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Mental disorder and violence: is there a relationship beyond substance use?

Richard Van Dorn · Jan Volavka · Norman Johnson

Abstract

Purpose A general consensus exists that severe mental illness (SMI) increases violence risk. However, a recent report claimed that SMI "alone was not statistically related to future violence in bivariate or multivariate analyses." We reanalyze the data used to make this claim with a focus on causal relationships between SMI and violence, rather than the statistical prediction of violence.

Methods Data are from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), a two-wave study ($N = 34,653$: Wave 1: 2001–2003; Wave 2: 2004–2005). Indicators of mental disorder in the year prior to Wave 1 were used to examine violence between Waves 1 and 2.

Results Those with SMI, irrespective of substance abuse status, were significantly more likely to be violent than those with no mental or substance use disorders. This finding held in both bivariate and multivariable models. Those with comorbid mental and substance use disorders had the highest risk of violence. Historical and current conditions were also associated with violence, including childhood abuse and neglect, household antisocial behavior, binge drinking and stressful life events.

Conclusions These results, in contrast to a recently published report, show that the NESARC data are consistent with the consensus view on mental disorder and violence: there is a statistically significant, yet modest relationship between SMI (within 12 months) and violence, and a stronger relationship between SMI with substance use disorder and violence. These results also highlight the importance of premorbid conditions, and other contemporaneous clinical factors, in violent behavior.

Keywords Violence · Severe mental illness · Epidemiology · Causality versus statistical prediction

R. Van Dorn (✉)
University of South Florida, Tampa, USA
e-mail: rvandorn@fmhi.usf.edu

J. Volavka
Department of Psychiatry, New York University School of Medicine, New York, NY, USA

N. Johnson
U. S. Census Bureau, Washington, DC, USA

Introduction

Over the past 20 years consensus has emerged among most researchers that there is a modest, yet statistically significant relationship between severe mental illness (SMI) and violence. Consequently, in recent years, much of the research designed to examine this relationship has focused on refining risk assessment [1–3]. Researchers have long understood that most people with mental illness are not violent, that most violent acts are committed by people who are not mentally ill, and that substance abuse—more common in people with mental illness—is responsible for much of the increased risk attributable to mental disorder [4–8].

Recently, a number of papers have sought to further clarify the relationship between mental disorder and violence by focusing on the roles that substance use [9, 10], prior violence [11], premorbid conditions [12], familial factors [13], and clinical features such as hostility and lack of insight [14, 15] play in increasing violence risk, in

addition to examining potential protective effects associated with psychopharmacological treatment [16]. All of these papers have, in one way or another, provided a more nuanced understanding of the complex relationship between mental disorder and violence. These published results also facilitate continued scientific discourse by providing opportunities to reexamine findings with different methodological and statistical assumptions, in addition to providing the starting point for the study of subsequent research questions. Using the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) data, this paper attempts both. That is, we reexamine prior published findings and attempt to advance our understanding of the relationship between mental disorder and violence by expanding upon prior research. The NESARC is a nationally representative two-wave longitudinal survey conducted between 2001 and 2005, with diagnostic information about mental disorder, substance use as well as violence. We explore three questions in this paper: (a) Is there a relationship between mental disorder and violence? (b) Do premorbid conditions, in this case childhood maltreatment and household antisocial behavior, increase the risk of adult violence for those with mental disorder? and (c) Does community-based outpatient treatment reduce the likelihood of violence for those with mental or substance use disorders?

The relationship between mental disorder and violence

A recently published paper by Elbogen and Johnson [9] that used the NESARC data found that SMI was statistically unrelated to community violence unless comorbid substance abuse or dependence was involved. Given the robust nature of the NESARC data, these findings could have a major impact on the practice of risk assessment and management, and could also mitigate the public perception that people with mental illness in the community are generally dangerous [17–21]. However, there are compelling reasons to reexamine the authors' findings. While some reasons have been raised previously [22], different aspects of Elbogen and Johnson's findings deserve continued attention. Specifically, Elbogen and Johnson based their conclusions of a null relationship between SMI and violence on assumptions consistent with the statistical prediction of violence. However, they neglected to consider the same relationship under assumptions consistent with causal modeling, which as we show, results in different conclusions. In addition to the differences between statistical prediction and causal modeling, there are three other areas that we considered important to reexamine. First, Elbogen and Johnson used lifetime diagnoses of mental illness to explain recent violence; however, in order to address issues of spatio-temporal ordering, we used past

year diagnoses of mental illness when examining recent violence. Second, Elbogen and Johnson used a diagnostically heterogeneous comparison group that combined people with no mental illness with people with other mental illnesses, including personality disorders; we instead created and analyzed a homogeneous comparison group and created an 'other' mental disorder group. Third, and finally, there were other relevant variables that were excluded from their statistical models that we chose to examine.

The role of childhood factors in explaining the relationship between mental disorder and violence

Recent investigations found that adults with schizophrenia who had a childhood history of conduct problems were significantly more likely to engage in violence than those without conduct problems [12] and were also less likely to experience reductions in violent behavior over a 6-month period when adherent with antipsychotic medications than those without conduct problems [16]. These findings, combined with other investigations of SMI and childhood experiences [23–27], point to a robust relationship between negative early life experiences and later social problems for this population. In this paper, we focus on differential violence outcomes associated with the presence of adverse childhood events, i.e., a childhood history of household antisocial behavior and abuse or neglect.

The role of outpatient treatment in reducing violence risk

Multiple studies have examined the role of psychopharmacological interventions in reducing violence [16, 28–34], which is an important line of investigation as these interventions are the primary mode of service delivery for adults with SMI [28]. However, fewer studies have sought to examine potential protective effects associated with outpatient treatment and reduced violence [35, 36]. The persistence of this empirical gap is particularly troubling within the context of mental disorder and violence [37, 38].

Methods

Data

The NESARC is a two-wave, face-to-face survey that was conducted between 2001 (i.e., Wave 1: 2001–2002) and 2005 (i.e., Wave 2: 2004–2005). The NESARC targeted an adult (i.e., 18 years and older) civilian noninstitutionalized population that resided in the United States and the District of Columbia (including Alaska and Hawaii). The original

housing unit sampling frame used for the NESARC was the American Community Survey, a national survey of over 78,000 households conducted by the Census Bureau. There were $N = 43,093$ Wave 1 interviews completed. Among those, 39,959 participants were eligible for the Wave 2 interview, while 34,653 completed the Wave 2 interview [39, 40]. All individuals provided informed consent prior to inclusion in the study. Our analytic sample matched the sample identified by Elbogen and Johnson ($N = 34,653$, unweighted) [9].

Weighting

The NESARC sample weights adjusted for selection probabilities, including subject-selection per household, nonresponse rates, and oversampling of young adults. Sample weights also adjusted for demographic characteristics in accordance with the 2000 Census [39]. We ratio-adjusted the sample weights to the study's sample size so that the variance estimates of parameters in regression models were produced correctly. Scaling the weight to the sample size maintains the relative importance of the observation as indicated by the weight accounting for the sampling effect so that confidence intervals and tests of parameter values are correctly calculated.

Measures

SMI comprises three diagnostic categories: schizophrenia, bipolar disorder and major depressive disorder, all of which are available in the NESARC data. The latter two diagnoses were obtained via the National Institute on Alcohol Abuse and Alcoholism Alcohol (NIAAA) Use Disorder and Associated Disabilities Interview Schedule–DSM-IV Version, which was administered at Wave 1. Schizophrenia was assessed via a question asking, "did a doctor or other health professional diagnose schizophrenia or psychotic illness or episode…in the last 12 months?"[1] We created a summary variable of "any SMI", which was positive for any of the three diagnoses, in addition to indicator variables representing each SMI condition.

In addition to the three measures of SMI, the NESARC also assessed other mental *disorders*. These other disorders included: generalized anxiety, specific and social phobia, hypomania, panic, panic with and without agoraphobia, agoraphobia without panic, and dysthymia. The NESARC also assessed the presence of the following personality disorders: antisocial, avoidant, dependent, obsessive–

compulsive, paranoid, schizoid, and histrionic. These 'other' mental disorders were combined into one group.

The NIAAA interview schedule assessed alcohol and drug abuse and/or dependence (SA/D) (i.e., cannabis, cocaine, opioids, hallucinogens, methamphetamine, inhalants, heroin, sedatives, tranquilizers, or other illicit drugs). We analyzed a summary variable of any SA/D and indicators of alcohol abuse/dependence only, drug abuse/dependence only, and poly-substance alcohol and drug abuse/dependence.

To make the comparisons easier between our revised models and the researchers' original models [9], we followed their coding schemes for other covariates, including: in the demographic domain age, education, sex, race, and income and perceiving threats in the clinical domain. In the clinical domain, we also included an indicator of binge drinking in the past year, which was based on the five questions assessing how often respondents consumed five or more drinks (i.e., coolers, beer, wine, liquor, or other alcohol) in one sitting. Those reporting any binge drinking in the past year were coded as 1 and compared to those with no such indication.

We created three variables to account for childhood maltreatment: physical abuse alone, neglect alone and combined abuse and neglect. We also created an index of household history of antisocial behavior that ranged from 0 to 4 and was based on the following questions: (a) Was your father/mother ever an alcoholic or problem drinker? (b) Did your father/mother ever have problems with drugs? (c) Did your parents ever spend time in jail? and (d) Did your parents ever fight? We also included an indicator assessing parental history of depression.

We included a past year stressful events scale, which ranged between 0 and 12; an indicator of marital status; an indicator for the number of people in the household being greater than the mean; and indicators assessing whether or not the respondent lived in the central city of a metropolitan statistical area (MSA) or not in the central city of an MSA; these indicators were compared to respondents not living in an MSA.

To assess the relationship between outpatient treatment and violence, we coded an indicator of treatment in the 12 months prior to the Wave 1 interview and also examined whether that treatment continued into the timeframes covered by the Wave 2 interview. Anyone who indicated treatment during all phases was coded as a treatment continuer; those positive for treatment at Wave 1, but not at Wave 2 were coded as a treatment discontinuer; the remaining cases were coded as not treated.

Violence was constructed to match the authors' prior analysis [9]. Any violent behavior was based on the following questions: since the last interview did you: (a) use a weapon like a stick, knife, or gun in a fight?; (b) hit

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[1] Given the wording of the NESARC interview question for "schizophrenia", it is more accurate to refer to this cluster of mental disorders as "psychotic disorders" [41]. However, we will use the term "schizophrenia" in order to maintain a consistent reference point to the prior authors' work.

someone so hard that you injured them or they had to see a doctor?; (c) start a fire on purpose to destroy someone's property or just to see it burn?; (d) force someone to have sex with you against their will?; (e) get into a physical fight when or right after drinking?; (f) get into a fight when under the influence of [a] drug?; (g) physically hurt another person in any way on purpose?; (h) get into a fight that came to swapping blows with someone like a husband, wife, boyfriend, or girlfriend?; (i) get into a lot of fights you started? Serious violence consisted of items a-d; substance-related violence consisted of items e and f.

Statistical analysis[2]

Univariate rates of violence by diagnostic classification, bivariate associations between mental disorder in the year prior to the Wave 1 interview and violence between Waves 1 and 2 and multivariable associations examining the relationship between mental disorder and violence are presented in the following Tables and Figures. Regression models control for the length of time between Waves 1 and 2, include the NESARC-created sample weight and were based on the preliminary assessments of multicollinearity among the independent variables. All analyses were conducted with SAS version 9.2. In sum, the models presented below and the variables included are meant to both replicate and expand upon Elbogen and Johnson's recently published paper [9].

Results

Table 1 shows the prevalence and relative risk of violence by past year diagnostic classification for the weighted NESARC data. These results show that all classifications of mental and substance use disorders evince a significantly elevated risk of violence compared to those with no diagnosed conditions. Those in the SMI + SA/D group had the highest rate of violence (9.41%), followed by those with other mental illness + SA/D (7.19%), SMI (2.88%), SA/D (2.49%), and other mental illnesses (1.43%); finally, the comparison group (i.e., those with no disorders) had a rate of violence of 0.83%.

While we show that all classifications of mental illness and substance use disorders elevate violence risk compared to those with no disorders, it is important to place these findings in their appropriate "risk"-related context. In addition to displaying the prevalence and relative risk (RR)

of violence, Table 1 also presents various measures of attributable risk for the diagnostic classifications in reference to the comparison group of those with no diagnosed mental or substance use disorders. (We present the relative risk as opposed to the odds ratio in this context given relative risk's common association with prevalence estimates and attributable risk [42]. However, we present regression-based odds ratios throughout the remainder of the paper to allow for a comparison between our results and those obtained by Elbogen and Johnson.)

Our analysis shows that those with SMI have a higher risk (higher incidence) of violence than those with no mental or substance use disorders (RR = 3.49). If those with SMI had that risk removed, their incidence of violence would decrease by 2.07 per 100 population (i.e., attributable risk), which would represent a 71% reduction of their violence incidence (i.e., attributable risk percent). A reduction of 0.19 new cases of violence per 100 population (exposed and unexposed) is expected if SMI is removed from the total population (i.e., population attributable risk). This reduction would represent a 19% decrease of the incidence of violence in the population (i.e., population attributable risk percent).

It is important to note that individuals with a mental disorder could have also had other, comorbid mental illnesses. We used a hierarchical classification scheme consistent with prior epidemiological research examining the relationship between mental disorder and violence, including that from the Epidemiological Catchment Area study [43]. Specifically, if someone was positive for both schizophrenia and bipolar disorder, they were included in the schizophrenia classification; and if someone met NIAAA assessment criteria for both bipolar disorder and depression, they were included in the bipolar classification. Also, each individual SMI condition could have been positive for other mental illnesses, including anxiety and personality disorders. Because of the possibility of additional comorbid mental disorders, we calculated rates of any violence for each diagnostic group by the number of diagnoses. For example, for the weighted data, 2.9% (N = 73) of all individuals with a SMI diagnosis were violent. Of those with SMI who were violent, 2% (N = 17) had a unitary SMI diagnosis; 2.1% (N = 16) had another mental disorder in addition to their SMI; and 4.3% (N = 40) had three or more diagnosed mental disorders. For most diagnostic classifications, the presence of additional disorders was associated with an increased risk of violence (Fig. 1).

Tables 2 and 3 display bivariate associations between mental disorder and substance use (Table 2) and dispositional, historical, clinical, and contextual factors (Table 3) and violence. As noted earlier, there is a significant and positive effect for SMI and all types of violence; further, there are significant effects for each of the SMI diagnoses

Table 1 NESARC data ($N = 36{,}019$: weighted): Association between any violence and mental disorder in the community

Diagnostic group	Past year violence					
	Prevalence	Relative risk (RR)	Attributable risk (AR)	Attributable risk % (AR%)	Population attributable risk (PAR)	Population attributable risk% (PAR%)
No mental or substance use disorder ($N = 24{,}951$)	0.83	–	–	–	–	–
SMI ($N = 2{,}531$)	2.88	3.49*	2.07	71.38	0.19	18.63
SMI + SU ($N = 592$)	9.97	11.45*	9.09	91.27	0.23	21.55
Other mental disorder ($N = 5{,}240$)	1.72	1.98*	0.85	49.42	0.12	12.12
Other mental disorder + SU ($N = 862$)	7.29	8.38*	6.42	88.07	0.20	18.69
Substance use disorder ($N = 1{,}843$)	2.86	3.29*	1.99	69.58	0.13	13.00

Statistical significance: *$p < 0.001$

Fig. 1 Percent of respondents reporting recent violence by type and number of diagnoses
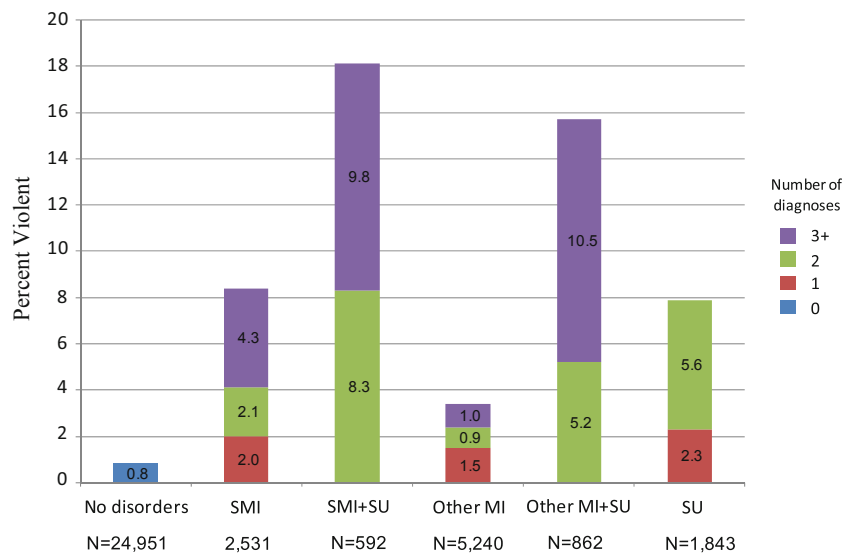
alone. The strongest associations with violence were for the SMI + SA/D conditions; of these, the schizophrenia + SA/D condition evinced the greatest risk of violence. It is also worth noting that the strength of the bivariate associations differed by substance use conditions. The third set of bivariate results in Table 2 displays these results. Alcohol use disorders were associated with the lowest risk of all substance use disorders except for the substance-related violence outcome. Next, the SMI + SA/D and the other mental illness + SA/D conditions were all associated with a higher likelihood of violence than any substance use disorder without a comorbid mental disorder.

Table 3 shows the remaining bivariate results. In the dispositional domain, there was a positive association between young age and violence. Other factors in this domain were negatively associated with violence. All factors in the historical domain were significantly associated with violence. A history of household antisocial behavior was associated with a twofold increase in violence for every one unit increase of the four possible

"behaviors". The effect for reporting abuse and neglect was stronger than for reporting either abuse or neglect alone. Both factors in the clinical domain were associated with violence. Multiple factors in the contextual domain were significant, including stressful life events and living in a residence with many people.

Tables 4 and 5 show multivariable results for violence by 'SMI' and the individual SMI diagnoses, respectively. Table 4 shows that, while controlling for all other factors in the model, SMI was significantly associated with any and substance-related violence, as was SMI + SA/D. A substance use disorder (SA/D) alone was only significantly associated with substance-related violence. Only SMI + SA/D and other mental illness + SA/D were related to serious violence.

Table 5 shows that bipolar disorder was associated with any violence. All individual SMI + SA/D conditions were significantly associated with the three violence outcomes (except for major depression + SA/D, which was not significantly associated with serious violence). The other

Table 2 Bivariate statistics for different diagnostic classifications by violence types

Characteristic	Any violence			Serious violence			Substance-related violence		
	OR	95% CI	Sig.	OR	95% CI	Sig.	OR	95% CI	Sig.
Wave 1									
Diagnostic indicators									
No mental illness or substance use disorder (reference)	–	–		–	–		–	–	
SMI	3.55	(2.71–4.65)	***	2.39	(1.65–3.44)	***	2.61	(1.80–3.79)	***
SMI with substance use disorder	12.20	(8.97–16.60)	***	10.01	(6.84–14.65)	***	32.68	(24.67–43.30)	***
Other mental illness	1.74	(1.33–2.27)	***	1.81	(1.33–2.46)	**	1.62	(1.15–2.27)	**
Other mental illness with substance use disorder	9.16	(6.84–12.27)	***	10.79	(7.83–14.88)	***	19.36	(14.58–25.71)	***
Substance abuse and/or dependence	3.02	(2.19–4.18)	***	2.52	(1.67–3.78)	***	10.49	(8.06–13.66)	***
Schizophrenia	5.84	(1.97–17.32)	**	5.97	(1.71–20.88)	**	4.96	(1.18–20.82)	*
Bipolar disorder	5.90	(3.75–9.28)	***	3.70	(1.94–7.06)	***	3.79	(1.93–7.43)	***
Major depression	2.94	(2.14–4.04)	***	1.95	(1.26–3.04)	**	2.26	(1.46–3.49)	***
Schizophrenia and substance abuse and/or dependence	19.87	(7.16–55.14)	***	29.31	(10.74–79.97)	***	56.24	(23.92–132.21)	***
Bipolar disorder and substance abuse and/or dependence	16.84	(10.28–27.58)	***	14.53	(8.01–26.34)	***	34.50	(21.76–54.71)	***
Major depression and substance abuse and/or dependence	9.98	(6.77–14.69)	***	7.07	(4.23–11.81)	***	30.43	(21.97–42.13)	***
SMI with alcohol use disorder	8.00	(5.18–12.37)	***	6.43	(3.70–11.17)	***	22.20	(15.39–32.01)	***
SMI with drug use disorder	11.17	(5.08–24.55)	***	15.23	(6.85–33.85)	***	16.57	(7.39–37.14)	***
SMI with comorbid alcohol and drug use disorders	26.38	(16.69–41.69)	***	17.53	(9.69–31.74)	***	83.96	(56.19–125.46)	***
Other mental illness and alcohol use disorder	6.24	(4.27–9.11)	***	9.09	(6.20–13.32)	***	14.34	(10.19–20.20)	***
Other mental illness and drug use disorder	10.46	(4.94–22.15)	***	3.12	(0.70–13.98)		15.83	(7.37–33.97)	***
Other mental illness with comorbid alcohol and drug use disorders	25.84	(15.97–41.81)	***	27.52	(16.19–46.77)	***	54.36	(34.53–85.58)	***
Alcohol use disorder	2.60	(1.81–3.76)	***	1.66	(0.98–2.80)		10.19	(7.71–13.46)	***
Drug use disorder	4.45	(1.82–10.87)	***	6.12	(2.48–15.08)	***	7.37	(3.08–17.64)	***
Comorbid alcohol and drug use disorders	6.90	(3.15–15.12)	***	9.78	(4.47–21.39)	***	18.29	(9.67–34.57)	***

Statistical significance: *$p < 0.05$; **$p < 0.01$ ***$p < 0.001$

mental illness + SA/D group evinced a lower violence risk than did the individual SMI + SA/D conditions (again, except for major depression + SA/D and serious violence).

Given the low base rate of violence in this sample and the low number of cases in individual SMI groups, we analyzed "any violence" in a multivariable model examining various substance use disorders (Table 6). None of the unitary substance use conditions (i.e., alcohol use, drug use, or combined alcohol and drug use disorders) were significantly associated with any violence. However, the addition of any mental disorder to any substance use condition resulted in a significant and positive association with any violence. Perhaps somewhat surprisingly, the greatest risk for violence was found for the other mental illness plus poly-substance use condition (OR = 4.00); however, the risk associated with SMI + poly-substance use disorders was also high (OR = 3.75). All drug use disorders were associated with greater risk of violence than were the alcohol use disorders.

There were consistent results between the bivariate and the multivariable models for other covariates. In the "any violence" models: younger age, household history of antisocial behavior, abuse, neglect, combined abuse/neglect, perceiving hidden threats, binge drinking and stressful life events were associated with increased violence. A high school education or higher, female sex and higher income were protective.

Premorbid conditions and the relationship between mental disorder and violence

Is the association between mental or substance use disorders and violence conditioned on the presence of adverse childhood events (i.e., any history of household antisocial behavior or abuse/neglect)? To address this question, we tested categorical interactions of each diagnostic classification by the presence of any adverse event. Participants with SMI and adverse childhood events were at increased

Table 3 Bivariate statistics for dispositional, historical, clinical and contextual factors by violence types

Characteristic	Any violence			Serious violence			Substance-related violence		
	OR	95% CI	Sig.	OR	95% CI	Sig.	OR	95% CI	Sig.
Wave 1									
Dispositional factors									
<Median age	5.16	(4.07–6.53)	***	3.96	(3.05–5.15)	***	9.56	(7.04–12.98)	***
≥High school education	0.55	(0.45–0.68)	***	0.43	(0.34–0.54)	***	0.56	(0.45–0.69)	*
Female	0.67	(0.57–0.80)	***	0.21	(0.16–0.28)	***	0.26	(0.21–0.32)	***
Race, white	0.64	(0.54–0.76)	***	0.60	(0.49–0.74)	***	0.86	(0.71–1.04)	**
>Median annual income (past 12 months)	0.45	(0.37–0.54)	***	0.59	(0.47–0.73)	***	0.50	(0.41–0.60)	***
Historical factors									
Household history of antisocial behavior (0–4)	2.01	(1.86–2.17)	***	1.92	(1.75–2.10)	***	1.86	(1.72–2.02)	***
Parental history of depression	1.82	(1.52–2.19)	***	1.63	(1.31–2.04)	***	1.80	(1.49–2.17)	***
No physical abuse or neglect (reference)	–	–		–	–		–	–	
Parental history of physical abuse	5.24	(3.84–7.16)	***	3.87	(2.56–5.84)	***	3.66	(2.57–5.20)	***
Parental history of neglect	4.77	(3.35–6.79)	***	4.62	(3.04–7.02)	***	2.03	(1.23–3.35)	**
Both abuse and neglect	9.44	(6.80–13.11)	***	7.26	(4.77–11.05)	***	4.30	(2.77–6.67)	***
Clinical factors									
Perceives hidden threats in others	3.76	(3.00–4.70)	***	4.57	(3.55–5.88)	***	3.81	(3.03–4.80)	***
Binge drinking	3.16	(2.65–3.77)	***	3.66	(2.96–4.51)	***	12.47	(10.16–15.32)	***
Contextual factors									
Life transitions (0–12)	1.47	(1.42–1.52)	***	1.43	(1.37–1.50)	***	1.54	(1.48–1.59)	***
Married	0.36	(0.30–0.43)	***	0.39	(0.31–0.48)	***	0.20	(0.17–0.25)	***
Number of people in household (GT med)	1.40	(1.18–1.67)	***	1.41	(1.14–1.74)	**	1.43	(1.19–1.71)	***
Not in MSA (reference)	–	–		–	–		–	–	
Central city	1.02	(0.81–1.28)		1.04	(0.79–1.38)		0.99	(0.77–1.26)	
Not in central city	0.67	(0.53–0.83)	***	0.71	(0.54–0.93)	*	0.78	(0.62–0.98)	*

Statistical significance: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

risk for any violence (OR = 3.15; $p < 0.001$), compared to those with SMI and no adverse childhood events. Those with SMI + SA/D and no adverse childhood events had a higher risk of violence compared to those with SMI only and no adverse childhood events, however, the difference was not statistically significant (OR = 2.03; $p = 0.07$). Yet, those with SMI + SA/D and adverse childhood events were significantly different from (OR = 4.33; $p < 0.001$) those with SMI only and no adverse childhood events. The same pattern held for those with other mental illnesses and no history of adverse events (OR = 0.83; $p = 0.56$), those within the same diagnostic classification, but with a history of adverse events (OR = 1.94; $p < 0.05$) and those with comorbid other mental illnesses with a substance use disorder but no history of adverse events (OR = 2.01; $p = 0.06$) and those in the same diagnostic classification, but with a history of adverse events (OR = 3.97; $p < 0.001$). Finally, those with a substance use disorder, but no adverse childhood events were not significantly more likely to be violent (OR = 1.00; $p = 0.98$) than the comparison group; yet those with a substance use disorder and any adverse childhood event (OR = 2.04; $p < 0.05$)

were significantly more likely to be violent than the comparison group. The regression model for these interactions controlled for all covariates, plus length of time between the Wave 1 and Wave 2 interviews (full results not shown). As an illustration of these categorical interactions, predicted probabilities from the "any violence" model found in Table 4 are presented in Fig. 2. Groups were stratified on the presence of any adverse childhood event. For each diagnostic group, including the reference group, the presence of any adverse childhood event doubled the risk of violence; the largest increase was found for those in the SMI only classification, where the presence of any adverse childhood event tripled the risk of violence.

Outpatient treatment and violence

Does outpatient treatment reduce violence? To address this question, we analyzed data from people in the following classifications: other mental disorders, comorbid other mental disorders + SA/D, SMI, SMI + SA/D, and SA/D. There was a low rate of outpatient treatment in the 12 months prior to the Wave 1 interview for those with

Table 4 Multivariable statistics for violence types by broad SMI groupings

Characteristic	Any violence			Serious violence			Substance-related violence		
	OR	95% CI	Sig.	OR	95% CI	Sig.	OR	95% CI	Sig.
Wave 1									
Dispositional factors									
<Median age	2.97	(2.28–3.88)	***	2.23	(1.65–3.02)	***	3.24	(2.32–4.53)	***
≥High school education	0.77	(0.60–0.97)	*	0.55	(0.42–0.71)	***	0.71	(0.55–0.92)	**
Female	0.62	(0.51–0.76)	***	0.21	(0.15–0.27)	***	0.33	(0.26–0.43)	***
Race, white	0.84	(0.69–1.03)		0.86	(0.67–1.09)		1.06	(0.84–1.32)	
>Median annual income (past 12 months)	0.61	(0.50–0.76)	***	0.70	(0.55–0.90)	**	0.66	(0.52–0.82)	***
Historical factors									
Household history of antisocial behavior (0–4)	1.32	(1.19–1.46)	***	1.33	(1.18–1.50)	***	1.32	(1.19–1.48)	***
Parental history of depression	0.91	(0.73–1.13)		0.91	(0.69–1.19)		0.84	(0.66–1.07)	
No physical abuse or neglect [Reference]	–	–		–	–		–	–	
Parental history of physical abuse	2.66	(1.85–3.82)	***	2.18	(1.37–3.48)	**	2.13	(1.40–3.23)	**
Parental history of neglect	2.61	(1.76–3.88)	***	2.60	(1.62–4.17)	***	0.91	(0.49–1.67)	
Both abuse and neglect	3.92	(2.64–5.84)	***	3.29	(1.97–5.50)	***	2.02	(1.17–3.50)	*
Clinical factors									
No mental illness or substance use disorder (reference)	–	–		–	–		–	–	
SMI	1.60	(1.17–2.20)	**	1.23	(0.81–1.87)		1.53	(1.01–2.33)	*
SMI with substance use disorder	2.57	(1.74–3.78)	***	1.88	(1.16–3.04)	*	5.20	(3.61–7.50)	***
Other mental illness	1.14	(0.86–1.52)		1.16	(0.83–1.63)		1.21	(0.84–1.74)	
Other mental illness and substance abuse and/or dependence	2.29	(1.59–3.28)	***	2.06	(1.37–3.10)	**	2.99	(2.11–4.24)	***
Substance abuse and/or dependence	1.29	(0.89–1.87)		0.92	(0.59–1.45)		2.50	(1.83–3.41)	***
Perceives hidden threats in others	1.39	(1.07–1.80)	*	1.85	(1.38–2.49)	***	1.38	(1.05–1.82)	*
Binge drinking	1.41	(1.11–1.77)	**	1.48	(1.13–1.93)	**	3.43	(2.64–4.46)	***
Contextual factors									
Stressful life events (0–12)	1.17	(1.11–1.22)	***	1.16	(1.10–1.23)	***	1.17	(1.11–1.22)	***
Married	0.60	(0.49–0.73)	***	0.59	(0.46–0.75)	***	0.38	(0.30–0.49)	***
Number of people in household (GT med)	0.99	(0.81–1.22)		1.07	(0.84–1.36)		1.22	(0.98–1.51)	
Not in MSA (reference)	–	–		–	–		–	–	
Central city	0.90	(0.70–1.16)		0.92	(0.68–1.25)		0.90	(0.68–1.19)	
Not in central city	0.77	(0.61–0.98)	*	0.82	(0.62–1.09)		0.88	(0.68–1.14)	

Statistical significance: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

mental or substance use disorders. Across the groups, only 12.80% of subjects (other mental illness: 5.84%; other mental illness + SA/D: 11.23%; SMI: 21.98%; SMI + SA/D: 32.83%; and SA/D: 5.58%) reported attending outpatient counseling. From those three groups, in the order presented above, 1.83, 3.58, 9.71, 18.75, and 1.38% were classified as treatment continuers; 4.02, 7.66, 12.28, 14.08, and 4.20% were classified as treatment discontinuers. Treatment discontinuers with 'other' mental disorders (1.30 vs. 0.68%), comorbid 'other' mental disorders and substance use (15.82 vs. 11.53%), SMI (4.10 vs. 2.60%) or SA/D (9.18 vs. 0.00%) reported higher rates of violence compared to treatment continuers; yet, none of these Chi-square differences were statistically significant. The rates of violence in the not treated cohort for the above groups, and in the same order presented above were 1.45, 6.27,

2.72, 9.17, and 2.23%. Treatment discontinuers with SMI + SA/D had lower rates of violence (7.15 vs. 11.95%) than their treatment continuing counterparts, though the differences were not statistically significant.

Discussion

Among the many challenges faced by persons with mental illness, perhaps none has a more insidious and far-reaching effect than does violence risk. Even if someone with mental illness never perpetrates a violent act, it is likely that they, because of their mental disorder, will be perceived as a threat by the general public. This is because much of the general public regards those with mental illness, particularly a SMI, as unpredictable and dangerous,

Table 5 Multivariable statistics for violence types by individual SMI diagnoses

Characteristic	Any violence			Serious violence			Substance-related Violence		
	OR	95% CI	Sig.	OR	95% CI	Sig.	OR	95% CI	Sig.
Wave 1									
Dispositional factors									
Median age	2.98	(2.28–3.89)	***	2.28	(1.69–3.09)	***	3.31	(2.37–4.64)	***
≥High school education	0.76	(0.60–0.96)	*	0.54	(0.41–0.70)	***	0.71	(0.55–0.91)	**
Female	0.63	(0.51–0.76)	***	0.21	(0.15–0.27)	***	0.34	(0.26–0.43)	***
Race, white	0.85	(0.69–1.04)		0.85	(0.67–1.09)		1.05	(0.84–1.32)	
>Median annual income (past 12 months)	0.62	(0.50–0.76)	***	0.72	(0.56–0.92)	**	0.66	(0.53–0.82)	**
Historical factors									
Household history of antisocial behavior (0–4)	1.32	(1.19–1.46)	***	1.32	(1.17–1.50)	***	1.32	(1.18–1.48)	***
Parental history of depression	0.90	(0.73–1.13)		0.90	(0.69–1.18)		0.84	(0.66–1.07)	
No physical abuse or neglect [Reference]	–	–		–	–		–	–	
Parental history of physical abuse only	2.65	(1.84–3.80)	***	2.18	(1.37–3.48)	***	2.11	(1.39–3.21)	***
Parental history of neglect only	2.65	(1.78–3.94)	***	2.65	(1.65–4.25)	***	0.92	(0.50–1.68)	
Both abuse and neglect	3.84	(2.58–5.73)	***	3.20	(1.91–5.35)	***	1.98	(1.14–3.43)	*
Clinical factors									
No mental illness or substance use disorder (reference)	–	–		–	–		–	–	
Schizophrenia	2.52	(0.79–8.09)		2.37	(0.61–9.16)		2.96	(0.63–13.87)	
Bipolar disorder	2.12	(1.28–3.51)	**	1.55	(0.77–3.11)		1.64	(0.78–3.44)	
Major depression	1.42	(0.99–2.04)		1.09	(0.67–1.78)		1.45	(0.90–2.33)	
Schizophrenia and substance abuse and/or dependence	4.01	(1.35–11.89)	*	6.11	(2.06–18.15)	**	10.81	(4.21–27.76)	***
Bipolar disorder and substance abuse and/or dependence	2.84	(1.58–5.09)	***	2.34	(1.16–4.70)	*	4.62	(2.64–8.07)	***
Major depression and substance abuse and/or dependence	2.36	(1.50–3.72)	***	1.40	(0.77–2.55)		5.09	(3.40–7.64)	***
Other mental illness	1.15	(0.86–1.54)		1.17	(0.83–1.64)		1.21	(0.84–1.74)	
Other mental illness and substance abuse and/or dependence	2.31	(1.61–3.31)	***	2.06	(1.37–3.10)	***	2.99	(2.10–4.24)	***
Substance abuse and/or dependence	1.29	(0.89–1.87)		0.91	(0.58–1.44)		2.49	(1.82–3.39)	***
Perceives hidden threats in others	1.36	(1.05–1.76)	*	1.83	(1.36–2.46)	***	1.38	(1.05–1.83)	*
Binge drinking	1.41	(1.12–1.78)	**	1.49	(1.14–1.95)	**	3.45	(2.66–4.48)	***
Contextual factors									
Stressful life events (0–12)	1.17	(1.11–1.22)	***	1.16	(1.10–1.23)	***	1.17	(1.11–1.22)	***
Married	0.60	(0.49–0.73)	***	0.59	(0.46–0.75)	***	0.38	(0.30–0.49)	***
Number of people in household	0.99	(0.81–1.22)		1.06	(0.83–1.36)		1.22	(0.98–1.51)	
Not in MSA (reference)	–	–		–	–		–	–	
Central city	0.91	(0.70–1.17)		0.92	(0.68–1.25)		0.91	(0.69–1.19)	
Not in central city	0.77	(0.61–0.98)	*	0.82	(0.62–1.09)		0.89	(0.69–1.15)	

Statistical significance: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

and a group to be avoided [18–21]. Therefore, any examination of the relationship between mental disorder and violence needs to be undertaken judiciously. Ultimately, one must balance the potential for increased stigma towards those with mental illness against the potential benefits of improved risk assessment, service delivery, resource planning, and treatment. It is with these ideas in mind that we undertook the analysis of the NESARC data.

Almost 20 years ago, Swanson and colleagues [43] published a seminal paper that was among the first to empirically demonstrate the link between SMI and violence in a large community sample. Since that time, with some exceptions [5], most researchers have concurred that a modest but statistically significant relationship exists between violence and SMI.[3] This prevailing view has been

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[3] Data from the MacArthur Violence Risk Assessment study showed that patients without alcohol or drug symptoms, as assessed by the MAST and DAST, were not significantly more violent than comparison group subjects without alcohol or drug symptoms (4.7 vs. 3.3%). However, it is also important to note that the MacArthur study used a patient sample (i.e., recently discharge from the hospital), which differs from the NESARC sample.

**Table 6** Multivariable statistics for any violence by specific substance use disorder categories

Characteristic	Any violence		
	OR	95% CI	Sig.
Wave 1			
Dispositional factors			
Median age	2.98	(2.28–3.89)	***
≥High school education	0.77	(0.61–0.98)	*
Female	0.64	(0.52–0.78)	***
Race, white	0.85	(0.69–1.04)	
>Median annual income (past 12 months)	0.62	(0.50–0.76)	***
Historical factors			
Household history of antisocial behavior (0–4)	1.32	(1.19–1.46)	***
Parental history of depression	0.89	(0.71–1.11)	
No physical abuse or neglect (reference)	–	–	
Parental history of physical abuse only	2.72	(1.89–3.91)	***
Parental history of neglect only	2.63	(1.76–3.93)	***
Both abuse and neglect	3.90	(2.61–5.81)	***
Clinical factors			
No mental illness or substance use disorder (reference)	–	–	
SMI	1.64	(1.20–2.25)	**
SMI with alcohol use disorder	2.12	(1.29–3.47)	**
SMI with drug use disorder	2.72	(1.16–6.37)	*
SMI with comorbid alcohol and drug use disorders	3.75	(2.13–6.62)	***
Other mental illness	1.16	(0.87–1.55)	
Other mental illness with alcohol use disorder	1.89	(1.22–2.93)	**
Other mental illness with drug use disorder	2.28	(1.02–5.09)	*
Other mental illness with comorbid alcohol and drug use disorders	4.00	(2.26–7.07)	***
Alcohol use disorder	1.27	(0.84–1.92)	
Drug use disorder	1.51	(0.59–3.84)	
Comorbid alcohol and drug use disorders	1.46	(0.59–3.63)	
Perceives hidden threats in others	1.39	(1.07–1.80)	*
Binge drinking	1.40	(1.11–1.78)	*
Contextual factors			
Stressful life events (0–12)	1.16	(1.10–1.21)	***
Married	0.61	(0.50–0.75)	***
Number of people in household	0.99	(0.81–1.21)	
Not in MSA (reference)	–	–	
Central city	0.90	(0.70–1.16)	
Not in central city	0.77	(0.60–0.97)	*

Statistical significance: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

questioned recently as a result of an analysis that found that SMI alone was statistically unrelated to violence in both bivariate and multivariable analyses [9]. However, those prior results should be seen in the context of addressing the statistical prediction of violence and not, as the authors convey at different times throughout their paper, a test of the causal relationship between mental disorder and violence. Reanalyzing the NESARC data in a manner that tests a causal relationship shows that SMI is associated with an increased risk for violence in both bivariate and multivariable models. We now review differences between our analysis and that of the prior authors [9]. Within the context of these differences, it is important to note that our intent is to underscore that different decisions produce different conclusions. Given the clinical and policy significance attributed to empirical results these analytic and methodological differences need to be made clear.

Fig. 2 Predicted probability of any violence between Waves 1 and 2 as a function of mental disorder, substance use disorder, and history of childhood events
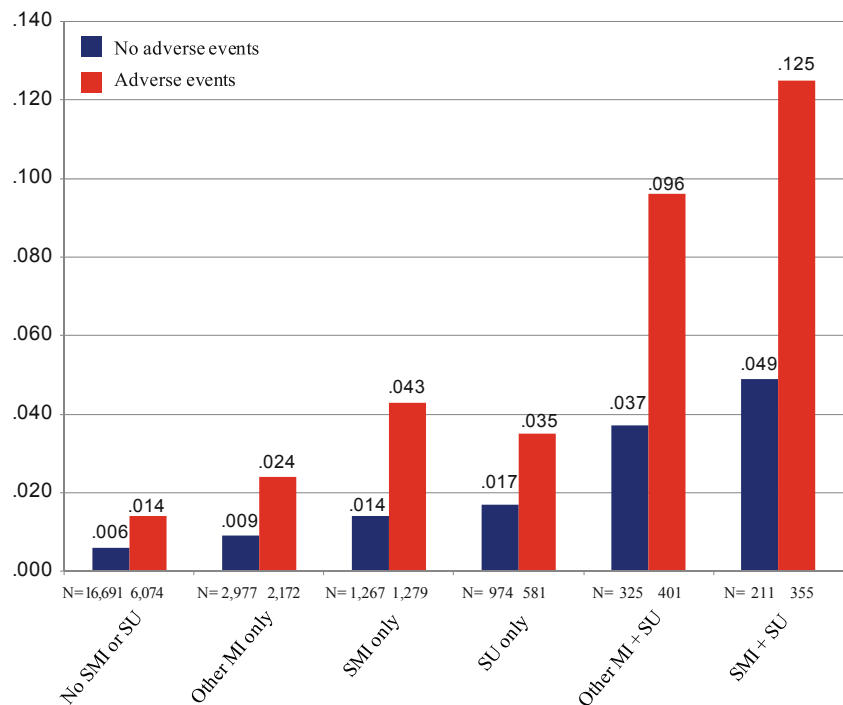
Lifetime diagnoses versus past year diagnoses

The researchers' original analysis relied on lifetime diagnosis of psychiatric disorder in examining the relationship between mental disorder, substance abuse, and violence. Reports from the NESARC data show high rates of remission from psychiatric and substance use disorders [44–46]; NESARC rates of remission are similar to rates found in other epidemiological studies, including the ECA [47] and the NCS [48]. This means that the researchers' analysis counted many people as positive on these disorders who may not have had them in years, which would render their causal statements about mental disorder and violence tenuous [31]. Using lifetime diagnoses likely suppresses whatever relationship may exist as it counts many people as having the risk factor who actually may not have had the risk factor during the observation period for violence.

The authors make an important point about temporal ordering and causality when they say, "…to establish that mental illness causes violence, it is necessary (though not sufficient) to demonstrate that mental illness precedes later violence" (p.153). Temporal ordering is indeed one criterion for establishing causation [49]. But equally important is spatio-temporal contiguity (i.e., the causal factor must be spatially near the effect). Associating lifetime mental illness with current violence falls short on contiguity and the resulting temporal priority for examining direct causation and biases the test in the direction of not finding an association. (A similar description of causal criteria, more

explicitly focused on epidemiology, is found in another treatise on the topic [50].)

Our analysis examining the impact of Wave 1 past year diagnoses on violence that took place between Waves 1 and 2 represents a test of the causal association of interest. Elbogen and Johnson report that they attempted this specification, and that the results did not differ from their lifetime diagnosis results. This is inconsistent with our results, which show a significant association between past year SMI and violence between Waves 1 and 2. Further, if true, as Elbogen and Johnson claim, it would imply, e.g., that lifetime substance abusers who were in remission from their disorder had the same risk of future violence as those who were not in *remission*. To account for this, one would need to posit either a remarkably increased rate in the relapse of substance abuse between Waves 1 and 2, or some exogenous past risk factor for both lifetime substance abuse and violence. Whatever is the case, logically it could not be that current symptoms of substance abuse were causing violence, if in fact the presence or absence of those symptoms in the recent past makes no difference in the violence outcome.

Diagnostically heterogeneous comparison group

The second issue we identified as important for reanalysis and subsequent discussion was related to the diagnostically heterogeneous comparison group, or "no SMI group" created by Elbogen and Johnson. The various reference groups used for Elbogen and Johnson's bivariate and

multivariable analyses actually included thousands of people with substance abuse or dependence, with SMI and substance abuse or dependence comorbidity, and with other mental illnesses and personality disorders. In an epidemiological examination of SMI and violence, if it is appropriate to remove substance use disorders in order to examine the "true" relationship between mental disorder and violence, then we believe it is appropriate to remove it from both groups for comparison, not just one. We also believe the same is true for the 'other' mental disorders, including personality disorders that were part of the prior authors' comparison groups. Including these cases inflated the prior authors' comparison groups' rates of violence. Further, Elbogen and Johnson's decision to create and analyze a heterogeneous comparison group places both their methods and findings at odds with prior epidemiological studies of the mental disorder-violence relationship [23, 43, 51–54]. That is, when the focus of the study is on the relationship between mental disorder and violence, those with other mental illnesses are either removed from the data or grouped into "other mental illness" classifications. We are not aware of any epidemiological investigations that chose to create and analyze a heterogeneous comparison group as Elbogen and Johnson did when there was the ability disaggregate people by mental and substance use conditions.

Causal attribution versus statistical prediction

The third issue that we considered important to address in a reanalysis was related to the differences between statistical prediction and causal analysis; and how these two ideas were often used interchangeably in Elbogen and Johnson's paper. The need to pursue questions of causality and causal inference with non-experimental data has been recognized for some time across a range of disciplines [55, 56]. This is particularly important in the context of mental disorder and violence when one considers the potential for increased stigma towards those with mental illness that could result from incorrect results or unclear statistical and methodological practices. Still, it is equally important to recognize the inherent limitations of attempting to examine causal relationships with naturally occurring data. This includes the recognition that statements of causality are matters of judgment that outweigh statements of statistical probability [57]. Specific to Elbogen and Johnson's paper, we argue that methodological and statistical inconsistency or lack of clarity hindered the presentation of their results as they conflated ideas of prediction and causality in both the introduction of their paper and the presentation of their findings. For example, while Elbogen and Johnson stated that they were interested in "predicting" future violence, they invoked causality or the criteria for causation

throughout their paper and frequently interpreted their results as if they were examining a causal relationship between mental disorder and violence. For example, they included past, lifetime violence as an independent variable and found, not surprisingly, that this predicted future violence; with past violence in the multivariable model, SMI alone was not a significant predictor. The researchers then interpreted these results to mean that SMI alone was unrelated to violence.

Elbogen and Johnson's multivariable analyses could be considered generally correct (e.g., we would still strongly disagree with their use of a heterogeneous comparison group) if the task were simply to predict violence, as has been done in prior studies [5, 16], with a robust effect for past violence. As a causal model of violence, however, their analyses are misspecified. Since there is no true baseline measure of violence (i.e., no pre-mental illness observation of violence) much of the causal effect of mental disorder on violence has already occurred prior to study enrollment, and is captured in the lifetime measure of mental disorder. Thus, to say that future violence is predicted by past violence is a statistically meaningful but scientifically uninteresting explanation of violence. More importantly, it obscures the significant, albeit modest, causal relationship between SMI and violence.

We also removed the effect for juvenile justice contact from our regression models. As was the case with including prior violence, including an effect for juvenile justice contact likely introduced a bias as juvenile justice contact could have been a system response to early violence. We instead relied on theoretically relevant risk factors, including household history of antisocial behavior and indicators of childhood maltreatment.

Exclusion and miscoding of theoretically relevant variables

While Elbogen and Johnson can justify their inclusion or exclusion of certain variables from their regression models, we viewed our reanalysis as an opportunity to examine variables that were not included in their original analysis, but that we viewed as potential clinical intervention points or theoretically-indicated risk factors. For example, we included an indicator of binge drinking, which has been correlated with adverse outcomes [58, 59]. Another difference between our reanalysis and the authors' original analysis is that we included indicators of physical abuse and neglect. In coding only physical abuse, the researchers did not rely on prior research showing differential outcomes for various types of childhood maltreatment [60]. By doing so, they also included people in the "no abuse" category who had experienced childhood maltreatment. Also, the researchers included two factors related to

parental antisocial behaviors (i.e., parental arrest and parental fighting); yet, they did not include whether or not respondents' parents had problems with alcohol or drugs. In our reanalysis, we created a theoretically-based index of household antisocial behavior [61–63].

The authors only analyzed five factors (i.e., victimized in past year; any family or friend died in the past year; fired from job in the past year; divorced or separated in the past year; unemployed in the past year) from a 12-item stressful events scale [64]. In our reanalysis, we included the entire scale. Finally, detailed information regarding substance use was not utilized in the original analysis. Rather, only a general definition of "substance abuse and/or dependence" was analyzed. In our reanalysis, we analyzed more detailed substance use indicators.

When reanalyzing the NESARC data in a manner that tested a causal model of mental disorder and violence, and addresses issues related to: lifetime versus past year diagnoses, diagnostically heterogeneous vs. homogenous comparison groups, and the inclusion of other clinically- and theoretically-relevant covariates, we found that SMI was associated with any violence in both bivariate and multivariable models. Still, those with combined SMI and substance abuse or dependence disorders (i.e., SMI + SA/D) had a higher risk of violence, which is consistent with other findings [10, 65]; comorbid mental illness and polysubstance use disorders represented the highest risk for violence, which is a classification that the prior researchers did not analyze [9]. While our results show that substance use disorders increase violence risk, from a treatment perspective it is imperative that other factors are concurrently addressed and that substance abuse not be viewed as the master causal explanation for violence [66]. As an example of this, our categorical interactions and regression-based predicted probabilities showed that the presence of any adverse childhood event doubled, and for the SMI only group tripled, the risk of violence. The importance of premorbid conditions in predicting and managing violence [12], which is a complex and multi-determined behavior [67], should not be overlooked.

When considering our finding that SMI is associated with an increased risk of violence, it is important to emphasize our use of the term: "modest relationship." Empirically, these data show that other factors contribute more strongly to violent events for persons with mental disorder than does one's "mental illness" alone (cf., Tables 4-6); this finding is consistent with prior research [43, 53]. We are also in agreement with the importance of discussing the attributable risk of violence in addition to reporting the odds or relative risk [57] of the outcome. Various measures of attributable risk were presented in Table 1. These measures are important as they allow, in the case of the current paper, one to determine the percent reduction in the violent population that would occur if the group with a given risk factor (i.e., mental disorder) had a rate of violence as low as that observed in the comparison group without the risk factor (i.e., no disorder).

Beyond the reexamination of Elbogen and Johnson's findings, the current paper also examined the relationship between outpatient treatment and violence. While those with mental or substance use disorders who continued treatment between Waves 1 and 2 did not have a significantly reduced rate of violence compared to those in the same diagnostic groups who discontinued treatment, the direction was towards a protective effect for continued treatment and with enough cases a likely significant effect. It should be noted, however, that the treatment continuation effect for SMI + SA/D was not in the same direction as it was for the other groups. Those in the treatment continuation group for this final group had a higher rate of violence than those who discontinued treatment. Perhaps, the most interesting aspect of the treatment analysis was the low base rate of treatment initiation and treatment continuation.

In addition to limitations inherent in the NESARC data, we believe that being able to disentangle instances of unprovoked violence from violence that is a reaction to victimization in is critical. The interaction between victimization and violence [68, 69] is important on at least two levels. First, and relevant from an epidemiological perspective, we were unable to tell if a violent act was an act of self-defense (e.g., being hit first, then hitting that person back). Second, and relevant from a clinical perspective, we were unable to account for recent victimization conditioning future violence (e.g., victimization increasing psychotic symptoms like hostility or suspiciousness/persecution, which then increase violence risk). Future research should work to clarify this while building informed treatment models addressing these types of violence: one without the complications of victimization and the other with these complications. Future research should also strive to examine the relationship between treatment and violence. For example, future investigations should work to account for pharmacologic interventions in combination with outpatient treatment when possible.

It is also important to mention the lack of statistical power in our multivariable examinations of individual SMI conditions and violence. In all instances, and controlling for other factors in the models, individual SMI conditions were associated with increased violence, however, the 95% confidence intervals were quite wide, which in this case is a reflection of the limited statistical power associated with individual SMI conditions. For the three SMI conditions reported in Table 5, those with schizophrenia had the highest rate of violence (5.66%; $N = 6$), followed by bipolar disorder (4.94%; $N = 23$) and depression (2.66%; $N = 54$). The lack of significance in the "any violence"

multivariable regression for these individual SMI conditions, compared to the "no disorder" reference group, is a function of the low base rate of the outcome as each SMI condition evinced a substantially higher rate of violence than the reference group (cf., bivariate results in Table 2).

There are two other aspects of the potential mental disorder—violence relationship that should be explored in future research. First, regarding spatio-temporal contiguity, we maintain that our modeling of the relationship between Wave 1 past year mental disorder and Wave 2 violence represents a better test of the causal relationship between these factors than the prior authors' use of lifetime mental disorders for their key independent variables. Still, given that Wave 2 assessments took place between August 2004 and September 2005, which ranges between 2 and 4 years after the Wave 1 assessment, we do not have perfect spatio-temporal contiguity between mental disorder and violence. That is, if one takes a recovery-oriented perspective towards mental illness or focuses on mental disorder symptoms, which we discuss in more detail next, then even our approach of using Wave 1 past year diagnoses and Wave 2 violence creates a potentially longer than desired lag between the "cause and effect." While we recognize that the length of this gap is not ideal, there is a dearth of research that can inform the question of how long of a gap is too long when assessing mental disorder and violence. One way to improve this situation is to record the date(s) of violent events [70] through the use of timeline followback methods [71]. This additional information would be an improvement over currently employed violence assessment methods and simply controlling for time between assessments in regression models. The relevance of obtaining better information on the timing of violence becomes even more important if one considers the relationship between mental disorder and violence in the context of recovery-oriented mental health or one focuses on recent symptoms and disabilities, rather than mere presence of a disorder.

In both the NESARC data and data from the NCS [53], past year diagnoses were associated with higher rates of violence than were lifetime diagnoses. There are at least two implications of this. First, assessing the relationship between lifetime diagnoses and recent violence, as Elbogen and Johnson did and for the reasons we reviewed above, likely suppresses whatever relationship may exist as it counts many people as having the risk factor who actually may not have had the risk factor during the observation period for violence. Second, within the context of recovery-oriented mental health, understanding how fluctuating mental health conditions affect violence risk over time is important.

While debates regarding "recovery in" or "recovery from" [72] mental disorders are beyond the scope of this article, it is imperative that violence research focus on how

symptoms, disabilities, and functional impairments, all of which wax and wane over time, affect violence risk. The NESARC data provide an illustrative example of this issue for those with a major depressive disorder. There were 3,239 people (weighted) with a Wave 1 lifetime diagnosis of major depression (and no bipolar or schizophrenia disorder or co-occurring substance use disorder); however, 1,920 of these same individuals did not meet diagnostic criteria for a past year major depression diagnosis at Wave 1. The rate of violence between Waves 1 and 2 for these $N = 1,920$ people was 0.89, which is substantially lower than the rate for individuals with a Wave 1 past year depression diagnosis (2.7) and is only slightly higher than the violence rate for the no mental or substance use disorder reference group (0.83). Of the cases with a Wave 1 lifetime major depressive disorder, but no Wave 1 past year diagnosis (i.e., $N = 1,920$), $N = 376$ (19.6%) of those cases were positive for a major depressive disorder in the time between Waves 1 and 2 (i.e., positive for major depressive disorder at any time 'since the last interview'). In total then, of the people with a lifetime depressive disorder, but no Wave 1 past year disorder, 80% did not meet criteria at any point during the NESARC study. Did these people "recover" from their major depressive disorder? Were their symptoms in "remission" or "subclinical" and simply less acute in the year prior to the Wave 1 interview and between the Waves 1 and 2 interviews?

These recovery/remission/subclinical issues are most relevant to major depression, and perhaps less so for psychotic and bipolar disorders, which are often seen as chronic conditions. Patients with schizophrenia or bipolar disorder, even when in remission, often show residual symptoms such as disinhibition and cognitive impairment that may increase the risk of violence. Nevertheless, with regards to these latter two diagnoses, it is well known that much of the aggressive behavior is related to increased symptomatology. For example, most community-based aggressive behavior for those with schizophrenia occurs in the context of acute psychotic decompensation [31]. Similar symptom-violence spatio-temporal findings have been seen in inpatient settings, i.e., increased positive symptoms within 3 days of an aggressive incident were observed in schizophrenia inpatients [73]. Bipolar patients with a hospital discharge diagnosis of "manic episode" were not more likely to commit violent crime at some unspecified time after discharge than those with a diagnosis of depressive episode [74]. However, as the authors acknowledge, this epidemiological study "does not clarify whether any particular clinical phase of bipolar disorder (such as mania) may increase risk of violent crime" (p. 937). In fact, most of the aggressive behavior observed in those diagnosed with bipolar disorder occurs during manic or mixed episodes [75]. These prior clinical

observations point to the close temporal relationship between psychiatric symptoms and violence for schizophrenia and bipolar disorder, while the NESARC data show the importance of a recent, compared to a lifetime, major depression diagnosis for violence outcomes. Clearly, future research should emphasize how these spatio-temporal factors affect causal assessments of mental disorder and violence.

These revised results, in contrast to a recently published report [9], show that the NESARC data are remarkably consistent with the findings of Swanson et al. [43] from their Epidemiologic Catchment Area analysis 20 years ago: there is a statistically significant, yet modest relationship between recent SMI (within 12 months) and violence, and a stronger relationship between SMI with substance use disorder and violence. However, these results also point to the importance of considering premorbid conditions, and other contemporaneous clinical factors, when examining violence outcomes. This evidence should inform violence risk assessment as well as prevention and intervention strategies to reduce violence among persons with mental illness.

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