings of regret may drive them to kill themselves more frequently, especially if their victims were family members or their violent acts were carried out while intoxicated, compared with sexual offenders who perhaps more often self-justify their actions through denial. We found that women with violent offense charges had a much greater relative risk than men of this type. A nationally representative US case-control study reported that violent behavior in the preceding year predicted suicide independent of alcohol misuse, particularly so in women.<sup>47</sup> We found that this sex difference was largely explained by a higher prevalence of serious psychiatric illness among these women compared with their male counterparts. This concurs with findings reported recently from Switzerland.<sup>48</sup> Impulsive-aggressive behavior,<sup>49,50</sup> which we assume is far more common in this group than among women in general, may also play a key role in generating the particularly high relative risk seen among female violent offenders.

There is very little evidence to help explain the observed associations of higher suicide risk with property offending and traffic violation, although the great majority of people with criminal justice history have been charged with such offenses. From a public health viewpoint, therefore, significant reductions in these risks have the potential to prevent the largest number of suicides. A review of the evidence on the roles of psychopathology and personality factors in causing traffic accidents indicated that low tension tolerance, immaturity, personality disorder, paranoid conditions, and alcohol are particularly important predictors.<sup>51</sup> Some of these factors may also be implicated in subsequent higher suicide risk, especially personality disorder<sup>52</sup> and major affective disorder linked with alcohol misuse or dependence.<sup>53</sup> Again, impulsive-aggressive behavior may be a key determinant. There could also be subgroups with especially high suicide risk, such as those whose traffic violations have caused serious injury to others or whose livelihoods have been severely affected by long or indefinite driving bans. Before specific guidance to services can be given, more detailed studies are needed to identify and quantify risk in these subgroups.

## INTERPRETATION

We propose 2 broad theories that could explain our main finding that any criminal justice system contact is linked with higher suicide risk. Criminal offending and contact with the system may directly cause the increased risk observed, or they may already be at higher risk irrespective of this exposure because of antecedent risk factors in individuals and their families. In practice, the causal mechanisms may combine elements from both of these explanations; hence, these people may experience an exacerbation in their already elevated suicide risk on coming into contact with the system for the first time.

It was not possible to model causal mechanisms empirically in this case-control study, although our adjusted models suggest that raised suicide risk seen in people with a criminal justice history is partly explained by high prevalence of mental illness and, to a lesser extent, by the presence of social risk factors. Adjustment for psychiatric admission alone accounted for around half of the increased risk found. However, for many people, onset of psychiatric illness may lie on a causal pathway between criminal offending and suicide, and so this apparent confounding effect may be somewhat exaggerated. Alternatively, the adjusted estimates may be affected by residual confounding. From 1995, we also had access to all outpatient episodes as well as inpatient psychiatric care. We conducted a sensitivity analysis, restricted to 2000 to 2006, which showed that adjustment for any secondary care, as opposed to inpatient treatment only, did not materially alter the effect size estimates. Further adjustment for mental illness treated only in community settings may have attenuated the estimates further still. However, these data were unavailable and we know of no relevant population-based sources from elsewhere that could address this issue. We did not conduct separate analyses with adjustment for secondary care-treated drug/alcohol misuse because these conditions are known to be greatly underreported in the Psychiatric Central Register,<sup>54</sup> and in any case, these diagnoses were included in our overall adjustments for all psychiatric admissions. Opiate dependency, in people with or without psychiatric treatment, may be a particularly important omission, because this group is prone to repeated property offending, criminal justice system contact, and custodial sentencing.<sup>55</sup> A further potential confounder that was unavailable was low IQ, which has been shown to be linked with both criminal offending<sup>56</sup> and suicide<sup>57</sup> in population-based studies.

We believe that our findings of rising suicide risk with increasing recency and frequency of contact point toward a strong independent effect of criminal justice history. Thus, exposure to the criminal justice system in itself may contribute to elevating a person's suicide risk, rather than simply reflecting the traits and characteristics of people who come into contact with the system. This view concurs with results from a psychological autopsy study of young suicides, which showed that a forensic life event in the previous 6 months was a particularly strong risk factor.<sup>58</sup> Whether offending and criminal justice system contact play a causal role in exacerbating risk among already vulnerable individuals requires further examination using more detailed data sets and complex study designs.

## STRENGTHS AND LIMITATIONS

We conducted a nested case-control study with complete linkage between registers and with statistically efficient sampling, and we accounted for right censoring due to other causes of death and emigration. All adult suicides were ascertained and surviving controls were sampled randomly from the whole cohort at risk. Furthermore, exposures and covariates were measured prospectively before outcome. Thus, we precluded the 2 ma-

major flaws that are common in case-control studies: information bias between cases and controls in deriving explanatory variables and biased selection of controls.<sup>59</sup>

Our investigation also had several limitations. First, exposure status was delineated via criminal justice history alone, and so current status in the system was unknown. Therefore, we had no measure as to whether previous sentences were still being served or whether people had been charged with a new offense and were awaiting future adjudication. This latter group would include remand prisoners, who are known to be at especially high suicide risk.<sup>3</sup> Second, many people in our study, men especially, had complex criminal justice histories with multiple contacts for different crimes and judicial outcomes over time, making it difficult to infer relative risk specific to each verdict category. We partially addressed this problem by adjusting for all other verdict categories in an individual's history (Table 1). Third, we could not assess timing of mental illness onset in relation to criminal offending. In theory, we could have examined dates of criminal justice system contact in relation to dates of psychiatric admission, but these variables would not enable examination of temporality because admission could have occurred some time, or many years, after disease onset. Finally, some of our findings may not generalize entirely to larger countries with higher rates of criminal offending.

## CONCLUSIONS

Aside from prisoners and ex-prisoners, a much wider group of men and women processed by the criminal justice system have elevated suicide risk. Previous contact with secondary care psychiatric services is common, which highlights the opportunities for suicide prevention in this population. Improved mental health service provision is indicated for all people who pass through the criminal justice system, including those not found guilty and those not given custodial sentences. Better rates of detecting current psychopathology, by targeting individuals with a history of mental illness for instance, may be beneficial. These findings should be disseminated cautiously because sections of the general public and popular media may fail to appreciate that many offenders are vulnerable individuals who have been failed from an early age by their parents, other family members, and various public agencies. Indeed, we examined a section of society where major health and social problems coexist, including poverty and social exclusion, criminality, mental illness, and suicidal behavior. It is likely to be the co-occurrence of multiple problems that puts this already vulnerable group at higher risk of suicide, and yet public services tend to address each problem individually. Therefore, services should be better organized and coordinated to tackle these overlapping problems more effectively. The identification of precise causal mechanisms is also required to inform the development of effective suicide prevention interventions for the offender population.

**Submitted for Publication:** May 7, 2010; final revision received December 13, 2010; accepted December 15, 2010.

**Published Online:** February 7, 2011. doi:10.1001/archgenpsychiatry.2011.7

**Correspondence:** Roger T. Webb, PhD, Centre for Suicide Prevention, University of Manchester, Room 2.311, Jean McFarlane Bldg, Oxford Road, Manchester M13 9PL, England (roger.webb@manchester.ac.uk).

**Author Contributions:** Drs Webb and Qin had full access to all of the data in the study and take responsibility for the integrity of the data and accuracy of the data analysis.

**Financial Disclosure:** None reported.

**Funding/Support:** The investigation was funded by an American Foundation for Suicide Prevention award and by the Stanley Medical Research Institute.

**Role of the Sponsors:** The funding sources had no role in the design or conduct of the study; the collection, management, analysis, and interpretation of the data; or the preparation, review, or approval of the manuscript.

**Previous Presentations:** Summaries of these findings were presented at the annual meeting of the Royal College of Psychiatrists Faculty of Forensic Psychiatry; February 12, 2010; Dublin, Ireland; and at the 10th annual conference of the International Association of Forensic Mental Health Services (IAFMHS); May 26, 2010; Vancouver, British Columbia, Canada.

**Additional Contributions:** Esben Agerbo, DrMedSc, National Centre for Research-based Research, University of Aarhus, Aarhus, Denmark, generated the nested case-control study.

## REFERENCES

1. US Department of Health and Human Services. *National Strategy for Suicide Prevention: Goals & Objectives for Action*. Rockville, MD: US Department of Health and Human Services, Public Health Service; 2001.
2. Salive ME, Smith GS, Brewer TF. Suicide mortality in the Maryland state prison system, 1979 through 1987. *JAMA*. 1989;262(3):365-369.
3. Fazel S, Cartwright J, Norman-Nott A, Hawton K. Suicide in prisoners: a systematic review of risk factors. *J Clin Psychiatry*. 2008;69(11):1721-1731.
4. Pratt D, Piper M, Appleby L, Webb R, Shaw J. Suicide in recently released prisoners: a population-based cohort study. *Lancet*. 2006;368(9530):119-123.
5. Binswanger IA, Stern MF, Deyo RA, Heagerty PJ, Cheadle A, Elmore JG, Koepsell TD. Release from prison: a high risk of death for former inmates. *N Engl J Med*. 2007;356(2):157-165.
6. Karimnia A, Law MG, Butler TG, Levy MH, Corben SP, Kaldor JM, Grant L. Suicide risk among recently released prisoners in New South Wales, Australia. *Med J Aust*. 2007;187(7):387-390.
7. Hayes LM. National study of jail suicides: seven years later. *Psychiatr Q*. 1989;60(1):7-29.
8. Fazel S, Benning R, Danesh J. Suicides in male prisoners in England and Wales, 1978-2003. *Lancet*. 2005;366(9493):1301-1302.
9. Pritchard C, Cox M, Dawson A. Suicide and 'violent' death in a six-year cohort of male probationers compared with pattern of mortality in the general population: evidence of accumulative socio-psychiatric vulnerability. *J R Soc Health*. 1997; 117(3):180-185.
10. Boardman AP, Grimbaldston AH, Handley C, Jones PW, Willmott S. The North Staffordshire Suicide Study: a case-control study of suicide in one health district. *Psychol Med*. 1999;29(1):27-33.
11. Sattar G. The death of offenders in England and Wales. *Crisis*. 2003;24(1):17-23.
12. Björk T, Lindqvist P. Mortality among mentally disordered offenders: a community based follow-up study. *Crim Behav Ment Health*. 2005;15(2):93-96.
13. Linsley KR, Johnson N, Martin J. Police contact within 3 months of suicide and associated health service contact. *Br J Psychiatry*. 2007;190(2):170-171.
14. Sattar G, Killias M. The death of offenders in Switzerland. *Eur J Criminol*. 2005; 2(3):317-340. doi:10.1177/1477370805054100.
15. Kjelsberg E, Laake P. Is the high mortality risk in sentenced offenders independent of previous imprisonment? *Eur J Epidemiol*. 2010;25(4):237-243.
16. Gore SM. Suicide in prisons: reflection of the communities served, or exacerbated risk? *Br J Psychiatry*. 1999;175(7):50-55.



17. Fazel S, Benning R. Suicides in female prisoners in England and Wales, 1978-2004. *Br J Psychiatry*. 2009;194(2):183-184.
18. Teplin LA, Abram KM, McClelland GM. Prevalence of psychiatric disorders among incarcerated women, I: pretrial jail detainees. *Arch Gen Psychiatry*. 1996;53(6):505-512.
19. Teplin LA. Psychiatric and substance abuse disorders among male urban jail detainees. *Am J Public Health*. 1994;84(2):290-293.
20. Shaw J, Creed F, Price J, Huxley P, Tomenson B. Prevalence and detection of serious psychiatric disorder in defendants attending court. *Lancet*. 1999;353(9158):1053-1056.
21. Fazel S, Danesh J. Serious mental disorder in 23000 prisoners: a systematic review of 62 surveys. *Lancet*. 2002;359(9306):545-550.
22. Mortensen PB, Agerbo E, Erikson T, Qin P, Westergaard-Nielsen N. Psychiatric illness and risk factors for suicide in Denmark. *Lancet*. 2000;355(9197):9-12.
23. Qin P, Agerbo E, Mortensen PB. Suicide risk in relation to socioeconomic, demographic, psychiatric, and familial factors: a national register-based study of all suicides in Denmark, 1981-1997. *Am J Psychiatry*. 2003;160(4):765-772.
24. Pedersen CB, Gøtzsche H, Møller JO, Mortensen PB. The Danish Civil Registration System: a cohort of eight million persons. *Dan Med Bull*. 2006;53(4):441-449.
25. Juul K, Helweg-Larsen K. The Danish registers of causes of death. *Dan Med Bull*. 1999;46(4):354-357.
26. World Health Organization. *Manual of the International Classification of Diseases (ICD-8)*. Geneva, Switzerland: World Health Organization; 1967.
27. World Health Organization. *The ICD-10 Classification of Mental and Behavioural Disorders: Clinical Descriptions and Diagnostic Guidelines*. Geneva, Switzerland: World Health Organization; 1992.
28. Atkinson MW, Kessel N, Dalgaard JB. The comparability of suicide rates. *Br J Psychiatry*. 1975;127(9):247-256.
29. Walsh D, Mosbech J, Adelstein A, Spooner J, Dean G. Suicide and self-poisoning in three countries: a study from Ireland, England and Wales, and Denmark. *Int J Epidemiol*. 1984;13(4):472-474.
30. Hodgins S, Mednick SA, Brennan PA, Schulsinger F, Engberg M. Mental disorder and crime: evidence from a Danish birth cohort. *Arch Gen Psychiatry*. 1996;53(6):489-496.
31. Gosden NP, Kramp P, Gabrielsen G, Andersen TF, Sestoft D. Violence of young criminals predicts schizophrenia: a 9-year register-based followup of 15- to 19-year-old criminals. *Schizophr Bull*. 2005;31(3):759-768.
32. Saleva O, Putkonen H, Kiviruusu O, Lönnqvist J. Homicide-suicide: an event hard to prevent and separate from homicide or suicide. *Forensic Sci Int*. 2007;166(2-3):204-208.
33. Logan J, Hill HA, Black ML, Crosby AE, Karch DL, Barnes JD, Lubell KM. Characteristics of perpetrators in homicide-followed-by-suicide incidents: National Violent Death Reporting System—17 US States, 2003-2005. *Am J Epidemiol*. 2008;168(9):1056-1064.
34. Statistics Denmark. *Kriminalitet 2006*. Copenhagen: Statistics Denmark; 2007.
35. Munk-Jørgensen P, Mortensen PB. The Danish psychiatric central register. *Dan Med Bull*. 1997;44(1):82-84.
36. Danmarks Statistik. *IDA - en integreret database for arbejdsmarkedsforskning*. Copenhagen: Danmarks Statistiks trykkeri; 1991.
37. Clayton D, Hills M. *Statistical Models in Epidemiology*. Oxford, England: Oxford University Press; 1993.
38. Bruzzi P, Green SB, Byar DP, Brinton LA, Schairer C. Estimating the population attributable risk for multiple risk factors using case-control data. *Am J Epidemiol*. 1985;122(5):904-914.
39. Bird SM. Changes in male suicides in Scottish prisons: 10-year study. *Br J Psychiatry*. 2008;192(6):446-449.
40. Dunsieith NW Jr, Nelson EB, Brusman-Lovins LA, Holcomb JL, Beckman D, Welge JA, Roby D, Taylor P Jr, Soutullo CA, McElroy SL. Psychiatric and legal features of 113 men convicted of sexual offenses. *J Clin Psychiatry*. 2004;65(3):293-300.
41. Harsch S, Bergk JE, Steinert T, Keller F, Jockusch U. Prevalence of mental disorders among sexual offenders in forensic psychiatry and prison. *Int J Law Psychiatry*. 2006;29(5):443-449.
42. Wild NJ. Suicide of perpetrators after disclosure of child sexual abuse. *Child Abuse Negl*. 1988;12(1):119-121.
43. Pritchard C, King E. Differential suicide rates in typologies of child sex offenders in a 6-year consecutive cohort of male suicides. *Arch Suicide Res*. 2005;9(1):35-43.
44. Karimnia A, Law MG, Butler TG, Corben SP, Levy MH, Kaldor JM, Grant L. Factors associated with mortality in a cohort of Australian prisoners. *Eur J Epidemiol*. 2007;22(7):417-428.
45. Kennedy HG, Iveson RC, Hill O. Violence, homicide and suicide: strong correlation and wide variation across districts. *Br J Psychiatry*. 1999;175(11):462-466.
46. Linnola VM, Virkkunen M. Aggression, suicidality, and serotonin. *J Clin Psychiatry*. 1992;53(suppl):46-51.
47. Conner KR, Cox C, Duberstein PR, Tian L, Nisbet PA, Conwell Y. Violence, alcohol, and completed suicide: a case-control study. *Am J Psychiatry*. 2001;158(10):1701-1705.
48. Rossegger A, Wetli N, Urbanik F, Elbert T, Cortoni F, Endrass J. Women convicted for violent offenses: adverse childhood experiences, low level of education and poor mental health. *BMC Psychiatry*. 2009;9:81.
49. Dumais A, Lesage AD, Alda M, Rouleau G, Dumont M, Chawky N, Roy M, Mann JJ, Benkelfat C, Turecki G. Risk factors for suicide completion in major depression: a case-control study of impulsive and aggressive behaviors in men. *Am J Psychiatry*. 2005;162(11):2116-2124.
50. McGirr A, Renaud J, Bureau A, Seguin M, Lesage A, Turecki G. Impulsive-aggressive behaviours and completed suicide across the life cycle: a predisposition for younger age of suicide. *Psychol Med*. 2008;38(3):407-417.
51. Tsuang MT, Boor M, Fleming JA. Psychiatric aspects of traffic accidents. *Am J Psychiatry*. 1985;142(5):538-546.
52. Kryszynska K, Heller TS, De Leo D. Suicide and deliberate self-harm in personality disorders. *Curr Opin Psychiatry*. 2006;19(1):95-101.
53. Inskip HM, Harris EC, Barraclough B. Lifetime risk of suicide for affective disorder, alcoholism and schizophrenia. *Br J Psychiatry*. 1998;172(1):35-37.
54. Hansen SS, Munk-Jørgensen P, Guldbæk B, Solgård T, Lauszus KS, Albrecht-Nielsen N, Borg L, Egander A, Faurholt K, Gilberg A, Gosden NP, Lorenzen J, Richelsen B, Weischer K, Bertelsen A. Psychoactive substance use diagnoses among psychiatric in-patients. *Acta Psychiatr Scand*. 2000;102(6):432-438.
55. Doran CM. Economic evaluation of interventions to treat opiate dependence: a review of the evidence. *Pharmacoeconomics*. 2008;26(5):371-393.
56. Fergusson DM, Horwood LJ. Male and female offending trajectories. *Dev Psychopathol*. 2002;14(1):159-177.
57. Gunnell D, Magnusson PKE, Rasmussen F. Low intelligence test scores in 18 year old men and risk of suicide: cohort study. *BMJ*. 2005;330(7484):167.
58. Cooper J, Appleby L, Amos T. Life events preceding suicide by young people. *Soc Psychiatry Psychiatr Epidemiol*. 2002;37(6):271-275.
59. Breslow NE, Day NE. *Statistical Methods in Cancer Research I. The Analysis of Case-control Studies*. Lyon, France: International Agency for Research on Cancer; 1980.