

Major Mental Disorders and Criminal Violence in a Danish Birth Cohort

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Background: This epidemiological investigation was designed to examine the relationships between each of the major mental disorders and criminal violence. Specifically, we assessed whether a significant relationship exists between violence and hospitalization for a major mental disorder, and whether this relationship differs for schizophrenia, affective psychoses, and organic brain syndromes.

Methods: Subjects were drawn from a birth cohort of all individuals born between January 1, 1944, and December 31, 1947, in Denmark (N = 358 180). Because of the existence of accurate and complete national registers, data were available on all arrests for violence and all hospitalizations for mental illness that occurred for individuals in this cohort through the age of 44 years.

Results: There was a significant positive relationship between the major mental disorders that led to hospital-

ization and criminal violence (odds ratios 2.0-8.8 for men and 3.9-23.2 for women). Persons hospitalized for a major mental disorder were responsible for a disproportionate percentage of violence committed by the members of the birth cohort. Men with organic psychoses and both men and women with schizophrenia were significantly more likely to be arrested for criminal violence than were persons who had never been hospitalized, even when controlling for demographic factors, substance abuse, and personality disorders.

Conclusions: Individuals hospitalized for schizophrenia and men hospitalized with organic psychosis have higher rates of arrests for violence than those never hospitalized. This relationship cannot be fully explained by demographic factors or comorbid substance abuse.

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SEVERAL RECENT large-scale studies have determined that there is a relationship between mental disorders and violence.¹⁻⁵ It has also been found that rates of violence differ across diagnostic categories, suggesting that it is essential to examine diagnostic conditions separately in relationship to risk for violent behavior.

Investigations examining the relationship between schizophrenia and violence have found that persons with schizophrenia are at higher risk for violence than are nondisordered persons, but at lower risk than persons with antisocial personality disorders and substance abuse.^{2,5,6-22} The measures of violence employed in these studies include official arrests and convictions, self-reported fights in the community, and assaultive behavior on inpatient wards.

Organic brain disorder has also been associated with higher rates of violence in a limited number of studies^{5,6,13}; however, the reliability of these findings remains questionable because of the small numbers of affected subjects examined.

There is mixed evidence for the relationship between affective disorders and violence. Several studies of inpatients have noted that depressed individuals are significantly less likely to be violent than individuals with other types of disorders.^{8-10,23} Moreover, affective disorders were not found to be related to an increased risk for homicide in a Finnish cohort study.¹⁵ By contrast, other studies have found a relationship between affective disorders and homicide,²⁴ self-reported violent behavior,² and conduct disorder in childhood and adolescence.²⁵ One possible explanation for these conflicting results could be the potential moderating role of alcohol abuse in this relationship.

Even the largest cohort study that has examined specific categories of major mental disorders and their relationship to criminal violence did not have an adequate sample size to either reliably control for comorbid substance abuse and personality disorders or fully examine this relationship for both women and men.⁵ In this study, we identified a birth cohort in Denmark (N = 358 180) large enough to

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SUBJECTS AND METHODS

SUBJECTS

This study examined data from a birth cohort composed of all persons born in Denmark between January 1, 1944, and December 31, 1947. Exactly 358 180 individuals were found to have been born during the selected period; 10 004 (2.8%) were dropped because of death and 12 186 (3.4%) were dropped because of emigration, leaving 335 990 subjects in this study. Additional analyses revealed that, similar to our previous work using this sample,²⁶ the inclusion of dead and emigrated subjects did not significantly change the results of this study.

The final sample consisted of 173 668 men (51.7%) and 162 322 women (48.3%). Subjects' marital status, as reported in 1991, was as follows: 12.3% were single, 71.8% were married, 14.4% were divorced, and 1.3% were widowed. Socioeconomic status was indexed using occupational status, and classified using a revision of the 8-point prestige scale developed by Svalastoga²⁷ for the Danish population. Occupation was not available for 16.3% of the subjects. As per the recommendation of Cohen and Cohen,²⁸ these missing data were coded to the mean, and a dummy-coded variable (1, SES data present) was included as a statistical control in the logistic regression analyses.

CRIMINAL REGISTER

Official arrest and conviction data through 1991 were obtained from the Danish National Police Register in Copenhagen. As Wolfgang noted, "the criminal registry

office in Denmark is probably the most thorough, comprehensive, and accurate in the Western world."²⁹ Clearance rates (the proportion of reported crimes that result in arrest and conviction) for the index (felony level) crimes in Denmark ranged from 10.2% for the theft of mopeds to 97.7% for homicide at the time these data were collected.³⁰

In Denmark, as opposed to common-law countries, the police do not have the discretionary power of whether to arrest a person suspected of having committed a crime. Mentally ill individuals who commit a crime are first arrested, and then transferred for treatment. Later, many of these individuals may not be prosecuted for their offenses. This differs from police procedure in the United States, where mentally disordered individuals might be taken by police to a hospital rather than charged with an offense. The Danish practice of arresting all offenders regardless of their mental status reduces any prejudice, positive or negative, based on a suspect's mental status at the time of arrest. Therefore, arrest data, rather than conviction data, were examined in this study.

Lifetime arrest data were available for all types of offenses (traffic, special business laws, and index offenses). However, only criminal index violent offenses were considered in this study. The earliest age of arrest in the sample was 9 years. The age of majority in Denmark is 15 years. However, if individuals are arrested for a serious offense before the age of 15 years, that information is also included on their arrest records. Less than 1% of the violent arrests in the data were recorded before the age of majority.

Violent offenses included the following violations of the Danish Penal Code: murder (7.6% of total violent

Continued on next page

permit us to test hypotheses regarding violent crime among individuals with specific major mental disorders. We hypothesized that schizophrenia and organic psychoses, but not affective psychoses, would be significantly related to violence and that these differences would remain significant when sex, socioeconomic status (SES), personality disorder, and substance abuse were taken into account. We also explored the relative proportion of violence accounted for by individuals with major mental disorders.

RESULTS

MAJOR MENTAL DISORDERS AND VIOLENCE

Logistic regression analyses were conducted to examine the relationship between violence (yes vs no), and each major mental disorder (**Table 1**). Individuals with each type of major disorder were more likely than subjects who had never been hospitalized to have been arrested for a violent offense.

Socioeconomic Status

Logistic regression analyses were used to examine the relationship between violence and each type of major mental disorder for subjects with low and middle to high SES (**Table 2**). Men with each disorder, regardless of SES,

had significantly higher risks of violence than nonhospitalized men. Among women, SES seemed to moderate the relationship between the major mental disorders and violence. Affective psychoses and schizophrenia were significantly related to violence among women with middle/high SES, but not among those with low SES. In contrast, organic psychoses were significantly related to violence among women with low SES, but not among those with middle/high SES. Only the "other psychoses" diagnostic category was significantly related to violence for women regardless of their SES.

Substance Abuse

Logistic regression analyses were also used to examine the relationships between violence, major mental disorders, and secondary diagnoses of alcohol and/or drug abuse (**Table 3**). No comparisons of substance abuse were possible for persons who had never been hospitalized and thereby would not have any secondary diagnoses. These analyses revealed that both men and women with affective psychosis who do not have a secondary substance abuse diagnosis were not more likely to be arrested for violence than persons who had never been hospitalized. In addition, women with organic psychosis, but no secondary substance abuse diagnosis, were not more likely than women who had never been hospitalized to have a record of violent arrest. All other associations

offenses); attempted murder (11.0% of total); rape (11.1% of total); violence against authority (eg, assault on a police officer; 9.2% of total); assault (52.0% of total); domestic violence (0.09% of total); and robbery (8.2% of total).

PSYCHIATRIC REGISTER

Records of psychiatric hospitalizations through 1991 were obtained from the Danish Psychiatric Register at the Institute for Psychiatric Demography, Aarhus, Denmark. This register contains information for Denmark on all dates of admission and discharge to psychiatric hospitals, and the codes for primary, secondary, and tertiary diagnoses according to the *International Classification of Diseases, Eighth Revision (ICD-8)*. Previous studies employing data from the Psychiatric Register have found an agreement rate of more than 90% between the ICD-8 Register diagnoses and the diagnostic systems of DSM-III and DSM-III-R.³¹

For the purposes of statistical comparison, subjects were separated into diagnostic groups based on ICD-8 hospital discharge diagnoses. Subjects were assigned to a diagnostic group based on a hierarchy of diagnoses (from highest to lowest): schizophrenia (including all subtypes); organic brain syndrome (including dementia, alcoholic psychosis, psychosis associated with intercranial infection, and psychosis associated with cerebral infection or injury); affective psychoses (including depressive psychoses, mania, and bipolar disorder); and other psychoses (including reactive, paranoid, and unspecified). Those individuals who were admitted to a psychiatric hospital, but who did not have any of the above diagnoses at hospital discharge were not included in the analyses presented in this article.

Level of seriousness was indexed by the total number of days hospitalized that increased from the bottom to the top of the hierarchy of diagnoses. Although total time hospitalized was related to risk for violence (men: $\chi^2_1 = 471.23$, $P < .001$ [$n = 173\ 668$]; women: $\chi^2_1 = 228.08$, $P < .001$ [$n = 162\ 322$]), additional statistical controls for number of days hospitalized did not change the results of our study.

Secondary diagnoses of substance abuse (drug and/or alcohol) and personality disorder (schizoid, antisocial, paranoid, explosive, hysterical, and/or asthenic) (ICD-8 diagnoses) were also recorded.

STATISTICAL ANALYSIS

Logistic regression analyses were performed, and odds ratios calculated, to assess the relationship between each major mental disorder and arrests for violent offenses. Women were found to have a much lower rate of violence than men (0.2% vs 3.3%); therefore, all analyses were undertaken separately for men and women. The comparison group in all analyses consisted of the same-sex subjects in the sample who had never been hospitalized in a psychiatric ward. Analyses examining the associations between each disorder and arrests for violent crimes were repeated within different levels of other potential risk factors (eg, only for subjects of low SES). Logistic regression analyses were conducted to examine the associations between each of the major mental disorders and arrests for violent crime, controlling for the potential confounding factors of marital status, SES, substance abuse, and personality disorders. All levels were set at $\alpha = .05$.

between mental disorders and violence relationships remained significant for individuals with no secondary substance abuse diagnoses.

Personality Disorder

The proportions of persons within each diagnostic category (with and without personality disorders) who had been arrested for a violent crime were examined (**Table 4**). Individuals with a major mental disorder and no personality disorder were compared with those who had never been hospitalized. These analyses revealed that both the men and women with schizophrenia, organic and other psychoses, and no personality disorder had higher rates of violence than the never-hospitalized men and women. However, both men and women with affective disorders and no secondary personality disorder were not more likely than the never-hospitalized men and women to have been arrested for a violent offense.

DEMOGRAPHIC AND DIAGNOSTIC CONFOUNDING FACTORS

Logistic regression analyses were undertaken to examine the relationship between the major mental disorders and violence when sociodemographic factors and secondary diagnoses were controlled simultaneously. In these analyses, these possible confounding factors were en-

tered in separate blocks: sociodemographic factors (marital status and SES) were entered on the first block, substance abuse on the second block, and personality disorder on the third block (**Table 5**). For both men and women, all major mental disorder groups remained significantly different from the nonhospitalized comparison group when controlling for demographic factors. The further control for substance abuse rendered the major mental disorder/violence relationship nonsignificant for both men and women with affective disorder, and for women with organic psychosis. The addition of a control for personality disorder did not change the results. As can be seen by comparing Tables 1 and 5, the risk of arrest for violent crime among both men and women with different types of major mental disorders were reduced considerably when they did not present with co-occurring substance abuse or personality disorder.

PERCENTAGE OF VIOLENCE COMMITTED BY PERSONS WITH MAJOR MENTAL DISORDERS

Approximately 2.2% of the men in the cohort were hospitalized for a major mental disorder and committed 10% of the violent crimes committed by all the men in the cohort; 2.6% of the women had been hospitalized for a major mental disorder and committed 16% of the violent crimes committed by women in the cohort.

Table 1. Major Mental Disorders and Violent Arrest*

Diagnosis	Men		Women	
	No. (% Violent)	OR (95% CI)	No. (% Violent)	OR (95% CI)
None (reference group)	163 727 (2.7)	...	150 988 (0.1)	...
Schizophrenia	1143 (11.3)	4.6 (3.8-5.6)	680 (2.8)	23.2 (14.4-37.4)
Psychoses				
Organic	895 (19.4)	8.8 (7.4-10.4)	446 (2.0)	16.6 (8.4-32.6)
Affective	729 (5.2)	2.0 (1.4-2.8)	1234 (0.5)	3.9 (1.7-8.9)
Other	1042 (10.7)	4.4 (3.6-5.3)	1793 (1.2)	9.6 (6.1-15.0)

*OR indicates odds ratio; CI, confidence interval.

Table 2. Socioeconomic Status (SES) Comparisons for Major Mental Disorders and Violent Arrest*

Diagnosis	Men		Women	
	No. (% Violent)	OR (95% CI)	No. (% Violent)	OR (95% CI)
Low SES				
None (reference group)	68 568 (4.4)	...	44 568 (0.1)	...
Schizophrenia	422 (13.7)	3.5 (2.6-4.6)	155 (0.6)	4.4 (0.6-32.2)
Psychoses				
Organic	500 (22.0)	6.2 (5.0-7.6)	129 (4.7)	33.4 (14.2-78.5)
Affective	328 (7.6)	1.8 (1.2-2.7)	391 (0.5)	3.5 (0.9-14.4)
Other	511 (13.3)	3.4 (2.6-4.3)	599 (1.2)	8.1 (3.7-17.7)
Middle/High SES				
None (reference group)	83 743 (1.4)	...	68 057 (0.1)	...
Schizophrenia	344 (7.0)	5.4 (3.6-8.3)	263 (2.3)	29.4 (12.5-68.9)
Psychoses				
Organic	237 (9.7)	7.8 (5.0-12.0)	162 (0.0)	0.0 (...)
Affective	354 (3.4)	2.5 (1.4-4.5)	521 (0.4)	4.9 (1.2-20.0)
Other	405 (6.4)	5.0 (3.3-7.4)	693 (0.7)	9.2 (3.6-22.9)

*OR indicates odds ratio; CI, confidence interval; and ellipses, value not calculable.

COMMENT

The results of this study support the hypothesis that major mental disorders are associated with an increase in the likelihood of arrest for violence. Among men with major mental disorders, the highest risk for violence was observed among those with an organic brain syndrome, while among women, the highest risk was found among those diagnosed with schizophrenia. The effects of sex, marital status, and SES did not account for the associations observed between the major mental disorders and violent crime.

When controlling for comorbid substance abuse and personality disorders, persons hospitalized with affective disorders were not at higher risk for violent crime than those who were never hospitalized. However, these findings may underestimate the risk of violence among persons with affective disorders. Many of the cohort members who had never been hospitalized may have had a substance abuse and/or personality disorder that went undetected. In addition, a history of criminal behavior is relevant for the diagnosis of several personality disorders. Consequently, our logistic regression analyses may have overcontrolled for these disorders. Another way in which the present study may have underestimated the relationship between affective disorders and violence was by excluding cases of suicide at the time of the offense (cases

that would not have resulted in an arrest)—many of whom, it is reasonable to suggest, would have been depressed.

The finding that the highest risk for violent crime among the male cohort members was observed for those with organic brain syndromes is consistent with studies showing that violent behavior is often a consequence of brain injury,³²⁻³⁵ as well as with studies of aggressive behavior by patients with organic brain syndromes.¹³ This link between organic brain syndrome and violent behavior has largely been ignored, probably because of the predominance of studies that evaluate relatively small samples of patients (most of whom have schizophrenia) for short periods. Long-term epidemiological investigations, such as the current one, allow for the examination of organic brain syndrome in more detail, as it is a disorder that is more likely to occur in later stages of adulthood and may be misdiagnosed on first presentation. Among women, however, organic brain syndrome only increased the risk of violence if it was comorbid with substance abuse or low SES.

In studies of persons with major mental disorders, it has become customary in recent years to assume that the clusters of socially dysfunctional traits and behaviors that many of them present with are distinct disorders. However, currently there is no evidence indicating whether these traits and behaviors are in fact distinct disorders or a part of the major mental disorder. For ex-

Table 3. Substance Abuse Comparisons for Major Mental Disorders and Violent Arrest*

	Men		Women	
	No. (% Violent)	OR (95% CI)	No. (% Violent)	OR (95% CI)
Without Substance Abuse Diagnosis				
None (reference group)	163 727 (2.7)	...	150 988 (0.1)	...
Schizophrenia	846 (7.1)	2.8 (2.1-3.6)	565 (1.9)	16.0 (8.7-29.6)
Psychoses				
Organic	212 (9.0)	3.6 (2.2-5.7)	227 (0.4)	3.6 (0.5-25.6)
Affective	559 (3.2)	1.2 (0.8-1.9)	1045 (0.3)	2.3 (0.7-7.3)
Other	712 (7.9)	3.1 (2.4-4.1)	1497 (0.8)	6.5 (3.6-11.7)
With Substance Abuse Diagnosis				
Schizophrenia	297 (23.2)		115 (7.0)	
Psychoses				
Organic	683 (22.7)		219 (3.7)	
Affective	170 (11.8)		189 (1.6)	
Other	330 (17.0)		296 (3.0)	

*OR indicates odds ratio; CI, confidence interval.

Table 4. Personality Disorder Comparisons for Major Mental Disorders and Violent Arrest*

	Men		Women	
	No. (% Violent)	OR (95% CI)	No. (% Violent)	OR (95% CI)
Without Personality Disorder Diagnosis				
None (reference group)	163 727 (2.7)	...	150 988 (0.1)	...
Schizophrenia	717 (9.9)	4.0 (3.1-5.1)	357 (2.2)	18.5 (9.0-37.8)
Psychoses				
Organic	590 (15.3)	6.6 (5.2-8.2)	257 (0.8)	6.3 (1.6-25.6)
Affective	441 (2.9)	1.1 (0.6-1.9)	727 (0.3)	2.2 (0.6-9.0)
Other	687 (8.4)	3.4 (2.6-4.4)	1127 (0.6)	5.0 (2.4-10.7)
With Personality Disorder Diagnosis				
Schizophrenia	426 (13.6)		323 (3.4)	
Psychoses				
Organic	305 (27.5)		189 (3.7)	
Affective	288 (8.7)		507 (0.8)	
Other	355 (15.2)		666 (2.1)	

*OR indicates odds ratio; CI, confidence interval.

ample, longitudinal prospective studies of children of mothers with schizophrenia have consistently identified a subgroup who present a stable pattern of aggressive and/or antisocial behavior from a young age,³⁶⁻³⁷ and studies of children with depression identify a subgroup with conduct disorder.³⁸ Among persons who develop a major mental disorder, substance abuse in childhood or adolescence is more strongly associated with violent crime in adulthood than substance abuse in adulthood,³⁹ and individuals who will develop a major mental disorder may be more sensitive to the effects of alcohol than others.⁴⁰ These findings suggest that symptoms (eg, substance abuse) that we and others are labeling as distinct disorders, may in fact be a part of or at least related to the primary disorder. Consequently, while identifying certain problems presented by some persons with major mental disorders as distinct comorbid disorders improves communication, it may be inaccurate. The analyses in the present study that control for the presence of a personality disorder or substance abuse are based on the assumption that these problems are separate from the

major disorder. Similarly, SES and marital status can be viewed as indexes of psychosocial functioning that are greatly influenced by the major mental disorder, and not, as we have assumed in conducting our analyses, as characteristics distinct from the disorder.

Hodgins and colleagues⁴¹ have theorized that there are 2 types of offenders with major mental disorders. One type displays a stable pattern of antisocial behavior across the lifespan, thereby meeting criteria for antisocial personality, whereas the other type behaves violently later in life, because of the symptoms of the major mental disorder. Findings from the present investigation are consistent with this hypothesis, as the risk of violent crime was increased for persons with schizophrenia, with and without secondary personality disorders, among both men and women. Similarly, among the men with organic brain syndromes, risk for violence was elevated among both those with and without personality disorders. We plan to further explore the possibility that 2 types of offenders are represented within these major mental disorder categories in future research.

A critical review of the literature concerning crime and mental illness⁴² reported that alcohol use was often a confounding factor in this area of research. Alcohol and drug abuse have been found at rates of 27% to 55% in violent, mentally ill populations.^{43,44} In our sample, 39% of the subjects with a major mental disorder had a secondary diagnosis of substance abuse. Steadman and colleagues³ have also noted that substance abuse is an important risk factor for violence, but this was not true of the patients with schizophrenia in their sample.⁴⁵ The presence of an alcohol or drug use disorder increased the already elevated risks for violent crime among men and women in all diagnostic categories, except women with organic psychosis and men and women with affective psychoses. These results are consistent with much research showing that among both persons with and without major mental disorders, substance abuse increases the risk of violent crime.

Schizophrenia was the only major mental disorder associated with increased risks of violent crime among both men and women regardless of SES, marital status, and concurrent disorders. This conservative test supports the finding that schizophrenia is related to increased propensities for violence. The only other epidemiological investigation of the risk of violent crime among persons with different major mental disorders did not have sufficient subjects with schizophrenia to examine this relationship for those with and without substance abuse.⁵ Our study suggests that the increased risk for violence associated with schizophrenia exists separately from the noted risks associated with substance abuse.

Our study relies on official records of hospitalization and violence. The use of official records is most reasonable in cases of severe crime and psychopathology in which most of the offenders and patients would have had contact at some time with official systems. Given that major mental disorders and violence are the most severe forms of psychopathology and crime, and given that the data on hospitalization are available through the risk periods for these disorders, we believe the present findings accurately represent the risk of violent crime presented by persons with major mental illnesses in this cohort. However, it is possible that the most violent psychotic individuals would be more likely to be identified and hospitalized than those who are less severely ill.

Our study was conducted in Denmark, a country with relatively low rates of criminal violence. Denmark does not have the poverty, gang, and substance abuse problems that exist in some other countries. Our results concerning the percentage of violence accounted for by the mentally ill would not likely generalize to other countries. Although the mental health system in Denmark is similar to that in the United States in terms of historical changes related to deinstitutionalization, it is important to note that in Denmark there is one universally accessible mental health system. Therefore, it is possible that in Denmark, a greater proportion of the mentally ill receive care than in the United States, and that the care is more long-term. If this is the case, then the risks for violent crime observed in the present investigation may be lower than what would be found in countries providing less adequate mental health services. Our data do not al-

Table 5. Demographic and Secondary Diagnosis Controls for Major Mental Disorders and Violent Arrest*

	Controlling for Marital Status and SES, Adjusted OR (95% CI)	Controlling for Marital Status, SES, and Substance Abuse, Adjusted OR (95% CI)	Controlling for Marital Status, SES, Substance Abuse, and Personality Disorder, Adjusted OR (95% CI)
Men			
Schizophrenia	3.2 (2.6-3.9)	2.0 (1.5-2.6)	1.9 (1.4-2.6)
Psychoses			
Organic	5.4 (4.5-6.4)	2.6 (1.7-4.1)	2.2 (1.4-3.5)
Affective	1.7 (1.2-2.3)	1.1 (0.7-1.7)	0.8 (0.4-1.5)
Other	3.1 (2.5-3.8)	2.3 (1.8-3.1)	2.0 (1.4-2.7)
Women			
Schizophrenia	10.6 (6.5-17.4)	7.5 (4.0-14.1)	7.1 (3.3-15.3)
Psychoses			
Organic	8.8 (4.4-17.5)	2.1 (0.3-15.2)	1.2 (0.1-10.8)
Affective	2.8 (1.3-6.4)	1.7 (0.6-5.4)	1.4 (0.3-6.2)
Other	6.1 (3.9-9.7)	4.4 (2.4-8.0)	3.0 (1.4-6.7)

*SES indicates socioeconomic status; OR, odds ratio; and CI, confidence interval.

low us to examine the moderating effects of psychotropic medications on the relationship between psychosis and violence, but others have found that medication noncompliance is an important predictor of violence in psychotic populations.^{46,47}

POLICY ISSUES

Overall, the findings of this study suggest that a relationship between violence and major mental disorder does exist. Moreover, each of the major mental disorders is associated with different risk of violence. The knowledge that a person has a major mental disorder, by itself, is of limited use to policy makers and clinicians concerned with preventing violent behavior. This is because most individuals with major mental disorders are not violent, and most violent individuals do not have a major mental disorder. The factors, both individual and environmental, associated with violent behavior among persons with major mental disorders require further investigation. There is an urgent need to expand the use of validated instruments for the assessment of future violence in this population⁴⁸ and to implement treatment programs that are effective in preventing violent behavior.⁴⁹

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