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A META-ANALYSIS OF THE PREDICTION OF VIOLENCE AMONG ADULTS WITH MENTAL DISORDERS

by

HING PO LAM

A dissertation submitted to the Graduate Faculty in Criminal Justice in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

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This manuscript has been read and accepted for the
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Abstract

A META-ANALYSIS OF THE PREDICTION OF VIOLENCE AMONG ADULTS WITH MENTAL DISORDERS

by

Hing Po Lam

Adviser: Professor Karen Terry

The study of the risk for violence among persons with mental disorders has received substantial scientific attention over the past few decades; however, many uncertainties and controversies remain due to the wide disparities in the reported results. Using the state-of-the-art perspective of public health, a meta-analysis was conducted to clarify the ambiguities by synthesizing quantitative findings from 85 research reports (completed between January 1970 and May 2010) on violence risk assessment among mentally disordered adults. Results of this meta-analytic study revealed that the estimates of the prevalence of violence among the psychiatric population varied considerably from 1.1% to 78.4% with a combined mean rate of 19.3% (95% CI = 15.7–23.5%, k = 68, N = 160,206). Additionally, a total of 290 effect sizes were computed for 36 risk factors of interest and their relative strength in relation to violence was compared. Most importantly, this review demonstrated that mentally disordered patients were no more likely than their non-mentally disordered counterparts to commit violent acts. Overall, the findings have significant implications for clinicians, policy makers, researchers, and the general public, including the psychiatric patients. Lastly, a "Global Public Health-Comprehensive Meta-Analysis" (GPH-CMA) approach is proposed as a new direction for risk assessment and management.

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Introduction

It is difficult to forget Jack Nicholson's wild-eyed axe-wielding Johnny in the *Shining* or the cool rationality of Anthony Hopkin's Hannibal Lecter feeding sautéed brain to his expertly lobotomized victim. While cinematically very effective, these two movie scenarios are unfortunately symptomatic of the way mass media portrays mentally disordered individuals. Indeed, scientific studies from the last thirty years have confirmed that the mass media has a tendency to negatively stereotype the psychiatric population. Specifically, various analyses of American prime-time television programs found that persons with mental disorders were frequently depicted as violent or homicidal (e.g., Diefenbach, 1997; Diefenbach & West, 2007; Gerbner et al., 1981; Signorielli, 1989; Wahl & Roth, 1982). Expressing this über-sensationalized coverage in numbers, Gerbner et al. (1981), for instance, found that 73% of the mentally ill characters in television dramas exhibited run-of-the-mill violent behavior while 23% went on murderous rampages. This reductionist approach is echoed by the Hollywood movie industry in that it does not endow characters suffering from psychiatric disorders with individual identities but lumps them together under the rubric of garden-variety crazies (e.g., Hyler et al., 1991; Levers, 2001; Edney, 2004). In the same vein, Shain and Phillips (1991), in their examination of stories from the *United Press International* database, observed that 86% of articles reporting on persons with mental health difficulties wrote about them solely from a violent crime angle, especially when murder or mass murder were involved. Studies from Britain, Canada, and Australia similarly revealed that mass media has tended to perpetuate the image of mentally disordered people as violent and criminally prone (e.g., Coverdale et al., 2002; Cutcliffe

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& Hannigan, 2001; Day & Page, 1986; Matas et al., 1986; Olstead, 2002; Philo et al., 1994; Porter, 2003; Wilson et al., 1999).

Largely based on the above-cited stereotypical treatment by the media, the public generally perceives persons with mental disorders as mad and dangerous, two factors that connote the unpredictable use of violence (Diefenbach & West, 2007; Hyler et al., 1991; Steadman & Cocozza, 1977; Thornton & Wahl, 1996; United States President's Commission on Mental Health, 1978). As a result, people believe that they are at risk of violence from this population and that mental disorders cause violence (Arboleda-Flórez et al., 1998). This belief is nothing new and not unique to Americans; on the contrary, it is an idea that reaches far back into history, crosses continents, and pervades many societies (Monahan, 1992).

While it is undeniable that some extremely violent acts and/or crimes are committed by psychiatric patients, are mental disorders really significantly associated with violence? More importantly, are mental disorders a leading risk factor for violence? In other words, how robust are mental disorders in predicting violence as compared with other potential risk factors? Of equal importance is the question of which factors are predictive of violence among the psychiatric population? Although these questions have received considerable scientific attention over the past few decades, many uncertainties and controversies remain as a result of contradictory findings in the extant literature. A thorough clarification of those ambiguities has significant implications for clinicians, policymakers, researchers, and the general public including psychiatric patients (Elbogen & Johnson, 2009). For this reason, a systematic review and/or quantitative synthesis of the reported results are needed. In particular, Douglas et al. (2009) found that there is a real dearth of meta-analytic studies devoted to the imperative inquiry of "[h]ow does psychosis compare with other risk factors for violence in terms of strength of

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association?" (p.692). More importantly, there is still another gap in the literature in that "there have been virtually no systematic efforts to incorporate [relevant findings] into a useful, empirically based framework for clinical assessment" (Borum 1996, p.947).

Using the public health perspective (Monahan & Steadman, 1994b; Steadman et al., 1994), this study addressed the abovementioned gaps in the literature by conducting a meta-analysis of the relevant empirical research on violence risk assessment among adults with mental disorders.

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Chapter 1: Literature Review

Relationship between Mental Disorders and Violence

The debate on the relationship between mental disorders and violence, including criminal violence, has been extensive but the results are far from conclusive. This is particularly evident in that one can easily identify a multitude of studies from different time periods that support an association between mental disorders and violence (e.g., Krakowski et al., 1986; Monahan, 1993; Mullen et al., 2000; Sosowsky, 1978; Swanson et al., 1990; Tiihonen et al., 1997; Torrey, 1994), while numerous other inquiries arrive at the opposite result with equally convincing evidence (e.g., Bonta et al., 1998; Elbogen & Johnson, 2009; Hodgins & Côté, 1993; Monahan & Steadman, 1983; Steadman & Keveles, 1972; Teplin, 1985; Teplin et al., 1994; Valdiserri et al., 1986). Accordingly, the prevailing view in the scientific community as to the importance of mental disorders as a contributing factor to violent behavior has been shifting back and forth. In brief, whenever a consensus appeared to have been reached, contradictory findings were not far behind. In fact, this scientific ping pong has been going on for about half a century.

Prior to the early 1990s, the general agreement in the field for about 15 years was that mental disorders did not constitute a significant risk factor for violence (e.g., Monahan, 1981b; Monahan & Steadman, 1983; Rabkin, 1979; Rice et al., 1990; Teplin, 1985). Most representatively, Monahan and Steadman (1983) concluded from their review of numerous studies that the alleged association between mental disorders and crime can be largely explained by demographic and historical factors because "[w]hen appropriate statistical controls are applied for factors such as age, gender, race, social class, and previous institutionalization, whatever relations between crime and mental disorder are reported, [they] tend to disappear"

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(p.152). About a decade later and informed by contemporary epidemiological findings (e.g., Link et al., 1992; Swanson et al., 1990), Monahan, a leading scholar in the field, changed his long-held view in this regard and stated that "there may be a relationship between mental disorder and violent behavior, one that cannot be fobbed off as chance or explained away by other factors that may cause them both" (Monahan, 1992, p.511).

After Monahan's turnabout, there was an upsurge of reviews and empirical studies that supported the perspective that mental disorders are a significant and reliable predictor of violence; some even argued that certain psychiatric diagnoses and symptom constellations may be causally related to violence (e.g., Brennan et al., 2000; Eronen et al., 1998; Eronen et al., 1996; Joyal et al., 2007; Link & Stueve, 1995; Link & Stueve, 1994; Modestin & Ammann, 1996; Monahan, 1993; Mulvey, 1994; Swanson et al., 1996; Tiihonen et al., 1997; Torrey, 1994; Wessely, 1998). For example, in their case-control study of criminality among male schizophrenics, Modestin and Ammann (1996) demonstrated that patients were five times more likely to commit a violent crime than the matched sample drawn from the general population. Eronen et al.'s (1998) narrative review identified that psychotic disorders were noticeably documented to have an increased risk of violence and that much of the observed violence in the mentally ill was directly related to psychotic symptoms such as delusions, hallucinations, and threat/control-override (TCO) symptoms. This finding, on the one hand, sparked a subtle line of argument that held that the dynamic psychopathological factor of symptoms is more predictive of violence than the relatively static diagnostic variable of acquiring a psychiatric status. On the other hand, the reported significance of symptomatology has often been cited as a strong piece of evidence to corroborate the connection between violence and mental disorders or mental health status (Link et al., 1992). Indeed, Link and Stueve (1994) argued that their preliminary findings

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supported “a causal relationship between mental illness and violence” since the data revealed that TCO symptoms predicted violent behaviors and explained group differences between mental health patients and community controls (p.155-156). More radically, while Link and Stueve (1995) acknowledged the methodological flaws in the literature, they argued that, by using different methodological strategies, the evidence can be interpreted as supportive of causality between mental disorders and violence and that consistent findings across studies could compensate for the methodological weaknesses of any individual study. Surveying the mounting evidence, Arboleda-Flórez (1998) remarked that the position of no relationship is getting more difficult to sustain because the existence of an association seems to be an accepted fact.

In spite of the above, findings marshaled from another body of research have cast doubt on the validity and reliability of any conclusive statements that tie violence to mental disorders in general and/or psychiatric symptoms in particular (e.g., Appelbaum et al., 2000; Arboleda-Flórez, 1998; Arboleda-Flórez et al., 1998; Bonta et al., 1998; Elbogen & Johnson, 2009; Skeem et al., 2006; Teplin et al., 1994). For instance, results of a six-year longitudinal study of 664 released jail detainees indicated that neither psychiatric status nor symptoms significantly predicted subsequent arrests for violent crime (Teplin et al., 1994). By employing an epidemiological framework, a critical review of more than 100 peer-reviewed articles emphasized that (1) given the wide variety of methodological flaws, the alleged causal inferences linking mental disorders to violence may have been premature; and (2) the empirical evidence regarding a statistical association between the two variables remains largely ambiguous (Arboleda-Flórez et al., 1996; Arboleda-Flórez et al., 1998). In another related discussion, Arboleda-Flórez (1998) added that “causal inferences are supportable by the empirical evidence of well-designed and well-executed research only if no compelling disconfirming evidence can be found” (p.8–9). This, obviously, is

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not the case. In particular, several subsequent analyses of data from the state-of-the-art MacArthur Violence Risk Assessment Study revealed that mental disorders were either not significantly related to violence or negatively associated with violence (e.g., Appelbaum et al., 2000; Monahan et al., 2001; Steadman et al., 1998). Moreover, the previously established link between psychiatric symptoms and violence was refuted in some later investigations (e.g., Appelbaum et al., 2000; Skeem et al., 2006; Swanson et al., 1999). Results from a recent longitudinal study also challenged the seemingly prevalent view that "mental illness is a leading cause of violence" since researchers found that "severe mental illness did not independently predict future violent behavior" (Elbogen & Johnson, 2009, p.152). In brief, "it is [still] unclear whether mental disorders, specific symptom constellations, or both contribute to violence" (Skeem et al., 2006, p.967).

More importantly, there is a fair number of studies that argue that other factors, such as medication non-compliance and past victimization, not psychiatric diagnosis per se, contributed to the (elevated) risk for violence among the mentally disordered (e.g., Bonta et al., 1998; Elbogen & Johnson, 2009; Fazel et al., 2009a; Fisher et al., 2006b; Fisher et al., 2007; Mulvey et al., 2006; Steadman et al., 1998; Swanson et al., 2006; Swartz et al., 1998). For example, Swanson et al. (1999) reported that "co-occurring substance abuse problems, history of criminal victimization, and age (being younger) were significantly associated with violent behavior when all sources of data were taken into account [while] clinical diagnosis and symptom variables were not related to violence" (p.185). By analyzing patterns and prevalence of arrest in a large cohort of 13,816 mental health service recipients, Fisher et al. (2006b) concluded that, although persons with severe mental illness had a substantial likelihood of being arrested, most of the offensive behaviors (including serious violence against persons) were committed by a small

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group of patients and by patients with socio-demographic features (men, non-white, and younger age) similar to the non-disordered offenders in the general population. Fisher et al. (2007) also found that 95% of mental health patients with a drug-related arrest had been involved in other non-drug-related offenses, especially crimes against persons; this pattern or prevalence rate, however, was almost identical to that of the drug arrestees without mental disorders. The similarities of demographic characteristics and offending pattern between the two groups indicated that violence among psychiatric patients was not solely due to their illnesses but to some well-established criminological risk factors including male gender, younger age, non-white, and having a substance abuse problem (Fisher et al., 2007; Fisher et al., 2006b). Accordingly, this camp of researchers proposed that understanding the relationship between mental disorders and violence requires the consideration of other non-psychopathological variables by employing a more expansive framework for study. Specifically, some experts strongly argued for the need to develop an analytical framework that includes a broader range of criminological factors (Fisher et al., 2006a; Silver, 2006). Similarly, Bonta et al. (1998) recommended that researchers should pay more attention to theories in social psychology and sociological criminology rather than relying solely on psychopathological models. Perhaps the most significant initiative in this regard is that advocated by the MacArthur researchers who substantially advanced the study of violence risk assessment from a public health perspective (Monahan & Steadman, 1994b; Steadman et al., 1994).

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A Public Health Perspective for Violence Risk Assessment and Management

In view of the widespread criticism regarding the limited competence of clinicians to predict violence among mentally disordered persons due to the lack of an unambiguous empirical knowledge base derived from methodologically sound and theoretically coherent studies, Monahan and Steadman (1994b) advocated a public health perspective for orienting future research in the field. By perceiving violence as a "'health problem' instead of a 'crime,' the emphasis of public health intervention is on prevention, rather than the treatment, of harm" (Monahan & Steadman, 1994b, p.2–3). To that end, Steadman et al. (1994) suggested that more attention should be given to the search for cues or risk factors that "bear a statistically robust relationship to violent behavior" rather than merely focus on the fundamental, albeit important, question of "whether mental disorder per se is a risk factor for violence" (p.299). This, indeed, aimed at overcoming one of the major methodological weaknesses that Monahan and Steadman (1994b) identified in the available literature: The problem of "impoverished predictor variables," which refers to the tendency of focusing on only one or a few variables for investigation such as psychiatric diagnosis and symptom severity scores. More explicitly, they stated that, to move "research on risk assessment forward, therefore, requires that an enriched set of cues or predictor variables be studied" (Monahan & Steadman, 1994b, p.9). As such, the public health approach is characterized by including a broad range of variables for the study of violence risk among persons with mental disorders.

In order to cope with the methodological limitations of earlier studies, Monahan and Steadman (1994b) believed that this actuarial approach to public health has the greatest potential to advance scientific understanding in addition to providing useful information for improving clinical practice and reforming mental health law and policy. Côté (2000) concurred with this

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strategy and emphasized that, in view of the fact that violent behaviors stem from a complex interaction of personal and environmental factors, the inclusion of a wide variety of variables into relevant analyses is advantageous in that it allows for putting into perspective the intricate relationship between mental disorders and violence. Another advantage of the proposed strategy is that it addresses not only the legal concern of *risk assessment* by identifying robust predictors for "in-out" decisions of institutionalization but also the clinical relevance of *risk management* by searching for dynamic factors that are likely to be modified through intervention to achieve risk reduction or prevention (Monahan & Steadman, 1994b; Steadman et al., 1994). This, in turn, highlights the importance of taking into account both static and dynamic variables in violence risk assessment (Côté, 2000).

More pragmatically, Steadman et al. (1994) developed a taxonomy for studying violence risk factors that has theoretical, clinical, or empirical importance. This public health taxonomy, which constituted the conceptual framework of the MacArthur Violence Risk Assessment Study, classified risk factors into four generic domains: Dispositional, historical, contextual, and clinical.

(1) Dispositional factors

Risk factors in this domain refer to the relatively enduring attributes that "reflect the individual person's predispositions, traits, tendencies, or styles" (Monahan & Steadman, 1994a, p.19). This includes demographic variables (e.g., age and gender), personality factors (e.g., anger, impulsiveness, and psychopathy), and neurological features (e.g., head injury and IQ).

(2) Historical factors

These factors are "[significant] events that have been experienced in the past that may predispose a person to act violently" (Monahan & Steadman, 1994a, p.227). Specifically, these variables pertain to family history (e.g., child abuse and familial deviance), work history (e.g.,

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employment and job perceptions), mental hospitalization history (e.g., treatment compliance and prior hospitalization), history of violence (e.g., violence toward others and violence toward self), and criminal and juvenile justice history (e.g., prior arrests and incarcerations).

(3) Contextual factors

The contextual domain takes into account "aspects of the current environment that may be conducive to the occurrence of violent behavior" (Monahan & Steadman, 1994a, p.227). It contains factors related to the social environment (e.g., perceived stress and availability of emotional and instrumental supports) and physical environment (e.g., availability of weapons and homelessness).

(4) Clinical factors

The final set of variables is largely derived from psychopathological models. It comprises "[various] types and symptoms of mental disorder, personality disorder, drug and alcohol abuse, and level of functioning" (Steadman et al., 1994, p.303).

Variables in the contextual and clinical domains are dynamic factors with relevance not only for risk assessment but for risk management since they are susceptible to change for the purpose of risk reduction or prevention. The dispositional and historical factors are static in nature in that they are immutable or difficult to modify through intervention. As such, these variables are deemed to be relevant to risk assessment only; however, they are related to risk management if "management strategies can be conditioned on dispositional and historical variables (e.g., a given treatment may be more effective with persons of one gender than of the other, a certain environment modification may work better with younger people than with older people)" (Steadman et al., 1994, p.304). Given the primary focus on prevention (rather than treatment) of harm in public health, one could argue that some of the static factors may also be

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valuable for risk management. Using history of child abuse as an example (although it is impossible to change or undo this antecedent), tragedies of this type can possibly be reduced by enhancing early preventive measures of child abuse.

Steadman et al. (1994) noted that their categorization of variables is not without controversy since the theoretical status of many predictors is not well established. For instance, "anger" and "psychopathy" can be subsumed under the clinical domain rather than classified as dispositional variables if researchers believe that these two factors represent the current state rather than reflect some enduring characteristic of a person. In spite of this, the MacArthur approach or the public health taxonomy has received wide recognition (e.g., Bonta et al., 1998; Borum, 1996; Côté, 2000; Elbogen & Johnson, 2009; Harris & Lurigio, 2007; Sirotich, 2008; Stuart & Arboleda-Flórez, 2001). It even spurred "a third generation of studies" in the field (Borum, 1996, p.947) and has become "a benchmark for the scientific community interested in the study of risk factors of violent behavior among the mentally ill" (Côté, 2000, p.49).

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The Empirical Status of Risk Factors for Violence

After Monahan and Steadman's (1994b) public health advocacy, there has been an influx of research aiming at identifying factors that are predictive of violence among persons with mental disorders. Findings from this new generation of studies have provided us with valuable insights to better comprehend the relationship between mental disorders and violence. In particular, the variables "substance abuse," "antisocial personality disorder" or "psychopathy," "past violence," and "prior criminal justice records" were repeatedly found to be significant in relation to violence. The robustness of these variables is evident in that they may be considered confounding factors that could dramatically increase the parameter estimates for the association between major mental disorders and violence if they are not controlled for (Douglas et al., 2009; Sirotich, 2008).

Nevertheless, considerable uncertainties regarding the interpretation and application of the findings remain since they vary substantially across studies. For example, Vevera et al. (2005) reported from their retrospective investigation of four independent psychiatric samples that substance abuse was not the leading risk factor for violence among patients suffering from schizophrenia because the two variables were not significantly associated with each other. In a national study of violent behavior among persons with schizophrenia, Swanson et al. (2006) showed that "[t]he significant bivariate effect of substance abuse on serious violence was rendered nonsignificant in the final model when controlling for age, PANSS positive symptoms, childhood conduct problems, and recent victimization" (p.497). After conducting a qualitative review of 22 major empirical studies published between 1990 and 2004, Joyal et al. (2007) concluded that "major mental disorders per se, especially schizophrenia, even without alcohol or drug abuse, are indeed associated with higher risks for interpersonal violence" (p.33). However,

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Elbogen and Johnson's (2009) longitudinal analyses indicated that "severe mental illness alone did not predict future violence; it was associated instead with historical (past violence, juvenile detention, physical abuse, parental arrest record), clinical (substance abuse, perceived threats), dispositional (age, sex, income), and contextual (recent divorce, unemployment, victimization) factors" (p.152). By conducting a meta-analysis of 20 studies published between 1970 and 2009, Fazel et al. (2009b) emphasized that, although schizophrenia and other psychoses were significantly associated with violence, "most of the excess risk appears to be mediated by substance abuse comorbidity" (p.1). In view of such discrepancies in the literature, it is not surprising that researchers are still puzzled by the fundamental but critical question of whether mental disorders without substance abuse comorbidity are actually associated with violence (Fazel et al., 2009a).

Similar to substance abuse, findings relating to the majority of potential risk factors are mixed. In particular, Sirotich's (2008) narrative review concluded that, although studies over the past 15 years have made substantial contributions to the understanding of violence risk among the mentally disordered, knowledge in this area is still "embryonic" because of wide disparities in the reported results. Similarly, Swanson et al. (2006) pointed out that "[t]he complex effects of clinical, interpersonal, and social-environmental risk factors for violence in [the psychiatric] population are poorly understood" (p.490). Overall, with the exception of criminal history and antisocial personality disorder or psychopathy, the empirical status of other variables has yet to be determined due to the conflicting findings in the extant literature.

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Some Possible Explanations for Discrepancies in the Empirical Findings

Although the inconsistency of findings may be caused by a variety of factors, methodological variation and the role of confounding variables are the most widely discussed explanations (e.g., Bonta et al., 1998; Douglas et al., 2009; Sirotich, 2008).

Methodological variation.

Apart from the scope of investigation or number of variables under examination, studies also varied greatly in basic designs (such as longitudinal and cross-sectional), use of sampling methods, types of respondents, sample sizes, conceptualization and operationalization of major constructs (especially mental disorders and violence), methods of data collection, and statistical procedures. Differences in methodology can have a significant impact on the conclusions reached. For instance, reviewers pointed out that interpretations varied depending on the nature of the comparison group used in different studies (Bonta et al., 1998; Douglas et al., 2009). To cite one example: The risk for re-offending or violence among psychiatric patients appeared to be higher if the comparison group was drawn from the general population while the risk seemed to be lower when comparisons were made with those from the criminal population (Bonta et al., 1998).

Although some efforts have been made to delineate the construct of mental disorder, no single precise or consistent definition exists (American Psychiatric Association, 1994; Bartol 2002; Blackburn, 2002). Indeed, it has been loosely defined, be it conceptually or operationally, throughout the literature. In some studies, mental disorder was referred to having Axis I diagnoses only, such as schizophrenia and major affective disorders (e.g., Elbogen & Johnson, 2009; Swanson et al., 1999), whereas others combined both Axis I and Axis II diagnoses, such as

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antisocial personality disorder and schizophrenia (e.g., Bland & Orn, 1986; Volavka et al., 1995). For instance, considering that antisocial personality disorder has been proven to be a robust predictor for violence and crime, the parameter estimates would have been higher in studies that defined mental disorder with this confounding variable than those without. Moreover, psychiatric diagnoses of the research participants were obtained by using various methods or assessment tools, such as official records and administration of the Diagnostic Interview Schedule (DIS) by lay interviewers, which also may affect the consistency of results.

Similarly, violence has been conceptualized in many different ways in the literature and included an array of behaviors ranging from homicide to harming others to verbal threats. In fact, "[i]t is virtually impossible to find violence defined in the same way in any two studies by different researchers" (Walsh et al., 2002, p.492). Additionally, there have been substantial variations in measurement such as sole reliance on official records, self-reports of violence, interviews of collateral informants, reviews of case notes, or the combined use of several measures. These may not only have created divergence but also caused inaccuracy in estimations because every measurement has specific limitations that could bias the results at different levels (Walsh et al., 2002). For instance, the problem of overestimation when using arrest records became apparent in that mentally disordered persons were more likely to be arrested than non-mentally disordered individuals (Teplin, 1984), while underestimation arose when researchers relied exclusively on the conviction rates because violent psychiatric patients may not be convicted as a function of diversion policies (Walsh et al., 2002). Overall, it is critically important to take into account methodological variations across studies when making conclusions or generalizations about the contribution of mental disorders to violence.

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The role of confounding variables.

Confounding can be defined as a distortion or bias of the estimated effect of an exposure (mental disorder) on an outcome (violence) as a result of the influence of an extraneous or third variable (e.g., criminal history) that is significantly associated both with the exposure and outcome but is not in the causal pathway of interest (Last, 2001). Accordingly, a confounder refers to a variable that meets the criteria of (1) having an association with the exposure; (2) being a risk factor for the outcome; and (3) not being in the causal pathway between the exposure and the outcome.

Apart from the few variables mentioned earlier, such as antisocial personality disorder and substance abuse, Arboleda-Flórez et al. (1998) strongly argued that age, gender, and race should also be considered confounding factors that warrant statistical control in the analysis of the association between mental illness and violence. However, it may be somewhat controversial to treat these variables as confounders especially if the empirical criteria for establishing confounding are strictly followed. For example, it has been argued that controlling for substance abuse is inappropriate since this variable may be on the causal pathway between mental disorder and violence (Fazel et al., 2009a). Arboleda-Flórez et al. (1998) suggested that researchers should seek to identify differences in results by comparing those with and without the controls for possible confounders if specific relationships among the variables or causal mechanisms remain unclear. Considerable efforts in this area have been made. For instance, certain studies documented that the relative association between major mental disorder and violence was reduced or insignificant when some of those competing or confounding factors were controlled (Douglas et al., 2009). Although there are similar studies that fail to report a decreased or insignificant association, the lack of consistency in findings may stem from the fact that

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confounding variables are not well controlled across studies (Douglas et al., 2009; Sirotich, 2008). In particular, Sirotich (2008) observed that most investigations did not control for the comorbidity of personality disorder, especially antisocial personality disorder, among samples. This would have a substantial impact on the outcome because "[some researchers have argued that] when compared with the risk posed by persons with primary diagnoses of personality disorder…MMI [major mental illness] poses an inverse relative risk for violence" (Douglas et al., 2009, p.683). A related issue is the lack of control for psychiatric comorbidity in general. Again, this may not only confound the unique contribution of specific disorders to violence but also give rise to the problem of divergence in results because studies demonstrated that persons with two or more psychiatric diagnoses have a higher risk of violence than patients suffering from a single disorder (Sirotich, 2008). In sum, the interpretation of findings may dramatically differ by simply controlling for potential confounding factors.

Based on the above discussion, it is reasonable to believe that the wide variation of estimates in associating mental disorder with violence may be due to the differences in methodology and treatment of confounders across studies. For that reason, a rigorous assessment should be carried out to determine their significance levels since controversies surrounding some explanations are unsettled. This can be achieved by performing a meta-analysis of moderators, if heterogeneity of variance in effect sizes is identified.

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The Need for a Meta-Analytic Study

Due to the increasing complexity of the literature and a multitude of conflicting research findings, answers to some crucial questions regarding the risk for violence among the psychiatric population remain elusive (Elbogen & Johnson, 2009; Fazel et al., 2009a; Swanson et al., 2006): For instance, to what extent are mental disorders independent predictors of violence? How common is violence among the mentally disordered, especially those suffering from schizophrenia? Is violence in this population largely due to psychopathological/clinical variables or risk factors in dispositional, historical, and contextual domains? To what extent is violence associated with variables in different domains? Obviously, the ultimate goal behind these questions is to identify factors that are predictive of violence among persons with mental disorders.

Clarification and verification of factors that have a statistically robust relationship with violence among the mentally disordered have major implications for clinicians, policymakers, and researchers (Steadman et al., 1994). Although there have been reviews of empirical studies in this area, they are largely narrative or qualitative in nature (e.g., Arboleda-Flórez et al., 1996; Joyal et al., 2007; Sirotich, 2008; Stuart, 2003; Walsh et al., 2002). The major criticism of these traditional qualitative reviews is their use of informal and subjective methods for data collection and interpretation which often yield imprecise, conflicting, or even wrongful conclusions (Cooper, 2010; Littell et al., 2008). Usually, "[w]hen results are mixed, narrative reviews may say just that" (Littell et al., 2008, p.13). This conclusion also highlights the inability of reconciling disparate results in qualitative research syntheses. In particular, such reviews are unable to make "statements regarding the overall magnitude of the relationship under investigation" (Cooper, 2010, p.7). Furthermore, traditional narrative techniques do not offer a

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systematic approach for explaining variations in findings across studies (Littell et al., 2008). Last but not least, qualitative reviews cannot handle a great deal of data in an efficient and effective manner because the cognitive capacity of human beings (researchers) to keep track of information is limited (Lipsey & Wilson, 2001). In view of this, methodologists have developed a more scientific and objective approach, namely meta-analysis, for synthesizing primary findings of previous research.

According to Borenstein et al. (2009), meta-analysis is a quantitative method for synthesizing and analyzing results from a body of related studies to provide a summary of the empirical knowledge. To combine various forms of quantitative data, meta-analysis extracts relevant outcomes from the primary research and transforms them into a common metric, referred to as the effect size, which is used for further analyses (Littell et al., 2008). An effect size, usually expressed as a point estimate with confidence intervals in meta-analytic studies, is "a measure of the strength (magnitude) and direction of a relationship between variables" (Littell et al., 2008, p.80). Building around the concept of effect size, meta-analysis allows researchers to (1) estimate the overall magnitude of a relationship between variables or impact of an intervention; (2) examine variations in results across studies; and (3) correct for error and bias in the original studies so that better or robust parameter estimates can be obtained (Borenstein et al., 2009; Cooper, 2010; Littell et al., 2008; Rothstein et al., 2002). As such, this quantitative approach to research synthesis is preferred over the traditional narrative review (Cooper, 2010; Lipsey & Wilson, 2001; Littell et al., 2008). In particular, meta-analytic reviews are replicable since the whole process of research synthesis is guided by a set of explicit rules and procedures that allows for scientific validation (Cooper, 2010).

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Although three meta-analyses of violence risk among the mentally ill had been conducted (Bonta et al., 1998; Douglas et al., 2009; Fazel et al., 2009b), they are limited in scope and/or biased in estimation due to various methodological and/or analytical flaws. For instance, by focusing on only one clinical variable "psychosis" (Douglas et al., 2009) or a particular diagnosis "schizophrenia" (Fazel et al., 2009b) for investigation, these meta-analyses suffer from the problem of "impoverished predictor variables," a key methodological weakness in the study of violence risk assessment (Monahan & Steadman, 1994b). In fact, Douglas et al. (2009) also noted that their study can neither directly nor clearly answer the imperative inquiry of "[h]ow does psychosis compare with other risk factors for violence in terms of strength of association?" (p.692). According to Bonta et al. (1998), the major limitation of their study is the focus on a particular group of individuals for investigation, namely, mentally disordered offenders. Consequently, the findings cannot be generalized to other psychiatric populations such as those who are treated in civil hospitals or in the community. Additionally, the overall estimates for most of the individual predictors were based on findings from a small number of studies ($k < 10$) (Douglas et al., 2009). Furthermore, there is a lack of rigor in the explanation of significant heterogeneity. Specifically, no moderator analyses were performed even though substantial heterogeneity across studies was identified. Last but not least, Bonta et al.'s (1998) meta-analysis should be updated to obtain better estimates and reflect current knowledge. In particular, Bonta et al. (1998) only synthesized findings until 1995 and many methodologically sound studies have been published after Monahan and Steadman's (1994b) public health advocacy. Indeed, "[t]here is a growing consensus that meta-analyses and systematic reviews, particularly those with health policy or practice implications, should be updated whenever a sizeable number of new studies appear" (Richardson & Rothstein, 2008, p.72). This is critically important because the inclusion

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of new studies in the analysis might change the previous conclusions (Littell et al., 2008). Overall, none of the extant quantitative syntheses addressed the gaps in the literature with sufficient accuracy in terms of practical and theoretical relevance. As such, a more systematic meta-analysis is needed.

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Chapter 2: Research Questions

The goal of this study is to conduct a meta-analysis of the risk for violence among mentally disordered patients from a public health perspective. Specifically, the study aims to (1) estimate the prevalence of violence among adults with mental disorders; (2) assess the strength of association between mental disorders and violence; (3) determine the empirical status of potential risk factors for violence among the psychiatric population; and (4) identify moderator variables for explaining the inconsistency of findings in the extant literature. Specific questions to be addressed in this meta-analysis are:

(1) What is the base rate or prevalence of violence among adults with mental disorders?

(2) Does the prevalence of violence change over time?

(3) To what extent is mental disorder a significant predictor of violence?

(4) Which factors and factor domains (dispositional, clinical, historical, and contextual) predict violence and are some more powerful than others?

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Chapter 3: Method

Definitions

This meta-analytic review aimed at synthesizing results from studies of any design attempting to assess the risk for violence, whether criminal or non-criminal, among adults with mental disorders. The term "violence" refers to interpersonal violence or violence towards others. Specifically, it is defined as "any actual, attempted, or threatened harm to another person or persons" (Douglas et al. 2009, p.684). If a criminal record (arrest, prosecution, conviction, incarceration, or hospitalization due to intervention by the criminal justice system) exists based on any of the above-cited behaviors, it is classified as "criminal violence." If engaging in such behavior(s) did not produce a criminal record, it is categorized as "non-criminal violence." "Adults with mental disorders" pertains to persons aged 18 or older who were diagnosed with at least one psychiatric disorder, regardless of the age of onset and diagnostic/assessment methods.

Literature Search

A search for both published and unpublished English-language studies completed between January 1970[1] and May 2010 was conducted by using two primary methods. First, keyword searches were performed in the following 10 electronic bibliographic databases: Academic Search Complete, Criminal Justice Abstracts, Criminal Justice Periodicals Index,

[1] Although the earliest empirical findings regarding the relationship between mental disorders and violence emerged in the early 1920s (Monahan, 1992; Harris & Lurigio, 2007), the current meta-analysis only synthesized studies from 1970 onward, i.e., the decade in which the major deinstitutionalization movement of the mentally ill began (Madianos, 2010). This start date was chosen because studies prior to the deinstitutionalization era confirmed that mentally disordered persons were no more violent or dangerous than the general population and posed no threat to the community since they were housed in psychiatric hospitals (Harris & Lurigio, 2007). Moreover, scientific reports issued prior to the 1970s were rather scarce and difficult to evaluate due to limited and/or problematic data (Cocozza et al., 1978; Rabkin, 1979). Indeed, it was the increase in violent crimes among the psychiatric population and the upsurge of mentally ill persons in jails and prisons since the 70s that was and continues to be of special concern to social scientists (Cocozza et al., 1978; Lamb & Bachrach, 2001).

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Dissertation Abstracts, PsycARTICLES, PsycBOOKS, PsycEXTRA, PsycINFO, SocINDEX, and Sociological Abstracts. These databases covered a wide range of studies from different countries across various disciplines. Applying Boolean (e.g., AND, OR, and NOT) and Proximity (e.g., #, ? and *) operators in accordance with the features of each database, the following keywords derived from the main variables/concepts of the research questions were used to construct various search strings/statements for locating relevant articles: *mental disorder, mental illness, psychosis, psychotic disorder, psychiatric disorder, schizophrenia, affective disorder, mood disorder, personality disorder, comorbidity, dual diagnosis, violence, violent crime, violent behavior, homicide, criminal behavior, predictor, factor, association, and correlate*. These keywords were also vetted by conducting thesaurus searches in each database to ensure the inclusion of all important search terms. Taken together, the electronic search yielded a total of 6,276 citations (Appendix A), of which 1,557 were identified as duplicates at the initial stage. Specifically, based on the evaluation of 4,719 unique titles/abstracts, 741 documents were retrieved for full-text screening. Second, the reference lists of three prior meta-analytic studies (Bonta et al., 1998; Douglas et al., 2009; Fazel et al., 2009b) were reviewed to identify additional scientific reports for quantitative synthesis. This snowball search resulted in the retrieval of 120 full-text articles for review. Lastly, another nine studies were obtained from the reference lists of relevant literature.

The author evaluated all titles/abstracts and full-text reports for inclusion/exclusion. Two independent raters examined a random sample of 5% (k = 250) of the titles/abstracts and 10% (k = 88) of the full-text articles. The inter-rater reliability for title/abstract screening (Kappa = 0.917, $p < .001$) and for full-text evaluation (Kappa = 0.807, $p < .001$) was high. Disagreements between raters were resolved through discussion until a consensus was reached.

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Study Quality Assessment and Inclusion/Exclusion Criteria

In order to minimize the bias in the resulting estimations, one of the major concerns in meta-analytic review is the quality of studies to be sampled for synthesis. There are different approaches to address this issue. Some reviewers set forth in their inclusion criteria that only studies with a particular design and/or method (e.g., randomized controlled trials) are selected for analysis while others opt for the use of various scales (e.g., Methodological Rating Scale) to rate the overall quality of a study on different aspects such as attrition and types of outcome measure (Littell et al., 2008). However, these methods have been criticized as inappropriate or problematic in that they cannot adequately capture or reliably measure the potential biases of the original studies that may affect relevant estimations (see Littell et al., 2008 for a detailed discussion). In addition, Anderson et al. (2010) pointed out that "in more controversial domains the inclusion/exclusion decisions themselves become the focus of extended debate, thus decreasing the value of the meta-analysis itself" (p.158). Consequently, this quantitative review did not use study quality as an inclusion/exclusion criterion for sampling. Instead, specific methodological features of the primary studies were coded and examined in the moderator analysis for assessing the effects on the outcome. In fact, this approach for evaluating study quality is gaining popularity in meta-analytic research (Littell et al., 2008).

Based on the above discussion, a study of any design was included in this meta-analysis if it used a sample of participants aged 18 or older who had been diagnosed with at least one psychiatric disorder (1) to compare the risk for violence with their non-disordered counterparts; (2) to estimate the prevalence of violence; and/or (3) to evaluate the empirical status of public health risk factors. Included studies, of course, also had to clearly operationalize the outcome in terms of interpersonal violence as previously defined and report appropriate statistical

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information for calculating or estimating effect size statistics (e.g., prevalence point estimate and odds ratio). Specifically, studies were not included if violence was operationalized as self-harm, suicide, harm to property/objects, or any combination of these behaviors. Equally, studies with an outcome measure that mixed interpersonal violence with non-interpersonal violence (e.g., a mixture of "harm to persons" and "harm to property") were not selected unless they provided a separate analysis of interpersonal violence. Similarly, studies containing a mixed sample of adults and youth below the age of 18 were not included. Overall, 85 scientific reports met the inclusion criteria for this meta-analytic project.

There were six exclusion criteria. Studies were not selected if (1) they applied a case-control method to sampling a group of violent participants (case) to compare their characteristics with a control group of non-violent individuals; (2) they used a non-disordered sample for assessing some general mental health problems or ambiguous psychiatric variables (e.g., psychotic-like experience) for predicting violence; (3) they examined risk factors that were not within the scope of the public health perspective such as domain-specific factors in neurobiology; (4) their unit of analysis was not individuals (e.g., violent incidents); (5) their estimations or results were evidently biased;[2] and (6) they analyzed the data inappropriately.

Coding Procedure and Interrater Reliability

A coding book (Appendix B) was developed to gather data from studies meeting the criteria for inclusion. Basically, five categories of information were extracted from each article: (1) study characteristics such as year of publication and full citation of the report; (2) sample demographics such as gender and psychiatric diagnoses of the patients; (3) operationalization of

[2] For example, Swanson (1994) explicitly stated that the analyses or estimations were based on "some potentially problematic assumptions" (p.102).

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mental disorders such as method of assessment and the use of diagnostic tools; (4) operationalization of violence such as the setting in which violence occurred and method of data collection; and (5) effect sizes such as statistical information for calculating the prevalence of violence and the strength of individual risk factors in relation to violence.

In order to avoid the problem of dependent observation or "double counting" in meta-analytic studies, duplicated or overlapping effect sizes from the same sample reported in different articles were not coded. For instance, when multiple reports on the same risk factor (e.g., sex) were available, relevant data was retrieved only from the one providing the clearest details with the largest sample and the longest observation period of the outcome (i.e., violence). This rule was also applied to the coding of longitudinal or follow-up studies. However, it should be noted that some articles using the same or an overlapping sample for analysis were included since they evaluated the empirical status of different risk factors of interest. Also, some background information from the same study and sample could be coded or estimated from different articles. Regarding similar issues in the context of reporting multiple outcomes or effect sizes in a single article, specific rules were set for coding the most representative figure for overall analysis. For instance, if a study reported various estimates for "minor violence," "severe violence," and "any violence," results of the most inclusive category of "any violence" were coded while separated effect sizes (e.g., positive and negative symptoms) of the same construct (e.g., psychiatric symptoms) were combined through averaging.

Although in some studies the strength of specific risk factors in relation to violence was not directly or intentionally examined, estimation or coding based on the reported descriptive statistics was nevertheless possible. In fact, the majority of the effect sizes were computed by using simple count data. For instance, if both inferential statistics (e.g., chi-squared value) and

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descriptive data were presented, the latter were used for meta-analytic calculation although all information was coded. If contingency tables were reported with more than four cells, they were reduced to 2 x 2 tables for coding purposes. In order to satisfy the statistical assumptions of meta-analytic procedures, partial relationships or adjusted estimates (e.g., adjusted odds ratios) were not coded.

The author coded all 85 articles included in this meta-analysis. To assess interrater reliability, a research assistant was trained to code 10% of the studies. The agreement rates for almost all items exceeded 90%. Discrepancies between coders were resolved through discussion.

Statistical Procedures

The calculation/conversion of effect sizes and related statistical analyses were performed by using *Comprehensive Meta-Analysis–Version 2* (Borenstein et al., 2005), a sophisticated computer program that contains the most comprehensive set of analytical procedures currently available on the market (Bax et al., 2007; Littell et al., 2008). Due to the substantial variations in the measurement of variables, different effect size matrices were first used to estimate the relationship between the outcome of interest and each risk factor of violence in accordance with the available summary data reported by the studies. For instance, an odds ratio was used for studies that have categorical or binary data while Pearson's *r* was applied if the two variables were continuous. In view of the research questions posed by the current study, the effect size statistics were then converted into a common index of odds ratio for overall analysis and comparison. Indeed, the relevance and advantages of using odds ratio in this specific context has been acknowledged in the field (Douglas et al., 2009).

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Fixed-effects and random-effects models are the two major estimation methods in meta-analytic research. According to Borenstein et al. (2009), the fixed-effects model assumes that the true effect size in all studies is the same and that variation across studies is due to sampling error alone. By contrast, the random-effects model assumes that the true effect varies from study to study and that variation is the result of sampling error as well as other factors such as study characteristics and sample demographics. For this meta-analysis, the random-effects model was more appropriate and realistic because substantial variation across studies was expected. As demonstrated in the Literature Review section, this issue has been widely discussed by the research community. Indeed, random-effects estimation is often preferred over the fixed-effects method since "there is generally no reason to assume that...the true effect size is *exactly the same* in all the studies" (Borenstein et al., 2009, p. 69, emphasis in original).

With respect to the various specific analyses, basic descriptive statistics for the whole study and a combined mean effect size with a 95% confidence interval for the prevalence rate of violence and individual risk factors were presented. The 95% prediction intervals for each risk factor of interest were also calculated by using the formulas suggested by Borenstein et al. (2009). Moderator analyses were conducted if significant or substantial heterogeneity across studies or effect sizes was indicated by the Q-test and I^2 statistic. In order to address some specific research questions, meta-regression and cumulative meta-analysis were performed. Sensitivity analyses were used to determine the robustness of the findings. To examine potential publication bias, the funnel plot with trim-and-fill estimation was applied. This also aimed at assessing the impact of missing data or studies on the outcome.

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Chapter 4: Results

Characteristics of Included Studies

Table 1 summarizes the characteristics of the 85 scientific reports (representing 65 independent primary studies) that are included in this meta-analysis. The majority of the reports were peer-reviewed journal articles (*k* = 76, 89%) identified from five electronic bibliographic databases (*k* = 65, 76%). The reports were completed between 1980 and 2009 with more than 55% (*k* = 47) published after 1999. Although 60% (*k* = 51) of the articles reported receiving funding support from different agencies, 36% (*k* = 31) stated no source of funding. The most common design of the studies was cross-sectional (*k* = 48, 56%), followed by longitudinal truly prospective (*k* = 21, 25%), and longitudinal pseudo-prospective/ retrospective (*k* = 15, 18%). Forty-four percent (*k* = 37) of the investigations were purely archival and 13% (*k* = 11) used secondary data for analysis. As expected, a significant proportion of the studies (*k* = 65, 76%) adopted a non-random procedure for sampling. Over 60% (*k* = 52) of the studies were conducted in the United States, and 28% (*k* = 24) stemmed from Europe (including 14% from the United Kingdom and 14% from other European countries). Also, three studies were done in Canada and one in New Zealand, Israel, and South Africa respectively. About 40% (*k* = 20) of the U.S studies were carried out in California and the remainder came from a variety of states including New York, Massachusetts, Illinois, North Carolina, South Carolina, Missouri, Washington, D.C., Alaska, Colorado, Connecticut, Florida, Hawaii, Maryland, New Hampshire, Ohio, Pennsylvania, and Texas. Twenty-five percent (*k* = 21) of the studies collected the data in the 1980s or earlier while 47% (*k* = 40) collected the data between the 1990s and 2000s. Twenty-two percent (*k* = 19) of the articles did not report the data collection period of the studies. In addition, data collection

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of the studies was completed between 1978 and 2006, with a median year of 1995. The duration of data collection ranged from 0.46 to 576 months, with a mean of 50.59 (SD = 85.24) months and a median of 24 months.

Table 1
Characteristics of the Reports Included in the Meta-Analysis

Characteristics	*k*	%	Mean (SD)	Median	Range
Source					
Electronic bibliographic databases					
PsycInfo	58	68.24			
SocINDEX	2	2.35			
Sociological Abstracts	2	2.35			
Criminal Justice Abstracts	2	2.35			
Academic Search Complete	1	1.18			
Reference lists of major reviews					
Douglas et al (2009)	15	17.65			
Bonta et al (1998)	1	1.18			
Others	4	4.71			
Type of report					
Journal article					
Peer-reviewed	76	89.41			
Non-peer-reviewed/ Unclear	4	4.71			
Book or book chapter	3	3.53			
Doctoral dissertation	2	2.35			
Year of publication				2000	1980–2009
1980–1989	15	17.65			
1990–1999	23	27.06			
2000–2009	47	55.29			
Funding support					
Yes	51	60.00			
No	3	3.53			
Unclear	31	36.47			
Source of funding support					
Government	31	36.47			
Government and others	9	10.59			
Private organization	6	7.06			
Academic institution	2	2.35			
Unclear	3	3.53			
Study design					
Cross-sectional	48	56.47			
Longitudinal: Truly prospective	21	24.71			
Longitudinal: Pseudo-prospective/ retrospective	15	17.65			
Unclear	1	1.18			
Nature of the study					
Archival	37	43.53			
Non-archival	7	8.24			
Mixed	40	47.06			
Unclear	1	1.18			

(table continues)

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Table 1 *(continued)*

Characteristics	*k*	%	Mean (SD)	Median	Range
Used secondary data for analysis	11	12.94			
Sampling procedure					
Non-random	65	76.47			
Random	11	12.94			
Mixed	8	9.41			
Unclear	1	1.18			
Country of data collection					
United States of America	52	61.18			
United Kingdom	12	14.12			
Other European countries[a]	12	14.12			
Others[b]	6	7.06			
Unclear	3	3.53			
State of data collection (U.S. study)					
California	20	38.46			
New York	6	11.54			
Massachusetts	3	5.77			
Illinois	2	3.85			
North Carolina	2	3.85			
South Carolina	1	1.92			
Missouri	1	1.92			
Washington, D.C.	1	1.92			
Multiple states[c]	12	23.08			
Unclear	4	7.69			
Data collection period					
1980s or earlier	21	24.71			
1990s–2000s	40	47.06			
Others[d]	5	5.88			
Unclear	19	22.35			
Data collection end year				1995	1978–2006
1970–1979	1	1.18			
1980–1989	20	23.53			
1990–1999	30	35.29			
2000–2009	15	17.65			
Unclear	19	22.35			
Duration of data collection (months)			50.59 (85.24)	24.00	0.46–576.00
12 or below	26	30.59			
13–24	14	16.47			
25–36	10	11.76			
37–48	8	9.41			
49–60	9	10.59			
61 or above	11	12.94			
Unclear	7	8.24			

Note. *k* = number of reports.
[a] Denmark (*k* = 1); Germany (*k* = 1); Greece (*k* = 1); Netherlands (*k* = 1); Spain (*k* = 1); Sweden (*k* = 2); Switzerland (*k* = 5).
[b] Canada (*k* = 3); New Zealand (*k* = 1); Israel (*k* = 1); South Africa (*k* = 1).
[c] Other states not listed above include Alaska, Colorado, Connecticut, Florida, Hawaii, Maryland, New Hampshire, Ohio, Pennsylvania, and Texas.
[d] Four studies collected the data between the 1980s and 1990s, and one archival birth cohort study collected the data between 1944 and 1991.

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Overview of the Effect Sizes and Analytical Strategy

Table 2 provides an overview of the effect sizes computed from the 85 articles described above. A total of 68 effect sizes (based on 68 independent samples of 160,206 patients) were calculated from 66 reports representing 63 separate studies used to estimate the prevalence of violence among the mentally disordered patients. Moreover, 290 effect sizes in total were calculated for examining the empirical status of 36 risk factors for violence among the mentally disordered. The number of independent samples and the corresponding sample sizes for meta-analysis vary across individual risk factors of interest (see Table 2 for details). Only five articles or independent studies provided sufficient statistical information to produce six effect sizes (based on six unique samples of 28,257 participants) for assessing the relationship between mental disorder and violence by comparing the violent behavior of the mentally disordered patients and their non-disordered counterparts.

Main analyses (i.e., a combined mean effect size with the 95% confidence interval and tests of heterogeneity) and publication bias analyses were conducted separately for (1) the prevalence of violence among the mentally disordered patients; (2) the 36 risk factors for violence among the psychiatric population; and (3) the relationship between mental disorders and violence. Taken together, a total of 38 independent meta-analyses were performed. Considering the potential threats to validity and reliability of findings as a result of the lack of statistical power and other methodological issues, moderator analyses were only conducted for the prevalence estimate and for risk factors with at least 10 observations on the pre-specified moderator variables (Borenstein et al., 2009; Thompson & Higgins, 2002). In view of the fact that the present inquiry is a large-scale quantitative review, the author decided not to conduct the moderator tests for the violence risk factors at this juncture. However, those tests will be carried

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out and detailed in separate manuscripts for publication. Note that the term *study* in the subsequent analyses refers to an independent sample from which an effect size was generated. Additionally, a pre-selected random-effects model was applied to all relevant analyses for estimation.

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Table 2
Overview of the Effect Sizes

Estimate	No. of effect sizes	No. of unique samples	Sample size	No. of reports	No. of unique studies	Study[a] name with reference number
Prevalence of violence among adults with mental disorders	68	68	Total N: 160,206 Range: 26–103,344 Mean (SD): 2,355.97 (12,593.54) Median: 190.00	66	63	01) 01.Rep/Std.01-Soyka.et.al.2007 02) 02.Rep/Std.02-Bobes.et.al.2009 03) 03.Rep/Std.03-McDermott.et.al.2007 04) 04.Rep/Std.04-Joyal.et.al.2008 05) 05.Rep/Std.05-Elbogen.et.al.2006 06) 06.Rep/Std.06-Elbogen.Johnson.2009 07) 07.Rep/Std.07-Doyle.Dolan.2006 08) 09.Rep/Std.08-Hodgins.et.al.2007 09) 10.Rep/Std.09-Grossman.et.al.1995 10) 11.Rep/Std.10-Oulis.et.al.1996 11) 12.Rep/Std.11-Brown.et.al.1998 12) 13.Rep/Std.12-Brennan.et.al.2000 13) 14.Rep/Std.13-Novaco.1994.S1[b] 14) 14.Rep/Std.13-Novaco.1994.S2[b] 15) 15.Rep/Std.14-Rabinowitz.Mark.1999 16) 16.Rep/Std.15-Myers.Dunner.1984 17) 17.Rep/Std.16-Vitacco.et.al.2009 18) 18.Rep/Std.17-Egami.et.al.1996 19) 19.Rep/Std.18-Brekke.et.al.2001 20) 20.Rep/Std.19-Watts.et.al.2003 21) 21.Rep/Std.20-Boles.Johnson.2001 22) 22.Rep/Std.21-Monahan.et.al.2005 23) 23.Rep/Std.22-Lewis.et.al.2006 24) 24.Rep/Std.23-Swanson.et.al.2000 25) 25.Rep/Std.24-Swanson.et.al.2006 26) 26.Rep/Std.25-Tardiff.et.al.1997 27) 28.Rep/Std.26-Hodelet.2001 28) 29.Rep/Std.27-Erickson.2005 29) 30.Rep/Std.28-Grevatt.et.al.2004 30) 31.Rep/Std.29-Murphy.et.al.2001 31) 32.Rep/Std.30-Scott.et.al.1998 32) 33.Rep/Std.31-Ho.et.al.2009 33) 34.Rep/Std.32-Troisi.et.al.2003 34) 35.Rep/Std.33-Dickerson.et.al.1994

(table continues)

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Table 2 *(Continued)*

Estimate	No. of effect sizes	No. of unique samples	Sample size	No. of reports	No. of unique studies	Study[a] name with reference number
Prevalence of violence among adults with mental disorders (cont'd)						35) 36.Rep/Std.34-Leonard.et.al.2006 36) 37.Rep/Std.35-Holcomb.Ahr.1988 37) 38.Rep/Std.36-Thomas.et.al.2005 38) 41.Rep/Std.37-Krakowski.Czobor.2004 39) 42.Rep/Std.38-Blum.2003 40) 43.Rep/Std.39-Steele.et.al.2003 41) 44.Rep/Std.40-Swanson.et.al.2002 42) 47.Rep/Std.41-Fulwiler.et.al.1997 43) 48.Rep/Std.42-Hodgins.et.al.2002 44) 49.Rep/Std.43-Mericle.Havassy.2008 45) 50.Rep/Std.44-Buchanan.1998 46) 51.Rep/Std.45-Ascher-Svanum.et.al.2006 47) 52.Rep/Std.46-Cirincione.et.al.1992.S1[c] 48) 52.Rep/Std.46-Cirincione.et.al.1992.S2[c] 49) 55.Rep/Std.48-Bergman.Ericsson.1996 50) 56.Rep/Std.49-Arseneault.et.al.2000 51) 57.Rep/Std.50-Sims.1989 52) 59.Rep/Std.52-Shore.et.al.1989 53) 60.Rep/Std.53-Yesavage.et.al.1981 54) 64.Rep/Std.54-Rossi.et.al.1986 55) 67.Rep/Std.55-McNiel.Binder.1989 56) 68.Rep/Std.55-McNiel.Binder.1986 57) 69.Rep/Std.56-McNiel.et.al.2000 58) 70.Rep/Std.57-Lamb.et.al.1995 59) 71.Rep/Std.58-Kaliski.Zabow.1995 60) 72.Rep/Std.59-Kravitz.et.al.2002 61) 73.Rep/Std.60-Lamb.Grant.1982 62) 75.Rep/Std.61-Modestin.et.al.1996 63) 76.Rep/Std.61-Modestin.Ammann.1996 64) 77.Rep/Std.61-Modestin.et.al.1997 65) 79.Rep/Std.62-Paradis.et.al.2000 66) 80.Rep/Std.63-Sturgeon.Taylor.1980 67) 81.Rep/Std.64-Estroff.Zimmer.1994 68) 82.Rep/Std.65-Robbins.et.al.2003

(table continues)

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Table 2 *(Continued)*

Estimate	No. of effect sizes	No. of unique samples	Sample size	No. of reports	No. of unique studies	Study[a] name with reference number
Sex	22	22	Total N: 24,130 Range: 42–7,962 Mean (SD): 1,096.82 (1,703.47) Median: 735.50	22	22	01) 01.Rep/Std.01-Soyka.et.al.2007 02) 03.Rep/Std.03-McDermott.et.al.2007 03) 05.Rep/Std.05-Elbogen.et.al.2006 04) 09.Rep/Std.08-Hodgins.et.al.2007 05) 11.Rep/Std.10-Oulis.et.al.1996 06) 13.Rep/Std.12-Brennan.et.al.2000 07) 15.Rep/Std.14-Rabinowitz.Mark.1999 08) 21.Rep/Std.20-Boles.Johnson.2001 09) 24.Rep/Std.23-Swanson.et.al.2000 10) 25.Rep/Std.24-Swanson.et.al.2006 11) 26.Rep/Std.25-Tardiff.et.al.1997 12) 38.Rep/Std.36-Thomas.et.al.2005 13) 41.Rep/Std.37-Krakowski.Czobor.2004 14) 44.Rep/Std.40-Swanson.et.al.2002 15) 46.Rep/Std.41-Fulwiler.Ruthazer.1999 16) 48.Rep/Std.42-Hodgins.et.al.2002 17) 64.Rep/Std.54-Rossi.et.al.1986 18) 65.Rep/Std.55-Binder.McNiel.1986 19) 69.Rep/Std.56-McNiel.et.al.2000 20) 74.Rep/Std.61-Modestin.Ammann.1995 21) 81.Rep/Std.64-Estroff.Zimmer.1994 22) 82.Rep/Std.65-Robbins.et.al.2003
Age	21	21	Total N: 15,405 Range: 64–2,934 Mean (SD): 733.57 (738.02) Median: 360.00	21	21	01) 05.Rep/Std.05-Elbogen.et.al.2006 02) 15.Rep/Std.14-Rabinowitz.Mark.1999 03) 24.Rep/Std.23-Swanson.et.al.2000 04) 25.Rep/Std.24-Swanson.et.al.2006 05) 35.Rep/Std.33-Dickerson.et.al.1994 06) 38.Rep/Std.36-Thomas.et.al.2005 07) 44.Rep/Std.40-Swanson.et.al.2002 08) 57.Rep/Std.50-Sims.1989 09) 64.Rep/Std.54-Rossi.et.al.1986 10) 66.Rep/Std.55-McNiel.et.al.1988 11) 69.Rep/Std.56-McNiel.et.al.2000 12) 72.Rep/Std.59-Kravitz.et.al.2002

(table continues)

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Table 2 *(Continued)*

Estimate	No. of effect sizes	No. of unique samples	Sample size	No. of reports	No. of unique studies	Study[a] name with reference number
Age (cont'd)						13) 85.Rep/Std.65-Monahan.et.al.2001 14) 01.Rep/Std.01-Soyka.et.al.2007 15) 26.Rep/Std.25-Tardiff.et.al.1997 16) 28.Rep/Std.26-Hodelet.2001 17) 31.Rep/Std.29-Murphy.et.al.2001 18) 41.Rep/Std.37-Krakowski.Czobor.2004 19) 47.Rep/Std.41-Fulwiler.et.al.1997 20) 52.Rep/Std.46-Cirincione.et.al.1992.S2 21) 75.Rep/Std.61-Modestin.et.al.1996
Race	14	14	Total N: 8,007 Range: 42–1,684 Mean (SD): 571.93 (525.22) Median: 313.50	13	13	01) 05.Rep/Std.05-Elbogen.et.al.2006 02) 21.Rep/Std.20-Boles.Johnson.2001 03) 23.Rep/Std.22-Lewis.et.al.2006 04) 25.Rep/Std.24-Swanson.et.al.2006 05) 26.Rep/Std.25-Tardiff.et.al.1997 06) 38.Rep/Std.36-Thomas.et.al.2005 07) 52.Rep/Std.46-Cirincione.et.al.1992.S1[c] 08) 52.Rep/Std.46-Cirincione.et.al.1992.S2[c] 09) 59.Rep/Std.52-Shore.et.al.1989 10) 64.Rep/Std.54-Rossi.et.al.1986 11) 65.Rep/Std.55-Binder.McNiel.1986 12) 72.Rep/Std.59-Kravitz.et.al.2002 13) 81.Rep/Std.64-Estroff.Zimmer.1994 14) 83.Rep/Std.65-Grisso.et.al.2000
Marital status	13	13	Total N: 12,192 Range: 95–2,899 Mean (SD): 937.85 (788.10) Median: 802.00	13	13	01) 01.Rep/Std.01-Soyka.et.al.2007 02) 05.Rep/Std.05-Elbogen.et.al.2006 03) 15.Rep/Std.14-Rabinowitz.Mark.1999 04) 24.Rep/Std.23-Swanson.et.al.2000 05) 25.Rep/Std.24-Swanson.et.al.2006 06) 38.Rep/Std.36-Thomas.et.al.2005 07) 44.Rep/Std.40-Swanson.et.al.2002 08) 59.Rep/Std.52-Shore.et.al.1989 09) 64.Rep/Std.54-Rossi.et.al.1986 10) 65.Rep/Std.55-Binder.McNiel.1986

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Table 2 *(Continued)*

Estimate	No. of effect sizes	No. of unique samples	Sample size	No. of reports	No. of unique studies	Study[a] name with reference number
Marital status (cont'd)						11) 72.Rep/Std.59-Kravitz.et.al.2002 12) 75.Rep/Std.61-Modestin.et.al.1996 13) 85.Rep/Std.65-Monahan.et.al.2001
Education	12	12	Total N: 8,346 Range: 64–1,662 Mean (SD): 695.50 (582.37) Median: 552.50	12	12	01) 01.Rep/Std.01-Soyka.et.al.2007 02) 05.Rep/Std.05-Elbogen.et.al.2006 03) 24.Rep/Std.23-Swanson.et.al.2000 04) 25.Rep/Std.24-Swanson.et.al.2006 05) 40.Rep/Std.36-Dean.et.al.2006 06) 44.Rep/Std.40-Swanson.et.al.2002 07) 64.Rep/Std.54-Rossi.et.al.1986 08) 72.Rep/Std.59-Kravitz.et.al.2002 09) 85.Rep/Std.65-Monahan.et.al.2001 10) 23.Rep/Std.22-Lewis.et.al.2006 11) 31.Rep/Std.29-Murphy.et.al.2001 12) 47.Rep/Std.41-Fulwiler.et.al.1997
Income	2	2	Total N: 1,665 Range: 262–1,403 Mean (SD): 832.50 (806.81)	2	2	01) 24.Rep/Std.23.Swanson.et.al.2000 02) 25.Rep/Std.24.Swanson.et.al.2006
Socio-economic status	4	4	Total N: 6,760 Range: 94–6,014 Mean (SD): 1,690.00 (2,884.87) Median: 326.00	4	4	01) 13.Rep/Std.12.Brennan.et.al.2000 02) 65.Rep/Std.55.Binder.McNiel.1986 03) 72.Rep/Std.59.Kravitz.et.al.2002 04) 75.Rep/Std.61.Modestin.et.al.1996

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Table 2 *(Continued)*

Estimate	No. of effect sizes	No. of unique samples	Sample size	No. of reports	No. of unique studies	Study[a] name with reference number
Anger	4	4	Total N: 5,469 Range: 94–4,284 Mean (SD): 1,367.25 (1,982.32) Median: 545.50	4	4	01) 07.Rep/Std.07.Doyle.Dolan.2006 02) 14.Rep/Std.13.Novaco.1994 03) 17.Rep/Std.16.Vitacco.et.al.2009 04) 85.Rep/Std.65.Monahan.et.al.2001
Impulsiveness	2	2	Total N: 988 Range: 49–939 Mean (SD): 494.00 (629.325)	2	2	01) 71.Rep.32D.Kaliski.Zabow.1995 02) 85.Rep.419.Monahan.et.al.2001
Neurological impairment	4	4	Total N: 1,772 Range: 106–939 Mean (SD): 443.00 (404.48) Median: 363.50	4	4	01) 04.Rep/Std.04-Joyal.et.al.2008 02) 35.Rep/Std.33-Dickerson.et.al.1994 03) 37.Rep/Std.35-Holcomb.Ahr.1988 04) 85.Rep/Std.65-Monahan.et.al.2001
Unemployment	6	6	Total N: 4,099 Range: 94–1,600 Mean (SD): 683.17 (550.54) Median: 581.00	6	6	01) 40.Rep/Std.36-Dean.et.al.2006 02) 44.Rep/Std.40-Swanson.et.al.2002 03) 64.Rep/Std.54-Rossi.et.al.1986 04) 72.Rep/Std.59-Kravitz.et.al.2002 05) 75.Rep/Std.61-Modestin.et.al.1996 06) 85.Rep/Std.65-Monahan.et.al.2001

(table continues)

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Table 2 *(Continued)*

Estimate	No. of effect sizes	No. of unique samples	Sample size	No. of reports	No. of unique studies	Study[a] name with reference number
History of violence	9	9	Total N: 2,826 Range: 40–939 Mean (SD): 314.00 (319.16) Median: 217.00	9	8	01) 27.Rep/Std.25-Tardiff.et.al.1997 02) 35.Rep/Std.33-Dickerson.et.al.1994 03) 38.Rep/Std.36-Thomas.et.al.2005 04) 59.Rep/Std.52-Shore.et.al.1989 05) 62.Rep/Std.53-Yesavage.1984 06) 63.Rep/Std.53-Yesavage.1983b 07) 67.Rep/Std.55-McNiel.Binder.1989 08) 71.Rep/Std.58-Kaliski.Zabow.1995 09) 85.Rep/Std.65-Monahan.et.al.2001
Self-harm behavior	5	5	Total N: 2309 Range: 64–939 Mean (SD): 461.80 (356.03) Median: 360.00	5	5	01) 38.Rep/Std.36-Thomas.et.al.2005 02) 47.Rep/Std.41-Fulwiler.et.al.1997 03) 66.Rep/Std.55-McNiel.et.al.1988 04) 75.Rep/Std.61-Modestin.et.al.1996 05) 85.Rep/Std.65-Monahan.et.al.2001
Criminal history	8	8	Total N: 4,745 Range: 88–1,409 Mean (SD): 593.13 (451.01) Median: 517.50	7	7	01) 25.Rep/Std.24-Swanson.et.al.2006 02) 38.Rep/Std.36-Thomas.et.al.2005 03) 44.Rep/Std.40-Swanson.et.al.2002 04) 52.Rep/Std.46-Cirincione.et.al.1992.S1[c] 05) 52.Rep/Std.46-Cirincione.et.al.1992.S2[c] 06) 59.Rep/Std.52-Shore.et.al.1989 07) 72.Rep/Std.59-Kravitz.et.al.2002 08) 85.Rep/Std.65-Monahan.et.al.2001
Earlier onset of mental disorder	7	7	Total N: 5,777 Range: 64–2,935 Mean (SD): 825.29 (985.49) Median: 360.00	7	7	01) 05.Rep/Std.05-Elbogen.et.al.2006 02) 15.Rep/Std.14-Rabinowitz.Mark.1999 03) 40.Rep/Std.36-Dean.et.al.2006 04) 44.Rep/Std.40-Swanson.et.al.2002 05) 31.Rep/Std.29-Murphy.et.al.2001 06) 47.Rep/Std.41-Fulwiler.et.al.1997 07) 75.Rep/Std.61-Modestin.et.al.1996

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Table 2 *(Continued)*

Estimate	No. of effect sizes	No. of unique samples	Sample size	No. of reports	No. of unique studies	Study[a] name with reference number
Prior psychiatric hospitalization	8	8	Total N: 4,967 Range: 92–1,407 Mean (SD): 620.88 (484.92) Median: 580.50	8	8	01) 05.Rep/Std.05-Elbogen.et.al.2006 02) 18.Rep/Std.17-Egami.et.al.1996 03) 24.Rep/Std.23-Swanson.et.al.2000 04) 25.Rep/Std.24-Swanson.et.al.2006 05) 70.Rep/Std.57-Lamb.et.al.1995 06) 72.Rep/Std.59-Kravitz.et.al.2002 07) 85.Rep/Std.65-Monahan.et.al.2001 08) 75.Rep/Std.61-Modestin.et.al.1996
Involuntary psychiatric hospitalization	5	5	Total N: 3,328 Range: 120–1,687 Mean (SD): 665.60 (651.72) Median: 327.00	4	4	01) 35.Rep/Std.33-Dickerson.et.al.1994 02) 52.Rep/Std.46-Cirincione.et.al.1992.S1[c] 03) 52.Rep/Std.46-Cirincione.et.al.1992.S2[c] 04) 64.Rep/Std.54-Rossi.et.al.1986 05) 85.Rep/Std.65-Monahan.et.al.2001
Duration of psychiatric hospitalization	2	2	Total N: 2,263 Range: 708–1,555 Mean (SD): 1,131.50 (598.92)	2	2	01) 01.Rep/Std.01-Soyka.et.al.2007 02) 38.Rep/Std.36-Thomas.et.al.2005
Violent victimization	3	3	Total N: 2,919 Range: 708–1,409 Mean (SD): 973.00 (380.50) Median: 802.00	3	3	01) 25.Rep/Std.24-Swanson.et.al.2006 02) 38.Rep/Std.36-Thomas.et.al.2005 03) 44.Rep/Std.40-Swanson.et.al.2002

(table continues)

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Table 2 *(Continued)*

Estimate	No. of effect sizes	No. of unique samples	Sample size	No. of reports	No. of unique studies	Study[a] name with reference number
Child abuse victim	4	4	Total N: 3,291 Range: 157–1,407 Mean (SD): 822.75 (514.93) Median: 863.50	4	4	01) 25.Rep/Std.24-Swanson.et.al.2006 02) 44.Rep/Std.40-Swanson.et.al.2002 03) 81.Rep/Std.64-Estroff.Zimmer.1994 04) 85.Rep/Std.65-Monahan.et.al.2001
Childhood conduct disorder or problems	4	4	Total N: 1980 Range: 64–1409 Mean (SD): 495.00 (617.17) Median: 253.50	4	4	01) 08.Rep/Std.08-Hodgins.et.al.2008 02) 25.Rep/Std.24-Swanson.et.al.2006 03) 46.Rep/Std.41-Fulwiler.Ruthazer.1999 04) 31.Rep/Std.29-Murphy.et.al.2001
Homeless	6	6	Total N: 4,182 Range: 64–1,407 Mean (SD): 697.00 (482.44) Median: 755.00	6	6	01) 24.Rep/Std.23.Swanson.et.al.2000 02) 25.Rep/Std.24.Swanson.et.al.2006 03) 38.Rep/Std.36.Thomas.et.al.2005 04) 44.Rep/Std.40.Swanson.et.al.2002 05) 47.Rep/Std.41.Fulwiler.et.al.1997 06) 85.Rep/Std.65.Monahan.et.al.2001
Living with family	3	3	Total N: 1,808 Range: 99–1,410 Mean (SD): 602.67 (706.29) Median: 299.00	3	3	01) 23.Rep/Std.22-Lewis.et.al.2006 02) 25.Rep/Std.24-Swanson.et.al.2006 03) 65.Rep/Std.55-Binder.McNiel.1986

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Table 2 *(Continued)*

Estimate	No. of effect sizes	No. of unique samples	Sample size	No. of reports	No. of unique studies	Study[a] name with reference number
Psychotic disorders	19	19	Total N: 19,248 Range: 64–7,962 Mean (SD): 1,013.05 (1,808.61) Median: 327.00	18	18	01) 05.Rep/Std.05-Elbogen.et.al.2006 02) 10.Rep/Std.09-Grossman.et.al.1995 03) 13.Rep/Std.12-Brennan.et.al.2000 04) 15.Rep/Std.14-Rabinowitz.Mark.1999 05) 24.Rep/Std.23-Swanson.et.al.2000 06) 26.Rep/Std.25-Tardiff.et.al.1997 07) 37.Rep/Std.35-Holcomb.Ahr.1988 08) 40.Rep/Std.36-Dean.et.al.2006 09) 44.Rep/Std.40-Swanson.et.al.2002 10) 47.Rep/Std.41-Fulwiler.et.al.1997 11) 52.Rep/Std.46-Cirincione.et.al.1992.S1[c] 12) 52.Rep/Std.46-Cirincione.et.al.1992.S2[c] 13) 59.Rep/Std.52-Shore.et.al.1989 14) 64.Rep/Std.54-Rossi.et.al.1986 15) 65.Rep/Std.55-Binder.McNiel.1986 16) 72.Rep/Std.59-Kravitz.et.al.2002 17) 78.Rep/Std.61-Modestin.Wuermle.2005 18) 81.Rep/Std.64-Estroff.Zimmer.1994 19) 82.Rep/Std.65-Robbins.et.al.2003
Mood disorders	11	11	Total N: 27,614 Range: 84–14,315 Mean (SD): 2,510.36 (4,518.17) Median: 607.00	11	11	01) 06.Rep/Std.06-Elbogen.Johnson.2009 02) 13.Rep/Std.12-Brennan.et.al.2000 03) 24.Rep/Std.23-Swanson.et.al.2000 04) 26.Rep/Std.25-Tardiff.et.al.1997 05) 37.Rep/Std.35-Holcomb.Ahr.1988 06) 64.Rep/Std.54-Rossi.et.al.1986 07) 65.Rep/Std.55-Binder.McNiel.1986 08) 72.Rep/Std.59-Kravitz.et.al.2002 09) 78.Rep/Std.61-Modestin.Wuermle.2005 10) 81.Rep/Std.64-Estroff.Zimmer.1994 11) 82.Rep/Std.65-Robbins.et.al.2003

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Table 2 *(Continued)*

Estimate	No. of effect sizes	No. of unique samples	Sample size	No. of reports	No. of unique studies	Study[a] name with reference number
Personality disorders	2	2	Total N: 689 Range: 82–607 Mean (SD): 344.50 (371.23)	2	2	01) 37.Rep/Std.35-Holcomb.Ahr.1988 02) 72.Rep/Std.59-Kravitz.et.al.2002
Psychiatric comorbidity	14	14	Total N: 130,133 Range: 42–103,344 Mean (SD): 9,295.21 (27,374.54) Median: 606.50	14	14	01) 04.Rep/Std.04-Joyal.et.al.2008 02) 05.Rep/Std.05-Elbogen.et.al.2006 03) 06.Rep/Std.06-Elbogen.Johnson.2009 04) 13.Rep/Std.12-Brennan.et.al.2000 05) 21.Rep/Std.20-Boles.Johnson.2001 06) 24.Rep/Std.23-Swanson.et.al.2000 07) 32.Rep/Std.30-Scott.et.al.1998 08) 36.Rep/Std.34-Leonard.et.al.2006 09) 39.Rep/Std.36-Moran.et.al.2003 10) 43.Rep/Std.39-Steele.et.al.2003 11) 44.Rep/Std.40-Swanson.et.al.2002 12) 72.Rep/Std.59-Kravitz.et.al.2002 13) 78.Rep/Std.61-Modestin.Wuermle.2005 14) 82.Rep/Std.65-Robbins.et.al.2003
Psychiatric symptoms	22	22	Total N: 111,926 Range: 40–103,344 Mean (SD): 5,087.55 (21,950.93) Median: 173.50	22	21	01) 01.Rep/Std.01-Soyka.et.al.2007 02) 05.Rep/Std.05-Elbogen.et.al.2006 03) 10.Rep/Std.09-Grossman.et.al.1995 04) 23.Rep/Std.22-Lewis.et.al.2006 05) 24.Rep/Std.23-Swanson.et.al.2000 06) 25.Rep/Std.24-Swanson.et.al.2006 07) 28.Rep/Std.26-Hodelet.2001 08) 35.Rep/Std.33-Dickerson.et.al.1994 09) 36.Rep/Std.34-Leonard.et.al.2006 10) 38.Rep/Std.36-Thomas.et.al.2005 11) 44.Rep/Std.40-Swanson.et.al.2002 12) 61.Rep/Std.53-Yesavage.1983a 13) 63.Rep/Std.53-Yesavage.1983b

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Table 2 *(Continued)*

Estimate	No. of effect sizes	No. of unique samples	Sample size	No. of reports	No. of unique studies	Study[a] name with reference number
Psychiatric symptoms (cont'd)						14) 69.Rep/Std.56-McNiel.et.al.2000 15) 70.Rep/Std.57-Lamb.et.al.1995 16) 73.Rep/Std.60-Lamb.Grant.1982 17) 85.Rep/Std.65-Monahan.et.al.2001 18) 54.Rep/Std.47-Young.et.al.2003 19) 07.Rep/Std.07-Doyle.Dolan.2006 20) 17.Rep/Std.16-Vitacco.et.al.2009 21) 40.Rep/Std.36-Dean.et.al.2006 22) 42.Rep/Std.38-Blum.2003.ES13
Psychopath	4	4	Total N: 1,168 Range: 53–871 Mean (SD): 292.00 (388.14) Median: 122.00	4	4	01) 58.Rep/Std.51-Hildebrand.et.al.2004 02) 84.Rep/Std.65-Skeem.Mulvey.2001 03) 17.Rep/Std.16-Vitacco.et.al.2009 04) 42.Rep/Std.38-Blum.2003
Level of functioning	8	8	Total N: 6,476 Range: 88–2,928 Mean (SD): 809.50 (931.48) Median: 564.50	8	8	01) 05.Rep/Std.05-Elbogen.et.al.2006 02) 15.Rep/Std.14-Rabinowitz.Mark 03) 24.Rep/Std.23-Swanson.et.al.2000 04) 35.Rep/Std.33-Dickerson.et.al.1994 05) 37.Rep/Std.35-Holcomb.Ahr.1988 06) 44.Rep/Std.40-Swanson.et.al.2002 07) 72.Rep/Std.59-Kravitz.et.al.2002 08) 85.Rep/Std.65-Monahan.et.al.2001
Severity of mental disorder	3	3	Total N: 2,009 Range: 302–1,404 Mean (SD): 669.67 (635.95) Median: 303.00	3	3	01) 25.Rep/Std.24-Swanson.et.al.2006 02) 31.Rep/Std.29-Murphy.et.al.2001 03) 40.Rep/Std.36-Dean.et.al.2006

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Table 2 *(Continued)*

Estimate	No. of effect sizes	No. of unique samples	Sample size	No. of reports	No. of unique studies	Study[a] name with reference number
Substance abuse	24	24	Total N: 32,801 Range: 42–14,315 Mean (SD): 1,366.71 (3,181.14) Median: 373.00	23	23	01) 05.Rep/Std.05-Elbogen.et.al.2006 02) 06.Rep/Std.06-Elbogen.Johnson.2009 03) 13.Rep/Std.12-Brennan.et.al.2000 04) 21.Rep/Std.20-Boles.Johnson.2001 05) 24.Rep/Std.23-Swanson.et.al.2000 06) 25.Rep/Std.24-Swanson.et.al.2006 07) 26.Rep/Std.25-Tardiff.et.al.1997 08) 28.Rep/Std.26-Hodelet.2001 09) 32.Rep/Std.30-Scott.et.al.1998 10) 37.Rep/Std.35-Holcomb.Ahr.1988 11) 38.Rep/Std.36-Thomas.et.al.2005 12) 43.Rep/Std.39-Steele.et.al.2003 13) 44.Rep/Std.40-Swanson.et.al.2002 14) 47.Rep/Std.41-Fulwiler.et.al.1997 15) 49.Rep/Std.43-Mericle.Havassy.2008 16) 52.Rep/Std.46-Cirincione.et.al.1992.S1[c] 17) 52.Rep/Std.46-Cirincione.et.al.1992.S2[c] 18) 66.Rep/Std.55-McNiel.et.al.1988 19) 69.Rep/Std.56-McNiel.et.al.2000 20) 72.Rep/Std.59-Kravitz.et.al.2002 21) 78.Rep/Std.61-Modestin.Wuermle.2005 22) 82.Rep/Std.65-Robbins.et.al.2003 23) 01.Rep/Std.01-Soyka.et.al.2007 24) 42.Rep/Std.38-Blum.2003
Lack of insight on mental disorder	3	3	Total N: 4,009 Range: 939–1,662 Mean (SD): 1,336.33 (366.79) Median: 1,408.00	3	3	01) 01.Rep/Std.01-Soyka.et.al.2007 02) 25.Rep/Std.24-Swanson.et.al.2006 03) 85.Rep/Std.65-Monahan.et.al.2001

(table continues)

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Table 2 *(Continued)*

Estimate	No. of effect sizes	No. of unique samples	Sample size	No. of reports	No. of unique studies	Study[a] name with reference number
Treatment non-compliance	5	5	Total N: 4,919 Range: 262–1,906 Mean (SD): 983.80 (593.13) Median: 939.00	5	5	01) 05.Rep/Std.05-Elbogen.et.al.2006 02) 24.Rep/Std.23-Swanson.et.al.2000 03) 44.Rep/Std.40-Swanson.et.al.2002 04) 51.Rep/Std.45-Ascher-Svanum.et.al.2006 05) 85.Rep/Std.65-Monahan.et.al.2001
Perceived treatment need	3	3	Total N: 2,176 Range: 262–1,010 Mean (SD): 725.33 (404.74) Median: 904.00	3	3	01) 05.Rep/Std.05-Elbogen.et.al.2006 02) 24.Rep/Std.23-Swanson.et.al.2000 03) 45.Rep/Std.40-Elbogen.et.al.2007
Duration of mental disorder	4	4	Total N: 847 Range: 64–360 Mean (SD): 211.75 (142.07) Median: 211.50	4	4	01) 47.Rep/Std.41-Fulwiler.et.al.1997 02) 75.Rep/Std.61-Modestin.et.al.1996 03) 35.Rep/Std.33-Dickerson.et.al.1994 04) 40.Rep/Std.36-Dean.et.al.2006
Relationship between mental disorders and violence	6	6	Total N: 47,246 Range: 679–34,345 Mean (SD): 7,874.33 (13,466.90) Median: 846.50	5	5	01) 06.Rep/Std.06-Elbogen.Johnson.2009 02) 18.Rep/Std.17-Egami.et.al.1996 03) 53.Rep/Std.46-Cirincione.et.al.1994.S1[c] 04) 53.Rep/Std.46-Cirincione.et.al.1994.S2[c] 05) 56.Rep/Std.49-Arseneault.et.al.2000 06) 57.Rep/Std.50-Sims.1989

Note. [a] See Appendix C for the full citation of the 85 research reports identified for this meta-analytic study and the corresponding study name with reference number used in all analyses. A *study* refers to an independent sample from which an effect size was calculated.
[b, c,] Independent sub-samples from the same report.

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Prevalence of Violence among the Mentally Disordered Patients

Main analyses.

Apart from providing a descriptive analysis on the characteristics of the samples and the distribution of the effect sizes, the question of whether the prevalence of violence among the psychiatric patients changed over time will be addressed systematically in this section.

Demographics.

There were 68 studies, completed between 1980 and 2009, available for estimating the prevalence of violence among the psychiatric patients. The majority of the studies (k = 63, 92.6%) were published journal articles and two were unpublished doctoral dissertations. More than 60% (k = 42) of the studies were conducted in the United States and 26% (k = 18) were carried out in Europe (including 13% from the United Kingdom and 13 % from other European countries). Individual sample sizes ranged from 26 to 103,344 with a mean of 2,356 (SD = 12,594) and a total of 160,206 patients. Two thirds of the patients were female (based on 63 studies of 138,148 participants). The mean age of the samples ranged from 21 to 84 with a mean of 38.69 (SD = 10.05) and a median of 38 years old (based on 51 studies with 118,812 participants). With respect to race, 64% of the patients were white (based on 42 studies with 18,591 patients). The commonly reported diagnoses of the patients included cognitive disorders such as dementia (66%), psychotic disorders (11%), mood disorders (8%), and substance abuse disorders (7%).

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Distribution of the effect sizes.

The results in Figure 1 shows that the prevalence estimates of violence reported from 68 studies varied considerably in size, ranging from 1.1% to 78.4% with a combined mean rate of 19.3% (95% CI = 15.7–23.5%, $p < .001$). Tests of heterogeneity revealed that there is substantial variation across studies and almost all variability is due to between-study differences ($I^2 = 99.21$, $Q(67) = 8438.47$, $p < .001$). At first glance, it looks as if the first two studies were potential outliers. This is because their estimates of 78.4% (95% CI = 69.4–85.4%) and 72.0% (95% CI = 64.9–78.2%) were extremely high and the two confidence intervals were substantially different from the overall estimate of 19.3% (95% CI = 15.7–23.5%). The issue of outliers will be discussed in the next section.

Moreover, the forest plot in Figure 1 illustrates that the relatively high prevalence estimates (crudely defined as greater than 20.0%) were largely unstable estimates with a wider confidence interval. As expected, these unstable estimates were derived from studies with smaller sample sizes (N < 100 in most cases). Visual inspection on the forest plot also suggested that the reported prevalence rates or estimates might be roughly classified into four groups:

(1) High estimates (range = 42.9–78.4%, $k = 14$);

(2) Medium-high estimates (range = 20.2–38.2%, $k = 19$);

(3) Medium-low estimates (range = 11.0–19.7%, $k = 18$); and

(4) Low estimates (range = 1.1–9.8%, $k = 17$).

Additional exploratory analyses, summarized in Table 3, indicate that there was a significant difference in mean rates across groups ($Q(3) = 486.65$, $p < .001$): A combined mean rate of 57.7% (95% CI = 51.2–64.0%), 26.9% (95% CI = 24.3–29.5%), 15.3% (95% CI = 13.9–16.7%), and 4.5% (95% CI = 3.7–5.4%) was computed for the high estimates, the medium-high estimates,

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the medium-low estimates, and the low estimates, respectively.[3] Consistent with the examination of individual estimates displayed in the forest plot, the widest confidence interval was calculated for the high-estimate group (12.8%), followed by the medium-high group (5.2%), the medium-low group (2.8%), and the low-estimate group (1.7%). Somewhat surprisingly, considerable heterogeneity of effects in all categories of prevalence estimates was identified, as indicated by the highly significant *Q* tests (*p*s < .001) and the large I^2 statistics (ranging from 71.12 for the medium-low group to 95.15 for the low group of estimates). Again, the I^2 statistics suggests that the majority of variation across studies (with each group) is due to between-study differences. This called for searching for potential moderators by conducting subgroup and meta-regression analyses.

In addition, it is worth mentioning that almost half of the high estimates (6 out of 14) were not statistically significant (*p*s > .05), as shown in Figure 2. This is important, since it points to the possible impact of publication bias or a small-study effect on the results. Systematic analyses for addressing the issue of publication bias will be presented immediately after the outlier analysis. Note that the detailed descriptive statistics of all prevalence estimates is contained in Appendix D.

[3] Although this analysis found a significant difference across groups, it *cannot* be formally treated as a moderator analysis for explaining variation across studies since the grouping variable (magnitude of effect sizes or prevalence estimates) is not a pre-specified moderator variable. In fact, it is important to note that the subgroup analysis reported here is solely for the purpose of data description and exploration.

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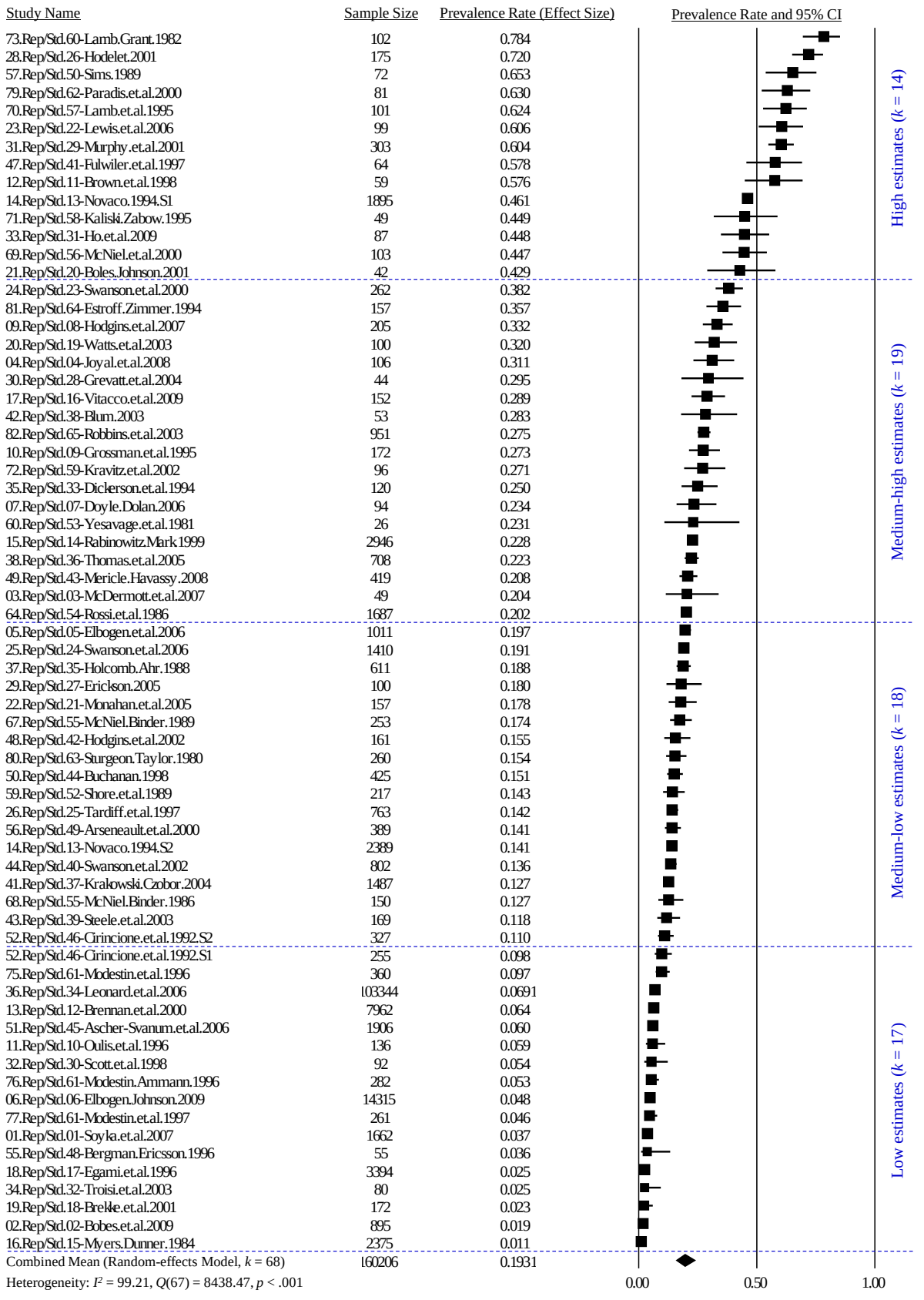

Figure 1. Prevalence of violence among adults with mental disorders *Note.* *k* = number of independent samples.

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Table 3
Exploratory Analyses on the Four Groups of Prevalence Estimates Classified by the Magnitude of Effect Sizes

			Mean ES and 95% CI			Heterogeneity		
Group of PR (Range)	*k*	N	PR	*LL*	*UL*	*Q*	*df(Q)*	I^2
High (0.429–0.784)	14	3,232	0.577 *	0.512	0.640	110.01***	13	88.18
Medium-High (0.202–0.382)	19	8,347	0.269 ***	0.243	0.295	84.83***	18	78.78
Medium-Low (0.110–0.197)	18	11,081	0.153 ***	0.139	0.167	58.86***	17	71.12
Low (0.011–0.098)	17	137,546	0.045 ***	0.037	0.054	329.53***	16	95.15
Omnibus test for group difference	68	160,206				486.65***	3	

Note. ES = effect size, measured as prevalence rate (PR); the four groups of prevalence estimates, roughly classified by visual inspection of the forest plot, were also outlined in Figure 1. *k* = number of independent samples; N = number of patients; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.
* $p \leq .05$. *** $p \leq .001$.

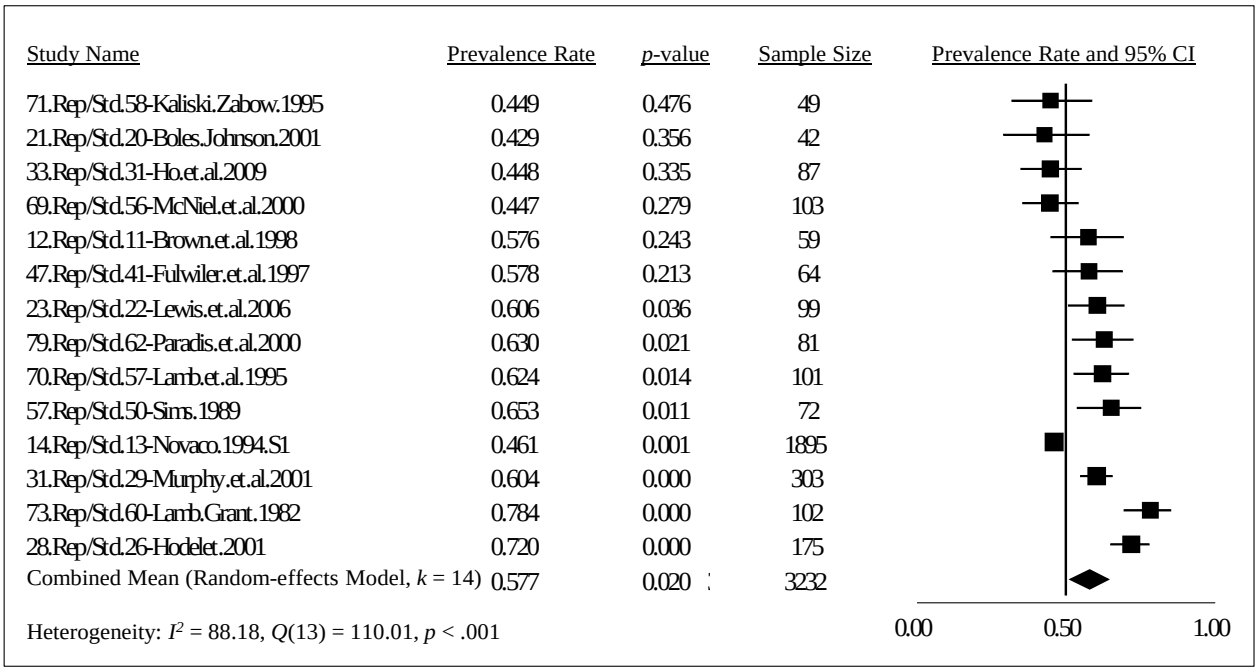

Figure 2. Forest plot of the high prevalence estimates of violence.
Note. Estimates were sorted by the sizes of *p*-values.

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Change of the prevalence of violence over time.

One simple but important question of theoretical and practical interest is whether the prevalence of violence among the mentally disordered patients changed over time. In order to address this question thoroughly, various analyses were carried out.

First, a standard meta-analysis for all studies combined, sorted in chronological order in terms of year of publication or completion, was conducted to provide an overview of the estimates across time. The forest plot in Figure 3 shows that the prevalence estimates fluctuated from time to time, but the degree of fluctuation decreased after 2001.

Second, studies completed in the same single years were grouped together to produce time-specific aggregated estimates (i.e., a single prevalence estimate was computed for each year), and were plotted in the line graph of Figure 4 for analysis. Basically, the line graph shows the same observation as Figure 3. Moreover, it reveals that several higher prevalence estimates were quite evenly distributed in the past three decades. Additionally, two extremely low estimates of 1.1% and 5.0% were recorded for the earlier years of 1984 and 1996, respectively. For the most part, the prevalence estimates fluctuated between 10% and 30% over the years.

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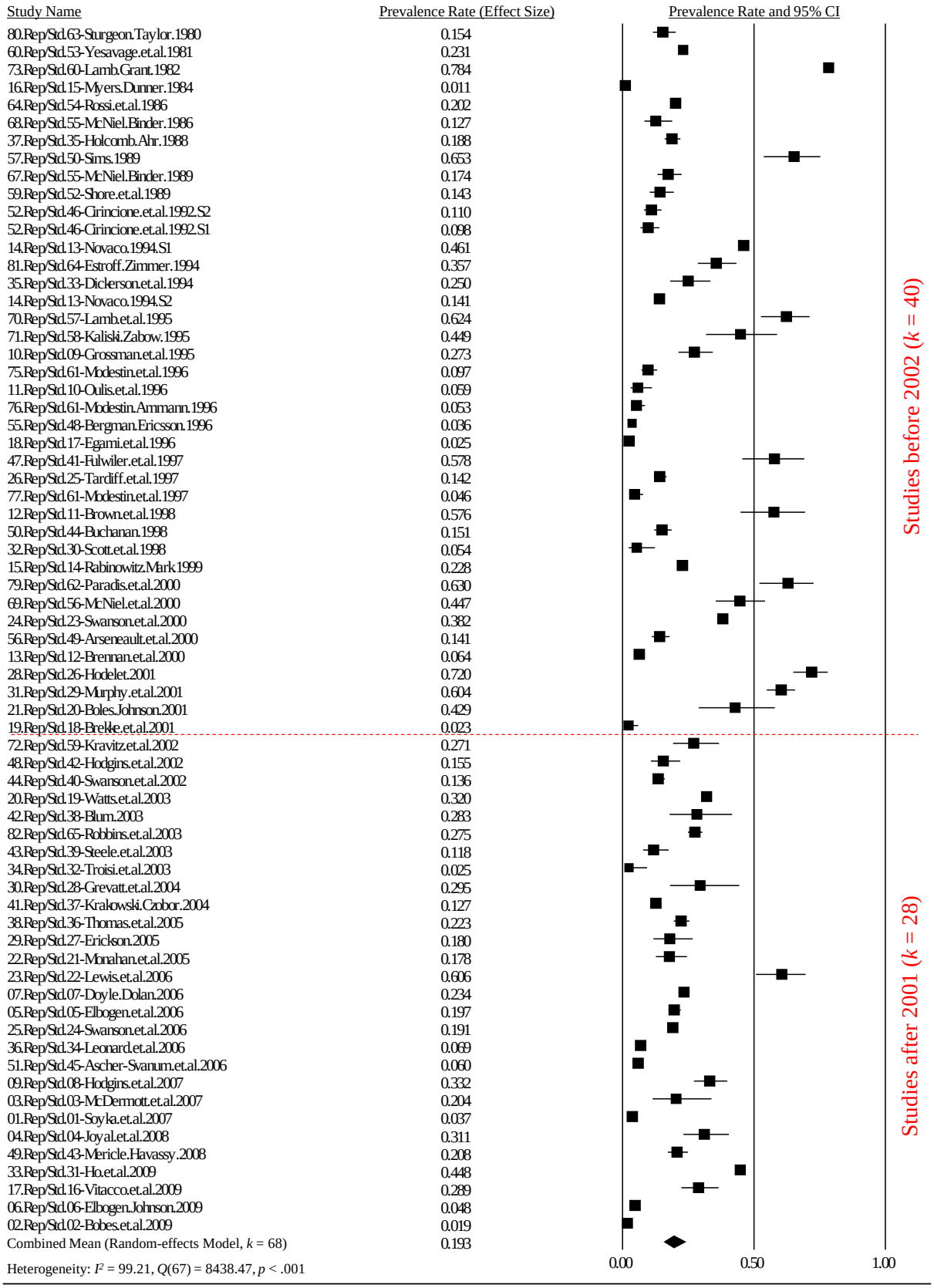

Figure 3. Prevalence of violence among the mentally disordered patients over time.
Note. Effect sizes were sorted by year of publication. *k* = number of independent samples.

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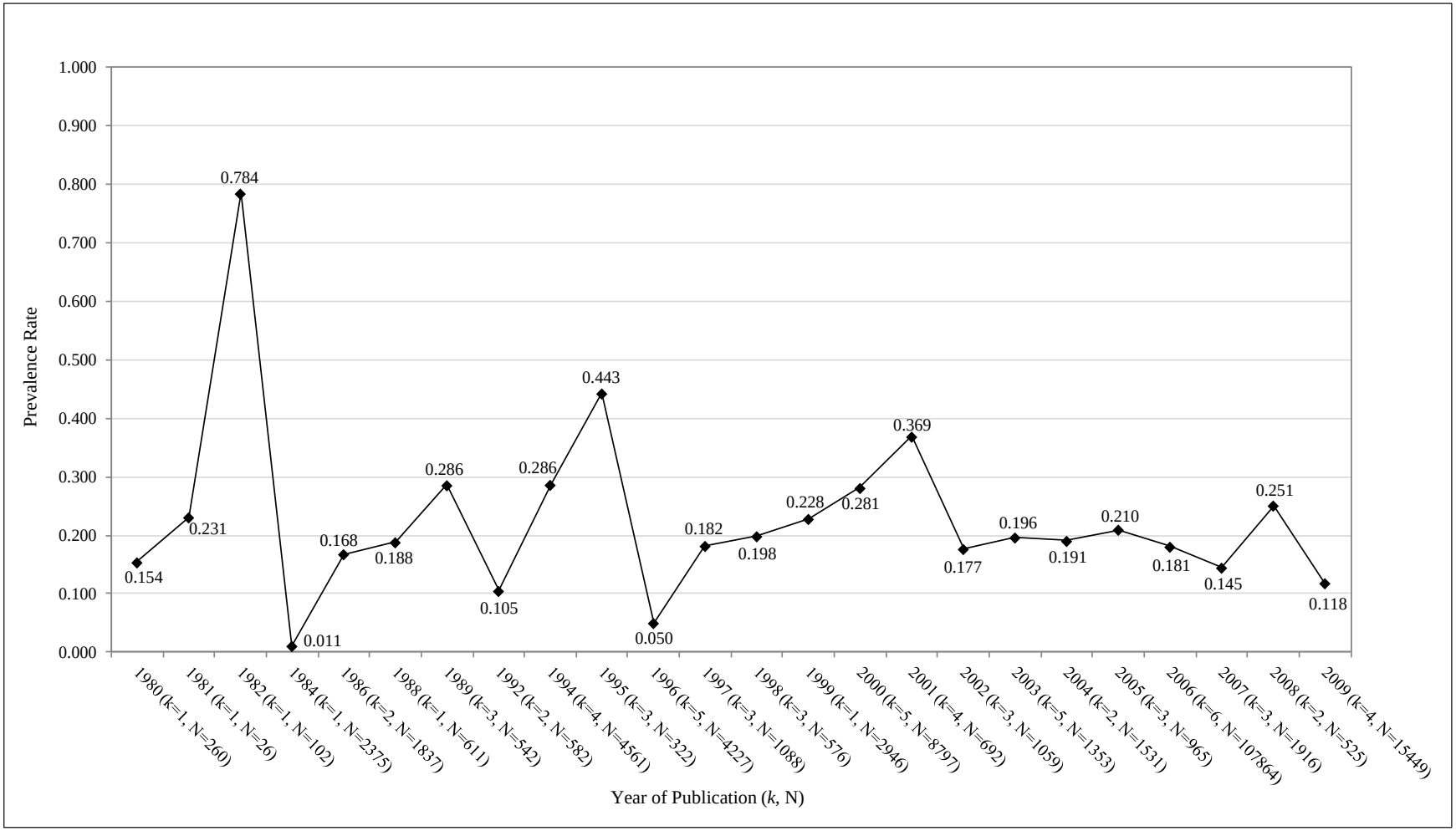

Figure 4. Time-specific aggregated prevalence estimates of violence among the mentally disordered patients.
Note. *k* = number of independent samples; N = number of patients.

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Third, a cumulative meta-analysis was performed to see how the prevalence estimate has shifted over time as data accumulated. According to Borenstein et al. (2009), cumulative meta-analysis is simply a procedure for performing a series of separate meta-analyses in one run so that the results can be summarized in one table or plot. Specifically, studies are first sorted in order (by any variable of interest); they are then added to the analysis one by one until all of them are included. The results are finally displayed in one table or graph on the basis of the sorting variable. If studies are sorted in chronological order for analysis, the results will give a picture of how the data or evidence accumulated, and how the conclusion may have changed, over a period of time. This can provide us with a historical perspective for analysis. Apart from displaying data patterns, it is noteworthy that this technique can also be applied to many other situations to achieve important goals such as assessing the potential impact of publication bias.

Figure 5 presents the results of the cumulative meta-analysis in which studies were sorted chronologically by year of publication for investigation. As shown in Figure 5, there was a drastic shift to the right of the violence rate in 1982. Other than that, the cumulative prevalence rates gradually stabilized and the width of the confidence intervals diminished. This was because the amount of data increased over time, so any additional study added to the analysis did not change the result dramatically. It was also evident that the estimate fluctuated intermittently until 2001, which was consistent with the findings of other analyses discussed above.

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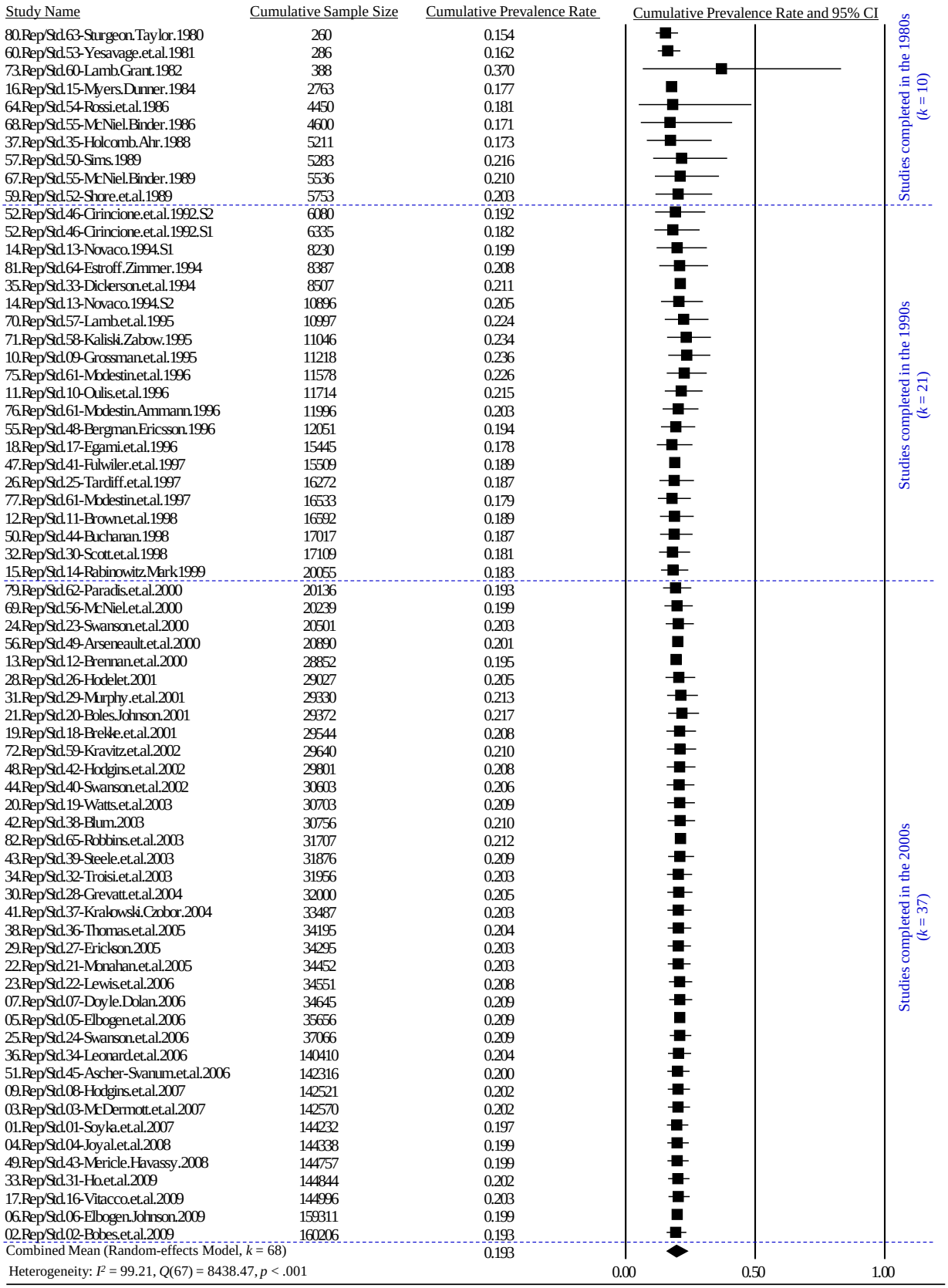

Figure 5. Cumulative meta-analysis on the prevalence of violence among the mentally disordered patients.
Note. Effect sizes (prevalence rates) were sorted by year of publication for analysis. *k* = number of independent samples.

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Fourth, a meta-regression analysis in Figure 6 reveals that the prevalence estimates did not change as a function of "year of publication" (β = -0.006, 95% CI = -0.037–0.025, p = .699, k = 68). This indirectly suggests that there was no significant change in the prevalence of violence over the past 30 years. In addition, the negative sign of the regression coefficient implies that there was a trend towards a decrease in the prevalence of violence over time, although the regression line was rather flat.

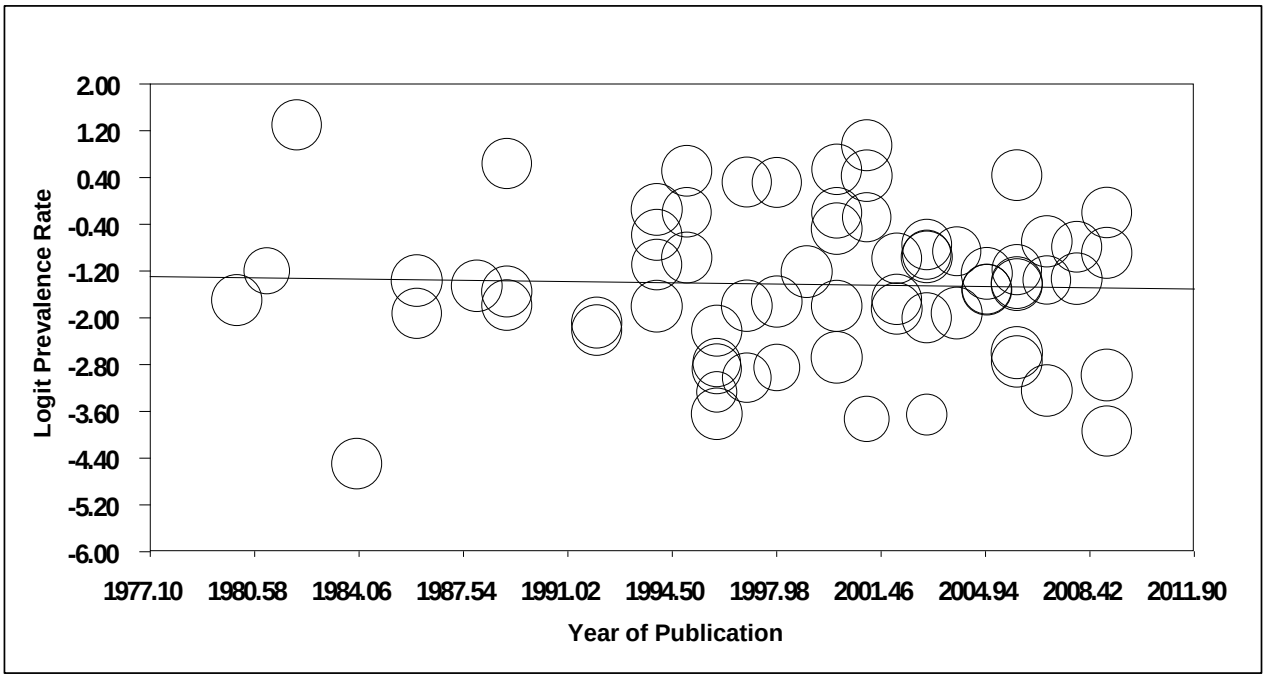

Figure 6. Regression of publication year on logit prevalence rate.
Note. Using the random-effects model (method of moments) for estimation, year of publication was found not significantly related to the prevalence estimates of violence (β = -0.006, 95% CI = -0.037–0.025, p = .699, k = 68). The covariate was normally distributed with the skewness and kurtosis statistics less than | 3 |.

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Finally, a subgroup analysis found no significant difference in mean prevalence rates across the three decades of 1980s, 1990s, and 2000s ($Q(2) = 0.48$, $p = .785$, $k = 68$). As summarized in Table 4, the overall prevalence estimates of 20.3% for the 1980s and 20.2% for the 2000s were virtually identical. Although the estimate of 17.4% calculated for the 1990s was slightly lower than that of the other two decades, the differences were not statistically significant. This further supports the observation of no significant change in the prevalence of violence among the mentally disordered over the past three decades. However, it is important to note that substantial variation in estimates across studies within each decade was detected as indicated by the highly significant Q tests (ps < .001) and the large I^2 statistics of 98.01 to 99.10. This suggests the existence of potential moderators and that meta-regression and subgroup analyses should be carried out. The forest plots for displaying individual studies completed in each decade are presented in Figures 7a to 7c.

Table 4
Mean Prevalence Rates of Violence among the Mentally Disordered Patients in the Past Three Decades

			Mean ES and 95% CI			Heterogeneity		
Year of publication	*k*	N	PR	*LL*	*UL*	*Q*	*df(Q)*	I^2
1980–1989	10	5,753	0.203***	0.114	0.334	451.52***	9	98.01
1990–1999	21	14,302	0.174***	0.118	0.248	1538.79***	20	98.70
2000–2009	37	140,151	0.202***	0.158	0.255	4016.29***	36	99.10
Omnibus test for group difference	68	160,206				0.48 n.s	2	

Note. ES = effect size, measured as prevalence rate (PR); *k* = number of independent samples; N = number of patients; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.
n.s = not significant. *** $p \leq .001$.

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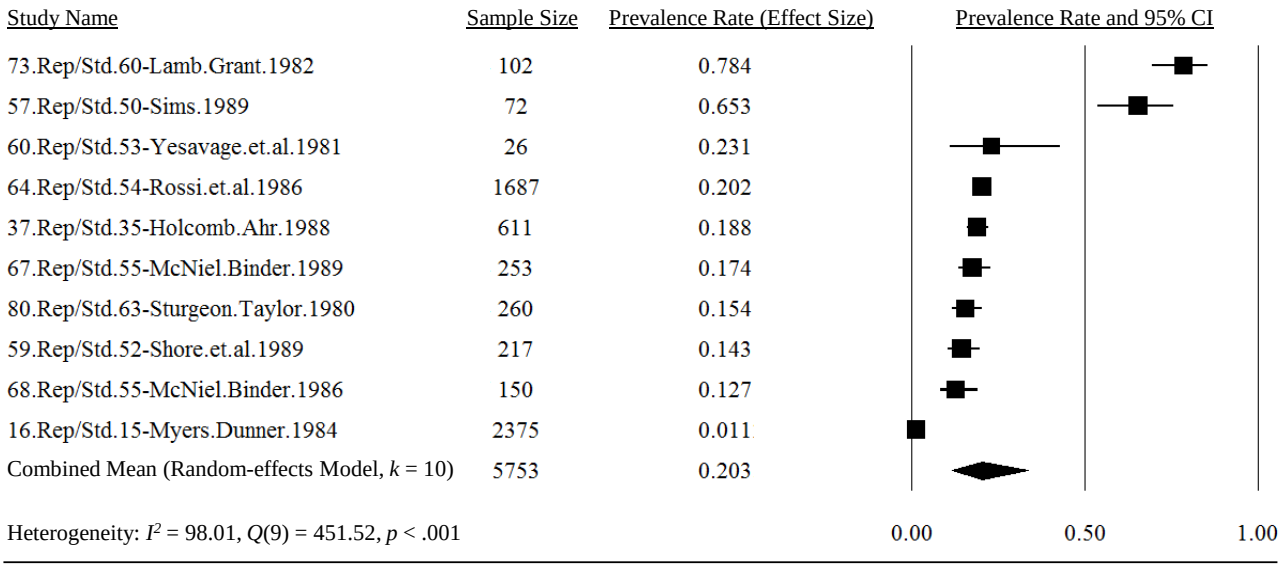

Figure 7a. Prevalence of violence among the mentally disordered patients in the 1980s.
Note. Prevalence rates were sorted by the magnitudes of effects for display. *k* = number of independent samples.

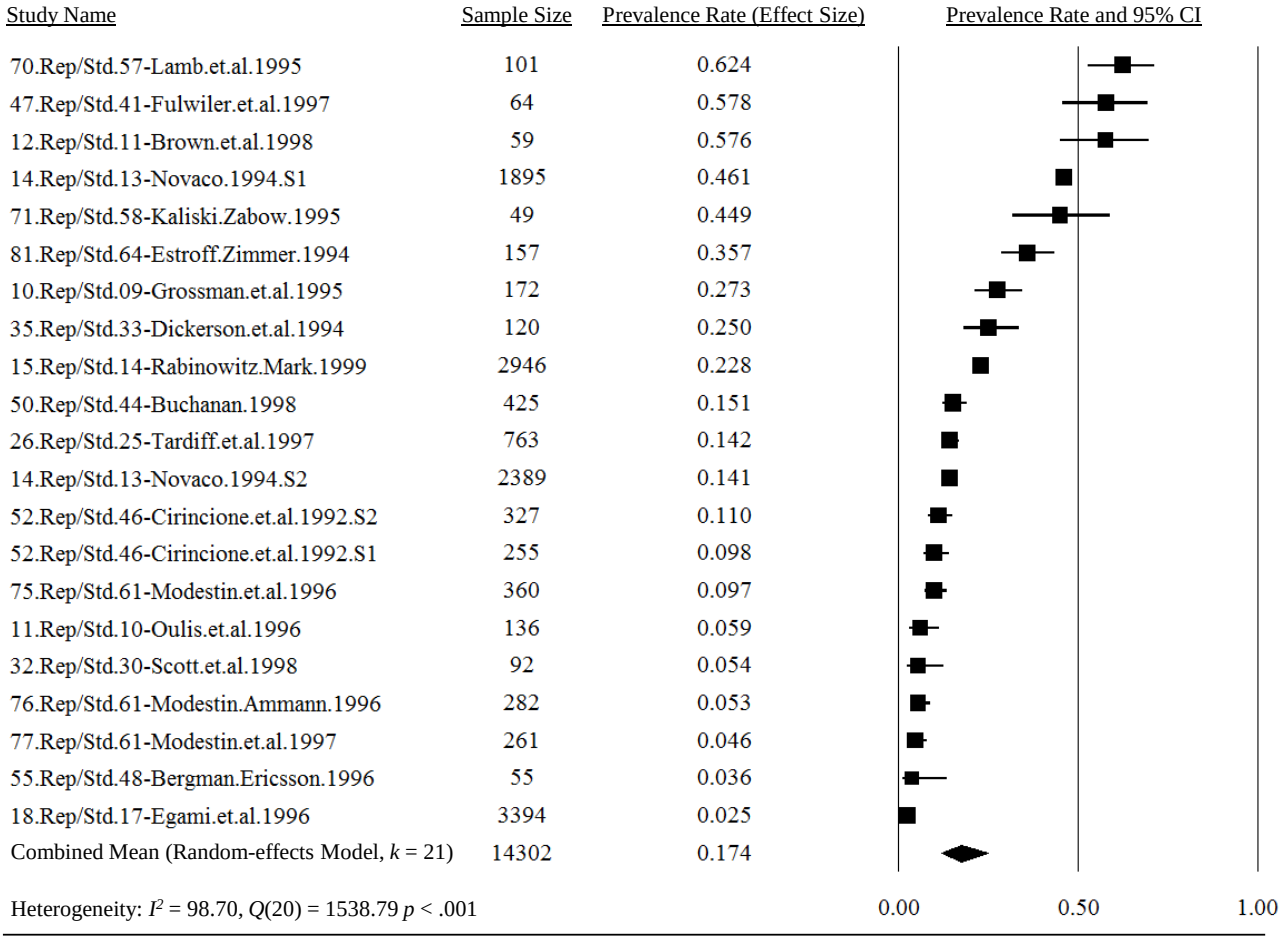

Figure 7b. Prevalence of violence among the mentally disordered patients in the 1990s.
Note. Prevalence rates were sorted by the magnitudes of effects for display. *k* = number of independent samples.

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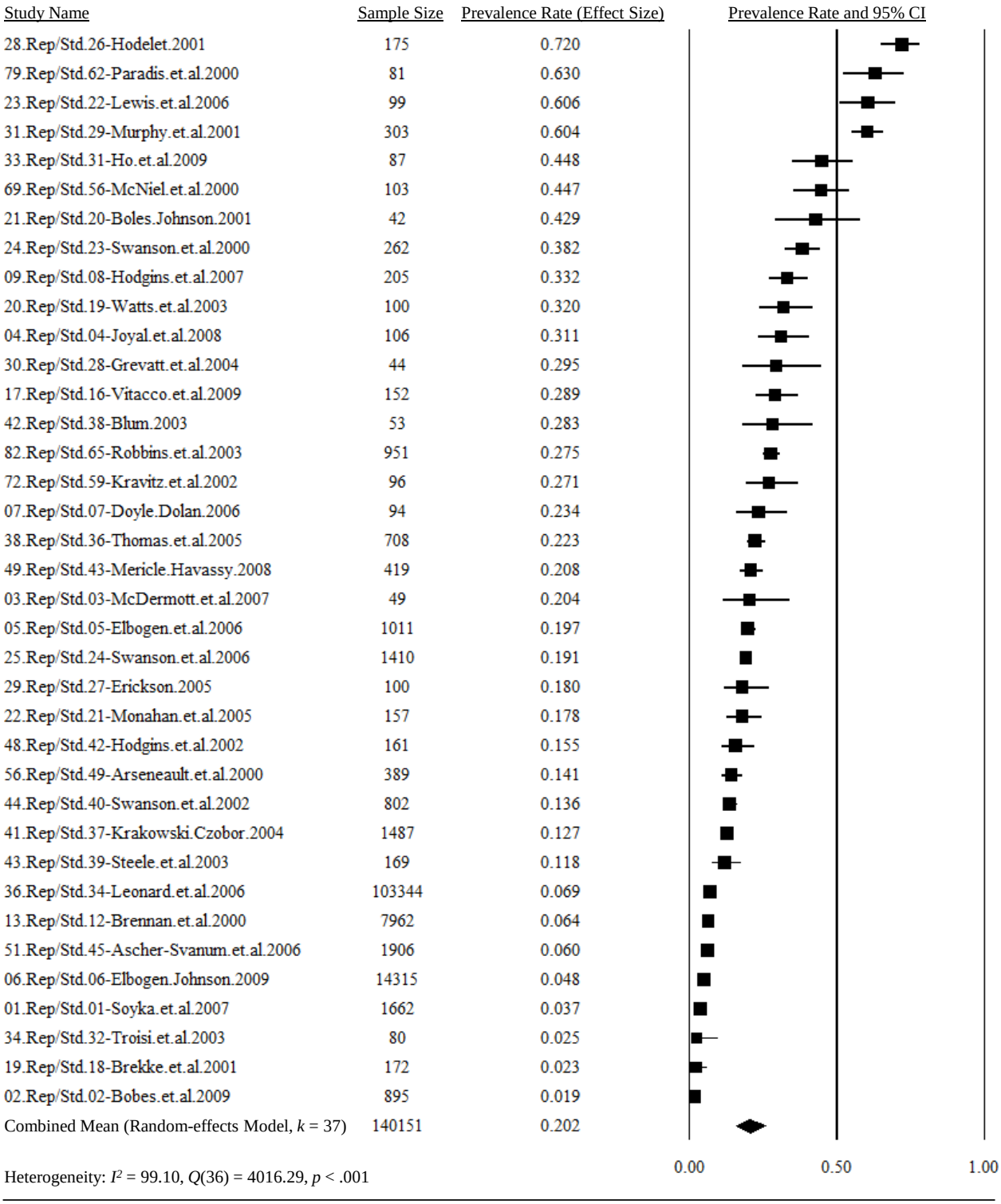

Figure 7c. Prevalence of violence among the mentally disordered patients in the 2000s.
Note. Prevalence rates were sorted by the magnitudes of effects for display. k = number of independent samples.

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Outlier analysis.

As indicated earlier, the prevalence estimates of the first two studies displayed in Figure 1 were considered potential outliers at the outset. However, a sensitivity analysis revealed that the exclusion of those two estimates from the calculation did not have a great impact on the result. Specifically, a slightly lower combined mean rate of 18.1% (95% CI = 14.8–22.1%, k = 66) resulted if the two estimates were removed from the analysis. Compared with the original mean estimate of 19.3% (95% CI = 15.7–23.5%, k = 68), this small amount of reduction in rate was not considered as practically and statistically significant. As such, they were included in all analytic procedures for estimation.

More comprehensively, a series of sensitivity analyses provided no evidence for the likely presence of outliers in this set of data, since the removal of any individual studies from the analysis did not change the result in a significant fashion. As shown in Figure 8, the mean prevalence rate was estimated at 18.7% to 20.0% when a different study was removed from the calculation at each pass. Note that there are 68 studies in Figure 8; however, the statistical information from each row is not the prevalence estimate of that study. Instead, it is the mean prevalence estimate from a (separate) meta-analysis based on 67 studies with that particular study removed from the calculation. For instance, the prevalence rate of 18.7% from the first row is not the estimate from the study "73.Rep/Std.60-Lamb.Grant.1982." Rather, it is the mean prevalence estimate from an independent meta-analysis based on all studies with the exception of "73.Rep/Std.60-Lamb.Grant.1982." Also note that individual prevalence estimates from the 68 studies were first sorted by the magnitudes of effects, from greatest to smallest, for sensitivity analyses.

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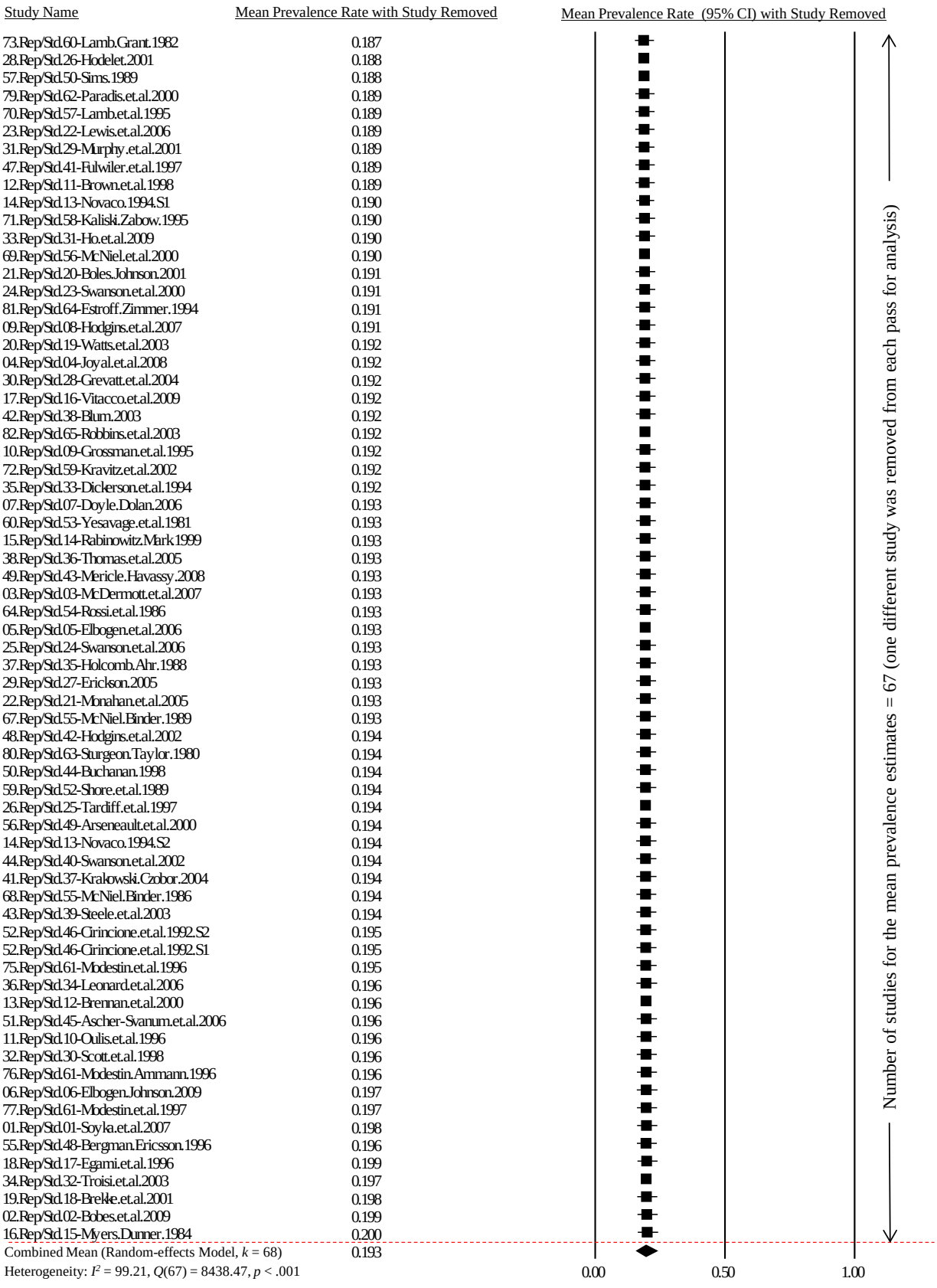

Figure 8. Sensitivity analyses on the prevalence of violence among the mentally disordered patients.

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Publication bias analysis.

In order to assess whether publication bias existed in the present meta-analytic estimation, an analysis was first performed to examine if there is a difference in the combined mean rate between the published and unpublished studies since this is the "only true test for publication bias" (Borenstein et al., 2009, p. 280).[4] There were only two unpublished doctoral dissertations that met the inclusion criteria of this meta-analytic study. The combined mean prevalence estimate from these two dissertations of 46.5% (95% CI = 15.9–80.1%, p = .859) was highly insignificant, as compared with the significant estimate of 18.7% (95% CI = 15.2–22.8%, p < .001, k = 66) from the published studies. However, the difference in rates was not statistically significant (Q(1) = 2.826, p = .093). In fact, the inclusion of the two unpublished studies in the analysis had virtually no impact on the main finding or original mean estimate of 19.3% (95% CI = 15.7–23.5%, k = 68). Specifically, the results demonstrated that the inclusion of the unpublished dissertations only slightly increased the overall estimate (0.6%). Such an increase in rate is minor and would not have any significant implications for clinical attention or policy making.

According to Borenstein et al. (2009), scientific findings have verified that studies with smaller samples are less likely to be published unless a significant result and/or a larger effect has been observed. Formulated differently, studies that reported greater than mean effects have a

[4] Although various statistical tests have been developed for assessing the potential impact of publication bias from different perspectives, it is important to note that all these techniques are based on a strong assumption of the negative relationship between the bias and sample size. Particularly, they have been used for testing if there is a relationship between sample size and effect size. An observed significant association implies the likely presence of bias or small-study effect, and vice versa. However, we can never solely rely on any of these tests for making a conclusive statement on the presence or absence of publication bias. Indeed, it is possible that results from these statistical procedures could be contradictory, largely because they are used to address different questions. Also, the results can reflect the existence of true heterogeneity among studies in that the estimate from smaller studies is systematically different from that of the larger studies. As such, the proper way for assessing bias is to incorporate relevant information from different tests for analysis and to discuss it in context (for details, see Borenstein et al., 2009).

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greater chance to be published. This common source of bias, the so-called small-study effect, must be addressed in any given meta-analysis since it can upwardly bias the overall estimate. One popular approach for assessing this sort of bias is the use of a funnel plot with the trim-and-fill procedure, which was developed by Duval and Tweedie (2000). Generally, this method is intended to examine if studies are systematically missing from the analysis. The basic idea is that bias *may* exist if the funnel plot is asymmetric,[5] as indicated by the fact that studies under review are highly clustered at either side of the mean near the bottom of the plot. If the clustering appears to the right of the mean, it reflects the possible existence of a small-study effect or bias, and that studies at the left (smaller studies with effects less than the mean) are missing from the analysis. Since the traditional funnel plot is a merely subjective means for evaluating the distribution of studies, the trim-and-fill procedure is then applied to estimate the number of missing studies, and the symmetry of the funnel plot is adjusted by imputing the missing studies into the analysis to obtain an "unbiased" or "adjusted" (new) summary effect.

The funnel plot with trim-and-fill estimation for the current meta-analysis is presented in Figure 9. The plot was rather symmetrical, although there were two studies spread out from the mean to the left near the bottom of the plot. This, in fact, indicates that smaller studies with effects less than the mean were included in the analysis which, in turn, suggests the unlikely presence of small-study effect or bias. However, there was a concern of missing studies from the right of the mean for analysis. Using the random-effects model, the trim-and-fill estimation revealed that no studies, either to the right or to the left of the mean, were missing from the present analysis. As a result, the "adjusted" summary effect was identical to the original estimate

[5] It is important to note that even if the funnel plot is evidently asymmetric, this does not confirm the existence of a publication bias, but may reflect heterogeneity in effect sizes. In fact, the shape of the funnel plot can be affected by many factors such as study-related and some other unknown factors (for details, see Borenstein et al., 2009).

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of 19.3% (95% CI = 15.7–23.5%, *k* = 68), represented by the equal diamonds in terms of size and position displayed in Figure 9. Overall, this suggests that the meta-analysis might have captured a representative sample of studies for estimation. In fact, the analysis was based on findings from 68 primary studies which is considered a large quantitative synthesis in the field.

Based on the discussion above, it is reasonable to believe that publication bias did not pose a significant threat to the validity of the findings on the prevalence of violence among mentally disordered patients. If all relevant studies were included in the analysis, the overall estimate would probably remain largely unchanged.

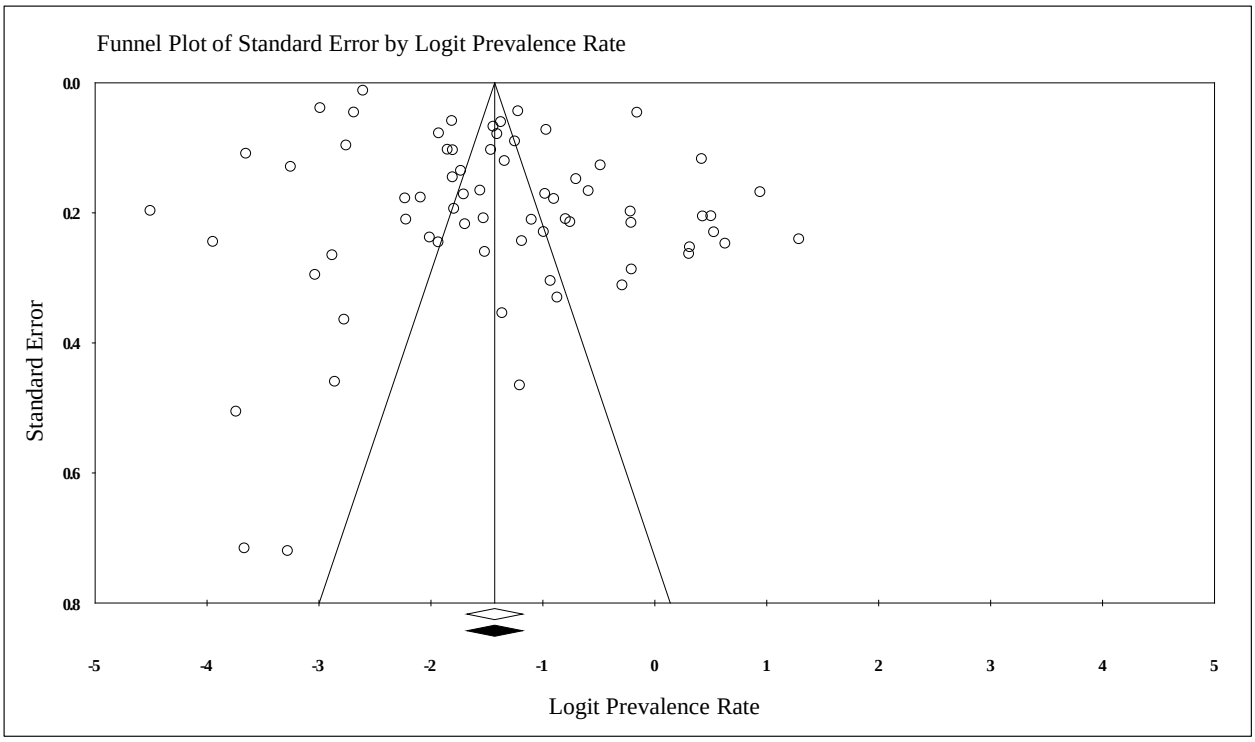

Figure 9. Funnel plot with trim-and-fill estimation.
Note. Open circles = observed studies or studies under review; open diamond = observed mean prevalence rate; filled diamond = trim-and-fill "unbiased" or "adjusted" estimate.
Since the trim-and-fill procedure estimated the number of missing studies at zero, no filled circles (representing imputed studies) were found in the funnel plot.

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Moderator tests.

As reported in Tables 5 through 9, a wide variety of moderator tests at different levels were conducted to identify the sources of heterogeneity in the findings. Specifically, a series of pre-specified potential moderators at the study, sample, and measurement levels were tested to see if they explained the variations in the prevalence estimates across studies by using the *Q*-test and I^2 statistic.

Study-level moderators.

Table 5 shows that three of the six moderators, namely, "nature of the study," "country of data collection," and "duration of data collection," were able to explain some variations across studies although substantial heterogeneity at each level of the moderator variables still existed. With regard to the "nature of the study," non-archival studies (7.3%, $k = 7$, N = 18,990) tended to produce a lower prevalence estimate than those of the pure archival studies (18.9%, $k = 30$, N = 121,390) and studies using mixed methods (23.7%, $k = 29$, N = 15,542), $Q(2) = 9.67$, $p < .01$, $k = 66$, N = 155,922.

The prevalence estimates also differed significantly as a function of "country of data collection" ($Q(4) = 62.66$, $p < .001$, $k = 66$, N = 160,006). The estimate of other European countries (5.6%, $k = 9$, N = 11,774) was substantially lower than that of the United States (21.7%, $k = 42$, N = 142,584), the United Kingdom (22.6%, $k = 9$, N = 1,924), Canada (53.9%, $k = 3$, N = 340), and other countries (24.3%, $k = 3$, N = 3,384). Note that the estimate from Canada was not significantly different from zero which was largely due to the available small-sized sample for analysis.

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With respect to the "duration of data collection," studies with an observation period of 36.01 to 48.00 months yielded the highest estimate (25.5%, k = 6, N = 4,563). With this exception, studies with longer periods of observation (defined as over 12 months) tended to produce a relatively lower prevalence estimate (8.0–17.6%) than studies with a shorter observation period of 12 months or below (23.7%, k = 21, N = 107,020), $Q(5) = 13.88$, $p < .05$, k = 60, N = 155,450.

None of the other three moderators, namely, "study design," "sampling procedure," and "data collection period," explained the variation of the findings in a significant manner.

Sample-level moderators.

Two sets of the moderator variables at sample level were tested. Table 6 presents the results of the socio-demographic and historical variables while Table 7 summarizes the findings pertinent to the clinical aspects of the patients.

In Table 6, a subgroup analysis of "type of patients" revealed that there was a significant difference across groups ($Q(5) = 63.01$, $p < .001$, k = 68, N = 160,206). Specifically, the prevalence of violence among forensic patients (35.6%, k = 10, N = 2,915) was significantly higher than that of non-forensic patients (14.0%, k = 34, N = 28,084) and community residents (5.6%, k = 3, N = 18,098) suggesting that the former group was more violent than the latter. Ten studies that used a mixed sample (N = 6,319) for investigation yielded an overall estimate of 14.8%, which was almost identical to the estimate of 14.0% in studies with non-forensic patients. Although the prevalence rate of criminal suspects or arrestees was the highest (58.4%, k = 5, N = 403), this estimate was not significantly different from zero. Similarly, the relatively high estimate for patients being classified in the categories of others (32.3%, k = 6, N = 104,387) was

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not statistically significant. Also, it should be noted that a considerable amount of heterogeneity remained in all groups of the patients as indicated by the highly significant *Q*-tests (*p*s < .001) and huge I^2 statistics of 89.68 to 99.55.

In addition, meta-regression analyses in Table 6 indicated that "sex" (β = 0.012, p < .01, k = 63, N = 138,158), "race" (β = 0.016, p = .05, k = 42, N = 18,601), "homeless" (β = 0.056, p < .001, k = 15, N = 124,863), "criminal history" (β = 0.021, p < .001, k = 25, N = 12,019), and "history of violence" (β = 0.020, p = .001, k = 20, N = 8,609) had a significant moderator effect on the prevalence estimates. This suggests that male gender, non-white race, homeless, criminal history, and history of violence were potential risk factors for violence. Moreover, it is important to note that the residual or unexplained heterogeneities are still high.

For the remaining four covariates, i.e., "mean age of the sample," "marital status," "education," and "unemployment," no significant moderating effect was observed. Overall, six of the ten moderator variables in this domain were found to be able to explain some variations across studies.

As shown in Table 7, the main feature of the findings with respect to the clinical moderators is that many of these variables such as "percent of patients with primary psychotic disorders in the sample" and "experience of psychotic symptoms or features" did not explain the variability of the prevalence estimates (*p*s > .05). This also implies that the variables or factors were not predictive of violence and that these factors in the clinical domain should not be over-emphasized in risk assessment. In fact, "comorbid substance abuse" (β = 0.015, p < .01, k = 41, N = 145,513) and "involuntary treatment" (β = 0.011, p < .05, k = 20, N = 10,653) were the only two variables found to have a significant moderating effect on the violence estimates.

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Somewhat surprisingly, "percent of patients with primary personality disorders in the sample" did not moderate the prevalence estimates (% transformed in SORT unit, $\beta = 0.090$, $p = .343$, $k = 50$, N = 145,396), although a marginally significant effect was detected if the variable was grouped into three levels for analysis ($Q(2) = 5.57$, $p = .062$, $k = 50$, N = 145,396). Also, several tests on "primary substance abuse disorders" and "any substance use" were not statistically significant. Note that the original unit of some variables, such as "percent of patients diagnosed with a primary personality disorder in the sample," was transformed into its squared root (SQRT) unit for additional meta-regression analysis because of the variables were not normally distributed. Indeed, the goal of conducting a subgroup analysis for those variables was to provide another alternative for dealing with the issue of normality in regression analysis.

Although "psychiatric comorbidity" in general and "comorbid personality disorders" in particular were found to have no moderating effect on the prevalence estimates, the results may be unstable since they were based on a small proportion of the studies for analysis. In fact, it is noteworthy that many studies did not report these two important pieces of information for rigorous estimation.

Measurement-level moderators.

The last two sets of moderator tests conducted were related to the measurement of the two main constructs, namely, mental disorders and violence. Most notably, all but two tests pertinent to the measure of violence were found to have a significant moderating effect on the outcome of interest.

As displayed in Table 8, the subgroup analyses of "diagnostic reliability" ($Q(1) = 5.36$, $p < .05$, $k = 67$, N = 159,787), "diagnostic tool" ($Q(2) = 7.01$, $p < .05$, $k = 68$, N = 160,206), and

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"time of psychiatric diagnosis" ($Q(2) = 57.38$, $p < .001$, $k = 42$, N = 34,046) were all significant, suggesting that these moderators had an impact on the prevalence rates. Regarding "diagnostic reliability," studies tended to produce a higher prevalence estimate if the psychiatric diagnoses of the patients were made by clinicians and/or obtained from relevant institutional records (20.2%, $k = 63$, N = 141,595), as compared with studies that established the diagnoses of the participants without having any confirmation from professionals (8.5%, $k = 4$, N = 18,194). With respect to the use of "diagnostic tool," the overall prevalence estimate from studies using any edition of DSM (23.2%, $k = 30$, N = 28,584) was significantly higher than that of the others (12.6%, $k = 21$, N = 20,219). Note that 17 studies (N = 111,403) did not specify the diagnostic tool applied; this group of studies yielded an overall estimate of 22.8%, which was close to the estimate of the DSM-group. As to "time of psychiatric diagnosis," studies established the diagnoses of participants "before violent incidence" or before the observation of violence yielded the lowest estimate (15.8%, $k = 32$, N = 29,035), whereas a substantially higher estimate was computed for the group of "after violent incidence" (31.8%, $k = 9$, N = 4,912) and the highest estimate was derived from a study using the "mixed" method (60.6%, $k = 1$, N = 99).

The results in Table 9 illustrate that four of the six variables related to the measure of violence were significant moderators of the prevalence estimates: "Type of violence" ($Q(2) = 99.01$, $p < .001$, $k = 35$, N = 22,052), "setting where violence occurred" ($Q(3) = 15.76$, $p = .001$, $k = 59$, N = 154,935), "length of observation" ($Q(7) = 64.94$, $p < .001$, $k = 66$, N = 157,659), and "method of data collection" ($Q(4) = 11.56$, $p < .05$, $k = 65$, N = 155,820).

With regard to the "type of violence" for investigation, 27 studies (N = 18,743) measured the outcome in terms of criminal violence and produced an overall estimate of 18.8%, which was lower than the estimate of 26.8% from seven studies (N = 2,414) that included both criminal and

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non-criminal violence in their measure. Although a significantly lower estimate of 1.9% was obtained from the investigation of non-criminal violence, this was based on the analysis of only one study with N = 895. Note that more than half of the studies (k = 35) did not specify the nature of the outcome for research.

The prevalence estimates also varied as a function of whether the incidents occurred in institutions or in the community. Specifically, it appeared that the violence rate observed in correctional or forensic institutions (28.4%, k = 4, N = 396) was higher than in general inpatient facilities (11.1%, k = 10, N = 110,867) and the community (19.5%, k = 42, N = 42,433), but was similar to the rate observed across different settings (21.6%, k = 3, N = 1,239). Also, it is noteworthy that there was no heterogeneity of estimates in the "correctional or forensic institutions" group (I^2 = 0.00).

Although the "length of observation on violence" was found to have a significant moderating effect on the outcome, the results may be confounded by age. Particularly, a great deal of heterogeneity in all categories of the moderator was identified (I^2 = 90.27–99.68). However, the unavailability of disaggregating data at the individual level makes it difficult to interpret this variable accurately. In fact, the results of the present analysis were also difficult to interpret. Here, the only figure to be highlighted is that studies that measured the outcome at one time point by examining "the nature of the (alleged) offense led to arrest or conviction" produced an extraordinary high estimate of 50.6% (k = 7, N = 621).

The last significant moderator was "method of data collection on violence." Studies that collected the data by means of self-report (13.4%, k = 13, N = 21,616) tended to produce a lower prevalence estimate than the others, ranging from 18.8% (k = 37, N = 126,760) for the group of studies that used institutional records to 27.8% (k = 2, N = 194) for studies using collateral report.

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Summary of the findings of moderator tests.

Half or 18 of the 36 moderator variables at different levels were found to be able to explain some variations in the prevalence estimates across studies. Of particular importance was the finding that the majority of the clinical variables was not related to the outcome of interest. As a matter of fact, the only two significant moderators in relation to the clinical aspects of the patients were “comorbid substance abuse” and “involuntary treatment.” In contrast, all but two moderators at the measurement level were significantly associated with the violence estimates. In sum, these findings suggest that we should avoid over-reliance on clinical variables for risk assessment and management.

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Table 5
Tests of Study-Level Moderators: Study-Related Variables

Moderator variable[a]	*k*	N	Mean ES and 95% CI PR	*LL*	*UL*	Heterogeneity *Q*	*df(Q)*	I^2
Study design								
Cross-sectional: Retrospective	41	135,593	0.202***	0.153	0.263	6713.95***	40	99.40
Longitudinal: Pseudo-prospective/ retro.	14	5,432	0.153***	0.109	0.210	220.30***	13	94.10
Longitudinal: Truly prospective	11	18,928	0.179***	0.096	0.308	1240.14***	10	99.19
Unclear[EX]	2	253	0.450 n.s	0.171	0.764	26.56***	1	96.23
Test for group difference	66	159,953				1.678 n.s	2	
Nature of the study								
Archival	30	121,390	0.189***	0.139	0.252	2600.89***	29	98.88
Non-archival	7	18,990	0.073***	0.032	0.159	318.77***	6	98.12
Mixed	29	15,542	0.237***	0.197	0.283	810.10***	28	96.54
Unclear[EX]	2	4,284	0.272 n.s	0.069	0.655	489.96***	1	99.80
Test for group difference	66	155,922				9.67**	2	
Sampling procedure								
Random	8	18,940	0.177***	0.081	0.342	732.73***	7	99.04
Non-random	53	131,323	0.199***	0.157	0.248	5112.23***	52	98.98
Mixed	5	5,659	0.143***	0.091	0.218	164.71***	4	97.57
Unclear[EX]	2	4,284	0.272 n.s	0.069	0.655	489.96***	1	99.80
Test for group difference	66	155,922				1.76 n.s	2	
Country of data collection								
United States of America	42	142,584	0.217***	0.166	0.278	6714.26***	41	99.39
United Kingdom	9	1,924	0.226***	0.167	0.300	77.91***	8	89.73
Other European countries	9	11,774	0.056***	0.040	0.079	74.27***	8	89.23
Canada	3	340	0.539 n.s	0.282	0.776	41.79***	2	95.21
Others[b]	3	3,384	0.243***	0.151	0.367	28.21***	2	92.91
Unclear[EX]	2	200	0.092 n.s	0.008	0.554	11.81**	1	91.53
Test for group difference	66	160,006				62.66***	4	
Data collection period								
Before 1995	23	23,957	0.129***	0.085	0.192	2372.86***	22	99.07
After 1994	31	133,770	0.201***	0.150	0.265	4544.83***	30	99.34
Unclear[EX]	14	2,479	0.325*	0.209	0.468	333.91***	13	96.11
Test for group difference	54	157,727				3.12 n.s	1	
Duration of data collection								
12.00 months or below	21	107,020	0.237***	0.145	0.361	1765.00***	20	98.87
12.01–24.00 months	8	6,176	0.176***	0.143	0.215	70.07***	7	90.01
24.01–36.00 months	8	7,186	0.080***	0.044	0.140	274.81***	7	97.45
36.01–48.00 months	6	4,563	0.255***	0.182	0.345	144.46***	5	96.54
48.01–60.00 months	7	19,041	0.161***	0.072	0.323	760.94***	6	99.21
60.01 months or above	10	11,464	0.174***	0.084	0.325	879.06***	9	98.98
Unclear[EX]	8	4,756	0.322 n.s	0.173	0.520	622.86***	7	98.88
Test for group difference	60	155,450				13.88*	5	

Note. [a] Pre-specified potential moderator variables or covariates.
[b] "Other countries" refers to New Zealand, Israel, and South Africa.
[EX] The category "Unclear" was excluded from the analysis for testing group differences, but the overall estimate was reported here for completeness and reference.
ES = effect size, measured as prevalence rate (PR); CI = confidence interval; *LL* = lower limit; *UL* = upper limit; *k* = number of independent samples; N = number of patients.
n.s = not significant. * $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

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Table 6
Tests of Sample-Level Moderators: Socio-Demographic and Historical Variables

Moderator variable[a]	*k*	N	Mean ES and 95% CI			Heterogeneity			Reg Coeff[b] and 95% CI		
			PR	*LL*	*UL*	*Q*	*df(Q)*	I^2	β	*LL*	*UL*
Type of patients											
Non-forensic	34	28,084	0.140***	0.109	0.178	1637.51***	33	97.98			
Forensic	10	2,915	0.356**	0.260	0.467	168.55***	9	94.66			
Suspects or arrestees	5	403	0.584 n.s	0.417	0.734	38.77***	4	89.68			
Community residents	3	18,098	0.056***	0.027	0.113	102.93***	2	98.06			
Others	6	104,387	0.323 n.s	0.110	0.648	1113.99***	5	99.55			
Mixed	10	6,319	0.148***	0.109	0.198	184.48***	9	95.12			
Test for group difference	68	160,206				63.01***	5				
Mean age	51	118,812	0.208***	0.162	0.263	4251.99***	50	98.82	0.008 n.s	-0.018	0.033
Sex: Male (%)	63	138,158	0.204***	0.167	0.247	5850.63***	62	98.94	0.012**	0.003	0.021
Race: Non-white (%)	42	18,601	0.246***	0.196	0.304	1874.98***	41	97.81	0.016*	0.000	0.032
Marital status: Single (%)	28	16,440	0.222***	0.172	0.283	1350.47***	27	98.00	0.000 n.s	-0.015	0.014
Education: Below high school (%)	11	8,371	0.181***	0.123	0.258	477.35***	10	97.91	-0.002 n.s	-0.028	0.024
Unemployment (%)	13	109,395	0.292**	0.185	0.427	1640.95***	12	99.27	-0.004 n.s	-0.030	0.022
Homeless (%)	15	124,863	0.207***	0.141	0.294	1884.04***	14	99.26	0.056***	0.036	0.077
Criminal history (%)	25	12,019	0.206***	0.152	0.274	1022.48***	24	97.65	0.021***	0.010	0.031
History of violence (%)	20	8,609	0.181***	0.123	0.257	816.00***	19	97.67	0.020***	0.008	0.032

Note. [a] Pre-specified potential moderator variables or covariates. All covariates were normally distributed with the skewness and kurtosis statistics no more than | 3 |.
[b] Reg Coeff = regression coefficient, applicable to meta-regression analyses only. All the meta-regression estimates reported were bivariate in nature, and the estimation method applied was random-effects model (method of moments).
ES = effect size, measured as prevalence rate (PR); CI = confidence interval; *LL* = lower limit; *UL* = upper limit; *k* = number of independent samples; N = number of patients
n.s = not significant. * $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

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Table 7
Tests of Sample-Level Moderators: Clinical Variables

			Mean ES and 95% CI			Heterogeneity			Reg Coeff[b] and 95% CI		
Moderator variable[a]	*k*	N	PR	*LL*	*UL*	*Q*	*df(Q)*	I^2	β	*LL*	*UL*
Psychotic disorders (%)	50	146,129	0.184***	0.148	0.226	5022.08***	49	99.02	-0.003 n.s	-0.010	0.004
Mood disorders[c] (%)	49	145,977	0.182***	0.146	0.224	4959.83***	48	99.03	-0.001 n.s	-0.013	0.012
Depressive disorders[d] (%)	48	138,046	0.202***	0.161	0.251	5043.97***	47	99.07	-0.013 n.s	-0.036	0.009
Depressive disorders[SQRT] (% transformed in SQRT unit)	48	138,046	0.202***	0.161	0.251	5043.97***	47	99.07	-0.034 n.s	-0.179	0.111
Depressive disorders[+]											
High (29.57–68.58%)	5	17,301	0.116***	0.047	0.259	802.12***	4	99.50			
Medium (7.23–18.81%)	7	3,293	0.289**	0.181	0.427	202.72***	6	97.04			
Low (1.56–4.39%)	6	1,594	0.274***	0.179	0.394	92.60***	5	94.60			
No (0.00%)	30	115,858	0.188***	0.136	0.255	2959.62***	29	99.02			
Test for group difference	48	138,046				5.79 n.s	3				
Bipolar disorders[e] (%)	46	137,838	0.200***	0.158	0.248	4903.10***	45	99.08	0.004 n.s	-0.014	0.022
Bipolar disorders[SQRT] (% transformed in SQRT unit)	46	137,838	0.200***	0.158	0.248	4903.10***	45	99.08	0.055 n.s	-0.075	0.184
Bipolar disorders[+]											
High (27.48–100.00%)	3	572	0.166*	0.038	0.501	64.47	2	96.90			
Medium (8.43–21.88%)	14	6,324	0.272***	0.213	0.340	298.98	13	95.65			
Low (3.85–8.03%)	3	15,049	0.137**	0.037	0.395	322.92	2	99.38			
No (0.00%)	26	115,893	0.178***	0.126	0.245	2729.05	25	99.08			
Test for group difference	46	137,838				5.31 n.s	3				
Personality disorders[f] (%)	50	145,396	0.196***	0.158	0.241	5158.87***	49	99.05	0.024 n.s	-0.027	0.075
Personality disorders[SQRT] (% transformed in SQRT unit)	50	145,396	0.196***	0.158	0.241	5158.87***	49	99.05	0.090 n.s	-0.096	0.276
Personality disorders[++]											
High (7.27–25.00%)	7	2,957	0.200***	0.156	0.253	38.50***	6	84.42			
Low (1.00–6.25%)	7	4,307	0.296***	0.215	0.392	106.38***	6	94.36			
No (0.00%)	36	138,132	0.185***	0.145	0.234	3268.61***	35	98.93			
Test for group difference	50	145,396				5.57#	2				
Substance abuse disorder[g] (%)	51	146,159	0.195***	0.157	0.239	5182.03***	50	99.04	0.006 n.s	-0.005	0.017
Substance abuse disorder[SQRT] (% transformed in SQRT unit)	51	146,159	0.195***	0.157	0.239	5182.03***	50	99.04	0.057 n.s	-0.039	0.153
Substance abuse disorder[+]											
High (39.22–100.00%)	6	15,903	0.203*	0.066	0.478	989.46***	5	99.49			
Medium (10.88–34.86%)	4	2,105	0.239**	0.131	0.394	104.34***	3	97.12			
Low (5.51–8.33%)	4	1,990	0.368 n.s	0.154	0.649	128.27***	3	97.66			
No (0.00%)	37	126,161	0.174***	0.135	0.222	3139.76***	36	98.85			
Test for group difference	51	146,159				3.44 n.s	3				
Any substance use[h] (%)	63	153,874	0.196***	0.160	0.238	6346.68***	62	99.02	0.002 n.s	-0.006	0.011
Experience of psychotic symptoms or features (%)	52	46,510	0.190***	0.151	0.237	3717.32***	51	98.63	0.002 n.s	-0.006	0.010

(table continues)

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Table 7 *(continued)*

Moderator variable[a]	*k*	N	Mean ES and 95% CI PR	*LL*	*UL*	Heterogeneity *Q*	*df(Q)*	I^2	Reg Coeff[b] and 95% CI β	*LL*	*UL*
Psychiatric comorbidity											
Above the mean of 45%	11	2,719	0.246**	0.124	0.430	494.68***	10	97.98			
Below the mean of 45%	13	20,765	0.157***	0.094	0.250	993.09***	12	98.79			
Yes but % unclear	19	122,593	0.151***	0.108	0.206	1800.84***	18	99.00			
Unspecified	25	14,129	0.233***	0.178	0.299	1357.74***	24	98.23			
Test for group difference	68	160,206				5.46 n.s	3				
Psychiatric comorbidity (%)	24	23,484	0.194***	0.127	0.284	1885.18***	23	98.78	0.009 n.s	-0.008	0.027
Comorbid substance abuse (%)	41	145,513	0.166***	0.133	0.206	3462.27***	40	98.84	0.015**	0.004	0.025
Comorbid personality disorder											
Mixed[i] (7.27–59.17%)	13	11,536	0.192***	0.114	0.305	898.64***	12	98.66			
Unspecified	55	148,670	0.193***	0.153	0.241	7454.30***	54	99.28			
Test for group difference	68	160,206				0.00 n.s	1				
Involuntary treatment[g] (%)	20	10,653	0.173***	0.131	0.226	557.46***	19	96.59	0.011*	0.002	0.021

Note. [a] Pre-specified potential moderator variables or covariates. Unless otherwise specified, all covariates were normally distributed with the skewness and kurtosis statistics no more than | 3 |.
[b] Reg Coeff = regression coefficient, applicable to meta-regression analyses only. All meta-regression estimates reported were bivariate in nature, and the estimation method applied was random-effects model (method of moments).
[c] The distribution of the variable "percent of mood disorders" in the sample was slightly kurtotic (Kurtosis statistic = 3.943).
[d] The distribution of the variable "percent of depressive disorders" in the sample was highly kurtotic (Kurtosis statistic = 8.912).
[e] The variable "percent of bipolar disorders" in the sample was not normally distributed (Skewness statistic = 4.202, Kurtosis statistic = 22.495).
[f] The distribution of the variable "percent of personality disorders" in the sample was highly kurtotic (Kurtosis statistic = 10.596).
[g] The distribution of the variable "percent of substance abuse disorders" in the sample was kurtotic (Kurtosis statistic = 7.360).
[h] Any substance use consisted of "occasional use" and "misuse," in addition to having a formal diagnosis of substance abuse disorder.
[i] Two studies did not report the percentage of comorbid personality disorders in the samples.
[SQRT] In order to deal with the issue of normality, the original unit of the variables was transformed into its squared root (SQRT) unit for analysis.
[+] Values with one standard deviation above the mean were classified in the "high" group. The "medium" and "low" groups consisted of the remaining values that were equal or greater than the mean and less than the mean, respectively.
[++] Values with one standard deviation above the mean were classified in the "high" group and the remaining values were categorized in the "low" group.
ES = effect size, measured as prevalence rate (PR); CI = confidence interval; *LL* = lower limit; *UL* = upper limit; *k* = number of independent samples; N = number of patients; PD = personality disorder.
n.s = not significant. # $p \leq .06$. * $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

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Table 8
Tests of Measurement-Level Moderators: Measure of Mental Disorder

Moderator variable[a]	*k*	N	Mean ES and 95% CI			Heterogeneity		
			PR	*LL*	*UL*	*Q*	*df(Q)*	I^2
Diagnostic reliability								
Yes[b]	63	141,593	0.202***	0.163	0.249	7713.25***	62	99.20
No	4	18,194	0.085***	0.039	0.172	176.63***	3	98.30
Test for group difference	67	159,787				5.36*	1	
Diagnostic tool								
Any edition of DSM	30	28,584	0.232***	0.162	0.321	2930.76***	29	99.01
Others[c]	21	20,219	0.126***	0.088	0.178	1178.52***	20	98.30
Unspecified	17	111,403	0.228***	0.140	0.348	3700.05***	16	99.57
Test for group difference	68	160,206				7.01*	2	
Time of psychiatric diagnosis								
Before violent incidence	32	29,035	0.158***	0.115	0.213	2082.05***	31	98.51
After violent incidence	9	4,912	0.318 n.s	0.127	0.599	849.63***	8	99.06
Mixed	1	99	0.606*	0.507	0.697	0.00 n.s	0	0.00
Unclear[EX]	26	126,160	0.192***	0.136	0.264	4857.98***	25	99.49
Test for group difference	42	34,046				57.38***	2	

Note. [a] Pre-specified potential moderator variables.
[b] Psychiatric diagnosis was made by clinicians or obtained from relevant institutional records, such as clinical reports.
[c] Other diagnostic tools consisted of "Any version of International Classification of Diseases & Related Health Problems (ICD, $k = 7$)," "Any version of Diagnostic Interview Schedule (DIS, $k = 3$)," "Research Diagnostic Criteria (RDC, $k = 5$)," "Any mixture of the listed non-DSM diagnostic tools ($k = 3$)" and "Others ($k = 3$)."
[EX] The category "Unclear" was excluded from the analysis for testing group differences, but the overall estimate was reported here for completeness and reference.
ES = effect size, measured as prevalence rate (PR); CI = confidence interval; *LL* = lower limit; *UL* = upper limit; *k* = number of independent samples; N = number of patients
n.s = not significant. * $p \leq .05$. *** $p \leq .001$.

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Table 9
Tests of Measurement-Level Moderators: Measure of Violence

Moderator variable[a]	*k*	N	Mean ES and 95% CI PR	*LL*	*UL*	Heterogeneity *Q*	*df(Q)*	I^2
Used items of validated scale[b]								
Yes	22	12,285	0.180***	0.127	0.247	1059.45***	21	98.02
No	46	147,921	0.200***	0.156	0.253	6577.91***	45	99.32
Test for group difference	68	160,206				0.27 n.s	1	
Type of violence								
Criminal	27	18,743	0.188***	0.127	0.269	2349.22***	26	98.89
Non-criminal	1	895	0.019***	0.012	0.030	0.00 n.s	0	0.00
Mixed	7	2,414	0.268***	0.206	0.341	65.78***	6	90.88
Unclear[EX]	33	138,154	0.198***	0.151	0.255	4134.59***	32	99.23
Test for group difference	35	22,052				99.01***	2	
Type of criminal records								
Arrest	10	9,864	0.212***	0.119	0.350	525.50***	9	98.29
Charge	2	253	0.171 n.s	0.003	0.931	58.98***	1	98.30
Conviction/ incarceration/ hospitalization	12	3,953	0.162***	0.085	0.288	483.17***	11	97.72
Unclear[EX]	3	4,673	0.222*	0.074	0.505	536.17***	2	99.63
Test for group difference	24	14,070				0.41 n.s	2	
Setting where violence occurred								
Community	42	42,433	0.195***	0.143	0.259	4720.94***	41	99.13
General inpatient facilities	10	110,867	0.111***	0.065	0.184	1231.60***	9	99.27
Correctional or forensic institutions	4	396	0.284***	0.241	0.330	1.59 n.s	3	0.00
Mixed	3	1,239	0.216**	0.108	0.384	47.46***	2	95.79
Unclear[EX]	9	5,271	0.259***	0.154	0.401	463.56***	8	98.27
Test for group difference	59	154,935				15.76***	3	
Length of observation								
Below 12.00 months	21	112,537	0.169***	0.123	0.227	1553.90***	20	98.71
12.00 months	9	5,809	0.288***	0.202	0.392	321.92***	8	97.51
12.01–24.00 months	4	1,052	0.292***	0.195	0.412	30.82***	3	90.27
24.01–60.00 months	5	16,745	0.063***	0.040	0.096	58.19***	4	93.13
Above 60.00 months	7	3,100	0.122***	0.073	0.195	105.48***	6	94.31
Lifetime (since age 18)	5	1,578	0.136***	0.058	0.286	117.44***	4	96.59
Lifetime	8	16,217	0.239*	0.103	0.463	2194.52***	7	99.68
Nature of index offense[c]	7	621	0.506 n.s	0.357	0.653	73.96***	6	91.89
Unclear[EX]	2	2,547	0.061 n.s	0.002	0.672	182.34***	1	99.45
Test for group difference	66	157,659				64.94***	7	
Method of data collection								
Institutional records	37	126,760	0.188***	0.146	0.239	3268.20***	36	98.90
Self-report	13	21,616	0.134***	0.080	0.218	952.08***	12	98.74
Collateral report	2	194	0.278***	0.202	0.370	1.77 n.s	1	43.54
Mixed (2 sources)	8	5,072	0.191**	0.086	0.370	660.49***	7	98.94
Mixed (3 sources)	5	2,178	0.269***	0.221	0.324	24.11***	4	83.41
Unclear[EX]	3	4,386	0.440 n.s	0.165	0.757	562.62***	2	99.64
Test for group difference	65	155,820				11.56*	4	

Note. [a] Pre-specified potential moderator variables.
[b] All studies defined specific violent acts for investigation; 32.35% (k = 22) adopted certain items from validated scales, such as Conflict Tactics Scale and Overt Aggression Scale, for research.
[c] Seven studies measured the outcome at one time point by examining "the nature of the (alleged) offense led to arrest or convictions."
[EX] The category "Unclear" was excluded from the analysis for testing group differences, but the overall estimate was reported here for completeness and reference.
ES = effect size, measured as prevalence rate (PR); CI = confidence interval; *LL* = lower limit; *UL* = upper limit; k = number of independent samples; N = number of patients.
n.s = not significant. * $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

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Risk Factors for Violence among Adults with Mental Disorders

Main analyses.

A total of 36 risk factors for violence from the four domains of the public health taxonomy were identified for meta-analysis. Specifically, 10 factors in the dispositional domain, 11 factors in the historical domain, 2 factors in the contextual domain, and 13 factors in the clinical domain were available for quantitative synthesis. The number of studies or independent samples (*k*) available for estimating the effect of individual risk factors for violence ranged from 2 to 24 (ten risk factors with $k > 10$ and only four with $k = 2$). Apart from the mean effect size with the 95% confidence interval and tests of heterogeneity, the 95% prediction interval was also calculated for risk factors with $k \geq 3$.[6] These results were presented in Tables 10 through 13.

It is important to note that a meta-analytic synthesis of a limited number of studies with very different characteristics should be read with caution since the estimates are largely unstable (Valentine et al., 2010). In view of the theoretical and clinical relevance, however, those estimates were reported here only for reference and completeness. This, in fact, also provides useful information for future study in the sense that those risk factors are under-researched. With this caveat in mind, the relative strength of some risk factors ranked in Table 14 should be read as preliminary findings instead of robust estimations. Equally important, some potential risk factors with $k = 1$ that were listed at the end of this section should not be overlooked in future investigation.

[6] Note that the 95% prediction interval was able to be calculated for risk factors based on the estimation of at least three studies, since the degrees of freedom (*df*) for calculation is "often taken as the number of studies minus 2 (that is, $k - 2$)" (Borenstein et al., 2009, p.130).

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Dispositional factors.

The results in Table 10 show that four of the following 10 dispositional factors with $k \geq$ 12 were found to have a small albeit significant effect[7] on violence (*OR* = 1.215–1.831, *p*s < .01): "Male gender" (*OR* = 1.831, *k* = 22), "non-white race" (*OR* = 1.739, *k* = 14), "younger age" (*OR* = 1.389, *k* = 21), and "lower education level" (*OR* = 1.215, *k* = 12). Tests of heterogeneity indicated that there was a high level of variation for "sex" (I^2 = 92.50) and "age" (I^2 = 90.98), in addition to low and medium levels of heterogeneity for "education" (I^2 = 35.81) and "race" (I^2 = 52.30), respectively.[8] "Marital status" (*OR* = 1.021, *p* = .846, *k* = 13) virtually had no effect on violence but a medium level of heterogeneity of effects (I^2 = 57.86) was identified.

"Lower socio-economic status" (*OR* = 2.627, *p* < .001) and "anger" (*d* = 0.661 or *OR* = 3.052, *p* = .001) yielded a moderate association with violence; however, both estimates were only based on findings from four studies (i.e., *k* = 4). Similarly, the observed small effect of "neurological impairment" (*OR* = 1.356, *p* = .004) was derived from the estimation of four independent samples or studies. Although no evidence of heterogeneity for "neurological impairment" (I^2 = 0.00) was revealed, a small amount of variation for "socio-economic status" (I^2 = 11.87) and a substantial level of heterogeneity for "anger" (I^2 = 95.77) were found.

Findings for the remaining two factors, namely, "lower income level" (*OR* = 1.656, *p* = .078) and "impulsiveness" (*d* = 0.064, *p* = .586), should be read with great caution since these are unstable estimates based on the minimum number of studies (i.e., *k* = 2) required for a meta-analysis (Valentine et al., 2010). Particularly, a large I^2 statistic of 74.60 was observed for

[7] According to Cohen (1988), a small effect size can be defined as having a *d* of 0.20, an *r* of 0.10, or an *OR* of 1.50. A large effect refers to having a *d* of 0.80, an *r* of 0.50, or an *OR* of 4.30. The medium effect of a *d* of 0.50, an *r* of 0.30, or an *OR* of 2.50 fell between the two extreme values of each index.

[8] The quantification of heterogeneity by Higgins and Thompson (2002): No heterogeneity (I^2 = 0); low heterogeneity (I^2 = 25); medium heterogeneity (I^2 = 50); and high heterogeneity (I^2 = 75).

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"income" although a low level of heterogeneity of an I^2 of 21.70 was detected for "impulsiveness."

In sum, regardless of the variations across studies and the use of a small number of studies for the estimation of some risk factors, the most predictive factor for violence in the dispositional domain was "anger" (*OR* = 3.052, as derived from converting *d* to *OR*), followed by "socio-economic status" (*OR* = 2.627), sex (*OR* = 1.831), "race" (*OR* = 1.739), "age" (*OR* = 1.389), "neurological impairment" (*OR* = 1.356), and "education" (*OR* = 1.215).

Historical factors.

As summarized in Table 11, nearly half or five of the 11 risk factors in the historical domain were found to have a highly significant medium to large effect on violence ($ps \leq .001$): "Violent victimization" (*OR* = 3.897, *k* = 3), "childhood conduct disorder or problems" (*OR* = 3.507, *k* = 4), "history of violence" (*OR* = 3.011, *k* = 9), "criminal history" (*OR* = 2.769, *k* = 8), and "earlier onset of mental disorder" (*OR* = 2.007, *k* = 7). "Involuntary psychiatric hospitalization" (*OR* = 1.505, *p* = .004, *k* = 5) and "prior psychiatric hospitalization" (*OR* = 1.377, *p* = .030, *k* = 8) produced significant small-sized effects. The remaining four factors, namely, "unemployment," "self-harm behavior," "duration of psychiatric hospitalization," and "being a child abuse victim," were not predictive of violence ($ps > .05$). These estimations, however, should be carefully interpreted since some of them were based on the results of a limited number of studies of $k < 5$. Additionally, moderate and high levels of heterogeneity in findings were identified (I^2 ranged from 46.53 to 91.00).

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Contextual factors.

There were only two contextual factors available for meta-analysis. The results in Table 12 show that a rather moderate size of mean effect was observed for both risk factors of interest: "Homeless" (*OR* = 2.228, *p* = .001, *k* = 6) and "living with family" (*OR* = 2.207, *p* < .001, *k* = 3). Tests of heterogeneity indicated that there was a great deal of variability of effects in "homeless" (I^2 = 80.87), while little variation across studies was evidenced in "living with family" (I^2 = 8.28). Again, these are not robust estimations since they were based on a small number of studies for quantitative review.

Clinical factors.

The majority of the risk factors (10 out of 13) in the clinical domain were found to have a significant or marginally significant relationship with violence (*p*s < .09). Specifically, the results in Table 13 illustrate that "psychopathy" (*OR* = 2.566, *p* = .002, *k* = 4) and "psychiatric comorbidity" (*OR* = 2.271, *p* < .001, *k* = 14) had a significant medium effect on violence. A highly significant albeit smaller effect resulted for "substance abuse" (*OR* = 1.868, *p* < .001, *k* = 24) and "psychiatric symptoms" (*OR* = 1.859, *p* < .001, *k* = 22). The small average effect of two risk factors referring to a similar concept was almost identical; they are "lower level of functioning" (*OR* = 1.772, *p* < .001, *k* = 8) and "higher severity level of mental disorder" (*OR* = 1.745, *p* = .010, *k* = 3). Another three related variables estimated in a small number of studies produced significant or marginally significant small to medium effects on violence: "Negative perception of treatment need" (*OR* = 2.282, *p* < .001, *k* = 3), "treatment non-compliance" (*OR* = 1.710, *p* = .022, *k* = 5), and "lack of insight on mental disorder" (*OR* = 1.234, *p* = .087, *k* = 3).

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The most important and interesting finding in the clinical domain is that "psychotic disorders" was not significantly related to violence (*OR* = 1.021, *p* = .897, *k* = 19) although it was estimated along with a huge I^2 of 88.81. Not surprisingly, a marginally significant negative association between mood disorders and violence was observed (*OR* = 0.737, *p* = .063, *k* = 11), again with a large I^2 of 84.82.

Neither "duration of mental disorder" (*d* = –0.005, p = .975, *k* = 4) nor "personality disorders" (*OR* = 1.059, *p* = .839, *k* = 2) predicted violent behavior. It is noteworthy that virtually no evidence of heterogeneity was observed for these two factors in that an I^2 of 2.35 and 0.00 was recorded for "duration of mental disorder" and "personality disorders," respectively. With the exception of these two factors, however, a moderate to high level of heterogeneity of effects were identified for all other risk factors of interest, as indicated by the I^2 statistics of 44.55 to 93.03. Another caveat is that nearly half or six of the risk factors in this domain were analyzed with a limited number of studies of $k < 5$.

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Table 10
Mean Effect of Dispositional Factors for Violence

			Effect size and 95% CI				Test of null (two-tailed)		Heterogeneity				95% PI	
Risk factor	*k*	N	*Cohen's d*	*OR*	*LL*	*UL*	*z*	*p*	*Q*	*df(Q)*	*p*	I^2	*LL*	*UL*
Sex (Male)	22	24,130		1.831	1.305	2.568	3.502	.000	280.09	21	.000	92.50	0.382	8.783
Age (Younger)	21	15,405		1.389	1.080	1.786	2.564	.010	221.83	20	.000	90.98	0.442	4.363
Race (Non-white)	14	8,007		1.739	1.442	2.099	5.775	.000	27.26	13	.011	52.30	0.998	3.031
Marital status (Single)	13	12,192		1.021	0.827	1.260	0.195	.846	28.48	12	.005	57.86	0.535	1.947
Education (Lower)	12	8,346		1.215	1.040	1.418	2.457	.014	17.14	11	.104	35.81	0.826	1.787
Income (Lower)	2	1,665		1.656	0.944	2.903	1.761	.078	3.94	1	.047	74.60	–	–
Socio-economic status (Lower)	4	6,760		2.627	1.937	3.564	6.209	.000	3.40	3	.333	11.87	1.076	6.411
Anger[a] ($\overline{X}_{violent} - \overline{X}_{non\text{-}violent}$)	4	5,469	0.661		0.271	1.050	3.327	.001	70.88	3	.000	95.77	-1.159	2.481
Impulsiveness[b] ($\overline{X}_{violent} - \overline{X}_{non\text{-}violent}$)	2	988	0.064		-0.167	0.296	0.545	.586	1.28	1	.258	21.70	–	–
Neurological impairment	4	1,772		1.356	1.101	1.671	2.859	.004	1.51	3	.680	0.00	0.864	2.129

Note. *k* = number of independent samples; N = number of patients; *Cohen's d* = standardized mean difference; *OR* = odds ratio; CI = confidence interval; *LL* = lower limit; *UL* = upper limit; PI = prediction interval (only calculated for risk factors with $k \geq 3$).
[a] Although it is not ideal, the original point estimate of $d = 0.661$ was transformed, via an r of 0.294, to an *OR* of 3.052 (95% CI = 2.760, 3.375) for overall comparison.
[b] Although it is not ideal, the original point estimate of $d = 0.064$ was transformed, via an r of 0.032, to an *OR* of 1.123 (95% CI = 0.895, 1.409) for overall comparison.

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Table 11
Mean Effect of Historical Factors for Violence

			Effect size and 95% CI			Test of null (two-tailed)		Heterogeneity				95% PI	
Risk factor	*k*	N	*OR*	*LL*	*UL*	*z*	*p*	*Q*	*df(Q)*	*p*	I^2	*LL*	*UL*
Unemployment	6	4,099	1.227	0.845	1.783	1.074	.283	15.27	5	.009	67.26	0.400	3.764
History of violence	9	2,826	3.011	1.960	4.625	5.031	.000	25.33	8	.001	68.41	0.807	11.233
Self-harm behavior	5	2,309	1.891	0.813	4.400	1.480	.139	44.47	4	.000	91.00	0.080	44.576
Criminal history	8	4,745	2.769	1.926	3.982	5.495	.000	24.96	7	.001	71.95	0.917	8.362
Earlier onset of mental disorder	7	5,777	2.007	1.505	2.676	4.742	.000	21.06	6	.002	71.51	0.833	4.835
Prior psychiatric hospitalization	8	4,967	1.377	1.031	1.840	2.166	.030	25.61	7	.001	72.67	0.572	3.316
Involuntary psychiatric hospitalization	5	3,328	1.505	1.142	1.984	2.902	.004	7.48	4	.113	46.53	0.686	3.303
Duration of psychiatric hospitalization (Longer)	2	2,263	1.287	0.804	2.059	1.051	.293	5.67	1	.017	82.38	–	–
Violent victimization	3	2,919	3.897	2.254	6.736	4.870	.000	3.94	2	.139	49.24	0.014	1050.172
Child abuse victim	4	3,291	1.377	0.780	2.431	1.103	.270	28.91	3	.000	89.62	0.102	18.662
Childhood conduct disorder or problems	4	1,980	3.507	1.860	6.614	3.878	.000	17.26	3	.001	82.61	0.222	55.321

Note. *k* = number of independent samples; N = number of patients; *OR* = odds ratio; CI = confidence interval; *LL* = lower limit; *UL* = upper limit; PI = prediction interval (only calculated for risk factors with $k \geq 3$).

Table 12
Mean Effect of Contextual Factors for Violence

			Effect size and 95% CI			Test of null (two-tailed)		Heterogeneity				95% PI	
Risk factor	*k*	N	*OR*	*LL*	*UL*	*z*	*p*	*Q*	*df(Q)*	*p*	I^2	*LL*	*UL*
Homeless	6	4,182	2.228	1.364	3.638	3.200	.001	26.14	5	.000	80.87	0.438	11.327
Living with family	3	1,808	2.207	1.664	2.926	5.496	.000	2.18	2	.336	8.28	0.254	19.210

Note. *k* = number of independent samples; N = number of patients; *OR* = odds ratio; CI = confidence interval; *LL* = lower limit; *UL* = upper limit; PI = prediction interval.

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Table 13
Mean Effect of Clinical Factors for Violence

			Effect size and 95% CI				Test of null (two-tailed)		Heterogeneity				95% PI	
Risk factors	*k*	N	*Cohen's d*	*OR*	*LL*	*UL*	*z*	*p*	*Q*	*df(Q)*	*p*	I^2	*LL*	*UL*
Psychotic disorders	19	19,248		1.021	0.746	1.398	0.130	.897	160.85	18	.000	88.81	0.265	3.929
Mood disorders	11	27,614		0.737	0.535	1.017	-1.857	.063	65.86	10	.000	84.82	0.241	2.258
Personality disorders	2	689		1.059	0.608	1.845	0.204	.839	0.04	1	.832	0.00	–	–
Psychiatric comorbidity	14	130,133		2.271	1.827	2.822	7.395	.000	77.19	13	.000	83.16	1.125	4.585
Psychiatric symptoms	22	111,926		1.859	1.384	2.497	4.123	.000	301.18	21	.000	93.03	0.484	7.138
Psychopathy	4	1,168		2.566	1.425	4.623	3.139	.002	9.99	3	.019	69.98	0.220	29.934
Level of functioning (Lower)	8	6,476		1.772	1.383	2.271	4.524	.000	28.08	7	.000	75.07	0.830	3.782
Severity of mental disorder (Higher)	3	2,009		1.745	1.141	2.670	2.566	.010	5.18	2	.075	61.35	0.018	173.405
Substance abuse	24	32,801		1.868	1.433	2.434	4.618	.000	166.26	23	.000	86.17	0.568	6.149
Lack of insight on mental disorder	3	4,009		1.234	0.970	1.569	1.711	.087	3.61	2	.165	44.55	0.115	13.295
Treatment non-compliance	5	4,919		1.710	1.082	2.702	2.297	.022	28.44	4	.000	85.94	0.318	9.184
Perceived treatment need (Negative perception)	3	2,176		2.282	1.594	3.269	4.503	.000	4.18	2	.124	52.16	0.054	96.819
Duration of mental disorder[a] ($\overline{X}_{violent} - \overline{X}_{non\text{-}violent}$)	4	847	-0.005		-0.197	0.187	-0.054	.957	3.07	3	.381	2.35	-0.456	0.446

Note. *k* = number of independent samples; N = number of patients; *Cohen's d* = standardized mean difference; *OR* = odds ratio; CI = confidence interval; *LL* = lower limit; *UL* = upper limit; PI = prediction interval (only calculated for risk factors with $k \geq 3$).
[a] Although it is not ideal, the original point estimate of *d* = -0.005 was transformed, via an *r* of 0.006, to an *OR* of 1.022 (95% CI = 0.800, 1.305) for overall comparison.

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Relative strength of the 36 risk factors in the four domains.

In view of the pressing need for searching for potential predictors of violence for risk assessment and management, the relative strength of the 36 risk factors in the four domains was ranked in Table 14 for overall comparison and reference. Note here again that some of the estimates may not be stable or robust since the number of studies available for meta-analysis was very limited and the observed heterogeneity was high. With this in mind, it appears that the strongest predictor of violence among all factors under review was "violent victimization" (*OR* = 3.897) and the least predictive factors of violence were "psychotic disorders" (*OR* = 1.021) and "marital status" (*OR* = 1.021).

Results in Table 14 also reveal that four of the top five risk factors for violence were from the historical domain and one belonged to the dispositional domain. This suggests that more attention should be paid to the life history of patients at the time of assessing risk although other factors should not be overlooked. In contrast, among the five risk factors ranked at the bottom, four were from the clinical domain and one was a dispositional factor. This suggests that violence risk assessment should not heavily rely on the traditional psychopathological model. With respect to future research, more attention should be given to risk factors with $k < 10$ for analysis. Additionally, more factors in the contextual domain should be identified for investigation.

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Table 14
A Summary of the Relative Strength of the 36 Risk Factors in the Four Domains

Risk factor	*k*	N	Mean effect size *Cohen's d*	Mean effect size *OR*	Test of null (two-tailed) *z*	Test of null (two-tailed) *p*	Heterogeneity I^2	Factor Domain
Violent victimization	3	2,919		3.897	4.870	.000	49.24	Historical
Childhood conduct disorder or problems	4	1,980		3.507	3.878	.000	82.61	Historical
Anger[a] ($\overline{X}_{violent} - \overline{X}_{non\text{-}violent}$)	4	5,469	0.661	3.052	3.327	.001	95.77	Dispositional
History of violence	9	2,826		3.011	5.031	.000	68.41	Historical
Criminal history	8	4,745		2.769	5.495	.000	71.95	Historical
Socio-economic status (Lower)	4	6,760		2.627	6.209	.000	11.87	Dispositional
Psychopathy	4	1,168		2.566	3.139	.002	69.98	Clinical
Perceived treatment need (Negative perception)	3	2,176		2.282	4.503	.000	52.16	Clinical
Psychiatric comorbidity	14	130,133		2.271	7.395	.000	83.16	Clinical
Homeless	6	4,182		2.228	3.200	.001	80.87	Contextual
Living with family	3	1,808		2.207	5.496	.000	8.28	Contextual
Earlier onset of mental disorder	7	5,777		2.007	4.742	.000	71.51	Historical
Self-harm behavior	5	2,309		1.891	1.480	.139	91.00	Historical
Substance abuse	24	32,801		1.868	4.618	.000	86.17	Clinical
Psychiatric symptoms	22	111,926		1.859	4.123	.000	93.03	Clinical
Sex (Male)	22	24,130		1.831	3.502	.000	92.50	Dispositional
Level of functioning (Lower)	8	6,476		1.772	4.524	.000	75.07	Clinical
Severity of mental disorder (Higher)	3	2,009		1.745	2.566	.010	61.35	Clinical
Race (Non-white)	14	8,007		1.739	5.775	.000	52.30	Dispositional
Treatment non-compliance	5	4,919		1.710	2.297	.022	85.94	Clinical
Income (Lower)	2	1,665		1.656	1.761	.078	74.60	Dispositional
Involuntary psychiatric hospitalization	5	3,328		1.505	2.902	.004	46.53	Historical
Age (Younger)	21	15,405		1.389	2.564	.010	90.98	Dispositional
Prior psychiatric hospitalization	8	4,967		1.377	2.166	.030	72.67	Historical
Child abuse victim	4	3,291		1.377	1.103	.270	89.62	Historical
Neurological impairment	4	1,772		1.356	2.859	.004	0.00	Dispositional
Duration of psychiatric hospitalization (Longer)	2	2,263		1.287	1.051	.293	82.38	Historical
Lack of insight on mental disorder	3	4,009		1.234	1.711	.087	44.55	Clinical
Unemployment	6	4,099		1.227	1.074	.283	67.26	Historical
Education (Lower)	12	8,346		1.215	2.457	.014	35.81	Dispositional
Impulsiveness[b] ($\overline{X}_{violent} - \overline{X}_{non\text{-}violent}$)	2	988	0.064	1.123	0.545	.586	21.70	Dispositional
Personality disorders	2	689		1.059	0.204	.839	0.00	Clinical
Duration of mental disorder[c] ($\overline{X}_{violent} - \overline{X}_{non\text{-}violent}$)	4	847	-0.005	1.022	-0.054	.957	2.35	Clinical
Psychotic disorders	19	19,248		1.021	0.130	.897	88.81	Clinical
Marital status (Single)	13	12,192		1.021	0.195	.846	57.86	Dispositional
Mood disorders	11	27,614		0.737	-1.857	.063	84.82	Clinical

[a] The original point estimate of d = 0.661 was transformed, via an r of 0.294, to an *OR* of 3.052 for overall comparison.
[b] The original point estimate of d = 0.064 was transformed, via an r of 0.032, to an *OR* of 1.123 for overall comparison.
[c] The original point estimate of d = -0.005 was transformed, via an r of 0.006, to an *OR* of 1.022 for overall comparison.

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Publication bias analysis.

In order to detect the potential threat of publication bias, trim-and-fill analyses for 32 risk factors meta-analyzed with $k \geq 3$ were performed. Note that the trim-and-fill analysis is only applicable to risk factors with an observation of $k \geq 3$. Since four of the 36 risk factors under review were based on the estimation of two studies ($k = 2$), such an analysis was not available for the factors. Results in Table 15 show that 10 risk factors were estimated to have more than one study missing on the left side of the mean. This suggests that the observed mean effects were overestimated and that the likely impact of including the proposed number of missing studies in the calculation would reduce the effects accordingly. For instance, the number of missing studies for "race" was estimated at four (N = 4), all to the left of the mean, and the inclusion of these four studies in the analysis would bring down the effect by 0.237, or specifically, from 1.739 to 1.502.

Moreover, two risk factors were estimated with more than one study missing; this time, on the right side of the mean. This suggests that the combined mean effects of 1.356 for "neurological impairment" and of 1.505 for "involuntary psychiatric hospitalization" were underestimated, and that the inclusion of the proposed two missing studies for analysis would increase the effects to 1.431 and 1.689, respectively. However, it should be noted that one of the limitations of the trim-and-fill procedure is that it may impute studies that are not actually missing if heterogeneity of effects is evident, since many other factors can alter the shape of the funnel plot (Borenstein et al., 2009). In sum, the trim-and-fill analyses reveal that publication bias has little or no impact on the current overall estimates of the risk factors in that "violent victimization" was the only factor estimated to have a negative change of greater than one point, or specifically –1.207.

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Also, publication bias in favor of positive or significant findings is believed to be less likely to exist in this research area; this is largely due to the fact that many studies tended to compare the predictive power of a set of risk factors for violence (Douglas et al., 2009). Specifically, if some factors were found to be insignificantly related to violence, the manuscript would still have a greater chance to be accepted for publication if other factor(s) were significant. This belief, indeed, was strongly supported by the literature review conducted for this meta-analytic study that revealed that conflicting findings of almost all risk factors are pervasive and evident. Based on the above analysis, it appears that publication bias does not pose a threat to the validity of the results.

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Table 15
Assessment of Publication Bias on the 32 Risk Factors for Violence: Results of the Trim-and-Fill Analysis[a]

Risk factor	*k*	Imputed studies N	Imputed studies Direction	Obs. MES *Cohen's d*	Obs. MES *OR*	Adj. MES	Change	Strength change
Demographic factor								
Sex (Male)	22	0	–		1.831	1.831	0.000	0.000
Age (Younger)	21	0	–		1.389	1.389	0.000	0.000
Race (Non-white)	14	4	Left		1.739	1.502	-0.237	-0.237
Marital status (Single)	13	2	Left		1.021	0.962	-0.059	-0.059
Education (Lower)	12	3	Left		1.215	1.149	-0.066	-0.066
Socio-economic status (Lower)	4	1	Right		2.627	2.720	0.093	0.093
Anger ($\overline{X}_{violent} - \overline{X}_{non\text{-}violent}$)	4	0	–	0.661		0.661	0.000	0.000
Neurological impairment	4	2	Right		1.356	1.431	0.075	0.075
Historical factor								
Unemployment	6	2	Left		1.227	1.015	-0.212	-0.212
History of violence	9	4	Left		3.011	2.094	-0.917	-0.917
Self-harm behavior	5	0	–		1.891	1.891	0.000	0.000
Criminal history	8	0	–		2.769	2.769	0.000	0.000
Prior psychiatric hospitalization	8	3	Left		1.377	1.102	-0.275	-0.275
Involuntary psy. hospitalization	5	2	Right		1.505	1.689	0.184	0.184
Violent victimization	3	2	Left		3.897	2.690	-1.207	-1.207
Child abuse victim	4	0	–		1.377	1.377	0.000	0.000
Childhood conduct dis./ problems	4	1	Left		3.507	3.079	-0.428	-0.428
Contextual factor								
Homeless	6	0	–		2.228	2.228	0.000	0.000
Living with family	3	2	Left		2.207	1.955	-0.252	-0.252
Clinical factor								
Psychotic disorders	19	0	–		1.021	1.021	0.000	0.000
Mood disorders	11	2	Left		0.737	0.666	-0.071	0.071
Psychiatric comorbidity	14	0	–		2.271	2.271	0.000	0.000
Psychiatric symptoms	22	3	Left		1.859	1.645	-0.214	-0.214

(table continues)

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Table 15 *(continued)*

Risk factor	*k*	Imputed studies N	Imputed studies Direction	Obs. MES *Cohen's d*	Obs. MES *OR*	Adj. MES	Change	Strength change
Psychopathy	4	0	–		2.566	2.566	0.000	0.000
Level of functioning (Lower)	8	1	Left		1.772	1.693	-0.079	-0.079
Severity of mental disorder (Higher)	3	0	–		1.745	1.745	0.000	0.000
Substance abuse	24	0	–		1.868	1.868	0.000	0.000
Lack of insight on mental disorder	3	0	–		1.234	1.234	0.000	0.000
Treatment non-compliance	5	0	–		1.710	1.710	0.000	0.000
Perceived treatment need (Negative perception)	3	0	–		2.282	2.282	0.000	0.000
Earlier onset of mental disorder	7	1	Left		2.007	1.854	-0.153	-0.153
Duration of mental disorder ($\overline{X}_{violent} - \overline{X}_{non\text{-}violent}$)	4	1	Left	-0.005		-0.053	-0.048	0.048

Note. [a] The trim-and-fill analysis is only applicable to risk factors with an observation of $k \geq 3$. Since four of the 36 risk factors under review were based on the estimation of two studies ($k = 2$), such an analysis was not available for the factors.
k = number of independent samples; N = number of imputed studies; *Cohen's d* = standardized mean difference; *OR* = odds ratio; Obs. MES = observed mean effect size; Adj. MES = trim-and-fill adjusted mean effect size; Change = the difference between the adjusted and observed mean effect sizes; Strength change = the difference between the observed and adjusted mean effect sizes taking into account the hypothesized effect direction.

Other potential risk factors for future study.

A total of 12 potential risk factors with $k = 1$ were identified and coded at the stage of data extraction in this meta-analytic research. These factors were included for reference for future study: "Anti-social personality characteristics," "verbal IQ," anxiety disorders" (e.g., post-traumatic stress disorder), "history of exposure to violence," "family history of violence" (e.g., parents ever fought with each other), "violent thought or fantasies," "perceived social support," "perceived stress," "crime victimization," "non-violent victimization," "financial problems or difficulties," and "living environments."

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The Relationship between Mental Disorders and Violence

Only six studies reported sufficient and unbiased statistical information for assessing the relationship between mental disorders and violence by comparing the proportion of the mentally disordered patients and their non-disordered counterparts in committing violent acts. Since there were too few studies available for conducting a robust moderator analysis, only an overall estimate with heterogeneity tests and publication bias analysis was performed.

Main analyses.

The results in Figure 10 indicate that there was no significant relationship between mental disorders and violence (*OR* = 1.537, 95% CI = 0.603–3.920, *p* = .368, *k* = 6, N = 47,246). In other words, mentally disordered patients were no more likely to commit violent behavior than the non-mentally disordered persons. However, it should be noted that considerable variability in findings was observed ($Q(5) = 236.81$, $p < .001$, $I^2 = 97.89$).

Publication bias analysis.

There was only one unpublished doctoral dissertation (57.Rep/Std.50-Sims.1989) in this meta-analytic estimation. A sensitivity analysis showed that the inclusion/ exclusion of this study in the calculation had no significant impact on the results. Specifically, the removal of this study from the analysis slightly reduced the overall estimate by 0.223 (*OR* = 1.314, 95% CI = 0.444–3.888, *p* = .621, *k* = 5, N = 46,567). The trim-and-fill estimation also revealed that no studies, whether to the right or to the left of the mean, were missing from the present analysis. Overall, this suggests that publication bias did not pose a significant threat to the validity of the findings.

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Study Name	Sample Size		Effect Size and 95% CI			OR and 95% CI
	MD	Non-MD	OR	LL	UL	
56.Rep/Std.49-Arseneault.et.al.2000	389	572	5.068	2.926	8.778	
57.Rep/Std.50-Sims.1989	72	607	3.428	2.052	5.725	
06.Rep/Std.06-Elbogen.Johnson.2009	14315	20030	3.212	2.804	3.679	
18.Rep/Std.17-Egami.et.al.1996	3394	6447	2.722	1.955	3.789	
53.Rep/Std.46-Cirincione.et.al.1994.S2	417	315	0.373	0.255	0.547	
53.Rep/Std.46-Cirincione.et.al.1994.S1	402	286	0.238	0.157	0.360	
Combined Mean (Random-effects Model, $k = 6$)	18989	28257	1.537	0.603	3.920	
Heterogeneity: $I^2 = 97.89$, $Q(5) = 236.81$, $p < .001$						0.1 1 10

Figure 10. The relationship between mental disorders and violence: A comparison between mentally disordered patients and their non-mentally disordered counterparts.
Note. MD = mentally disordered patients; Non-MD = non-mentally disordered counterparts; OR = odds ratio; CI = confidence interval; LL = lower limit; UL = upper limit; *k* = number of independent samples.

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Chapter 5: Discussion

Significance of this Meta-Analytic Study

In response to a definite and imperative call to systematically incorporate the mounting contradictory findings (with regard to the risk for violence among psychiatric patients) into a theoretically and practically sound framework as reference for different levels of intervention, this study availed itself of the most promising technique in the field of quantitative synthesis. Specifically, this is the first meta-analysis that assesses the risk for interpersonal violence among adults with mental disorders from a public health perspective. Using this state-of-the-art perspective for research, it addresses some limitations of prior meta-analyses, among them, limitations in scope and/or estimation bias due to various methodological and/or analytical flaws (for details, see the Literature Review section).[9] Equally important, this large-scale study provides significant information for clinicians, policymakers, researchers, and the general public, including mentally disordered patients.

It is, however, beyond the scope of this dissertation to exhaustively report, analyze, interpret, and discuss all the possible findings of this meta-analysis. In particular, as mentioned in the Result section, moderator analyses for the risk factors of interest have not been addressed although relevant information was extracted and coded.

[9] Note that two additional meta-analyses in this area (Large & Nielssen, 2011; Witt et al., 2013) were published after the data collection period of this study; however, they shared the same limitation(s) of the three pervious reviews discussed earlier (Bonta et al., 1998; Fazel et al., 2009b; and Douglas et al., 2009). Also, it is important to be aware of the considerable variations across all the meta-analytic studies. For instance, the operationalization of the outcome measure (violence) in the latest published study is substantially different from that of the current meta-analysis in that they roughly included "a [wide] range of violent outcomes (aggression, hostility, or violent offending)" for investigation (Witt et al., 2013, p.2). In addition, no quantitative review so far included pure adult samples (aged 18 or older) for evaluation. As such, their results are not directly comparable to those of the present study. In order to provide a more comprehensive picture and maximize the utility of the available evidence, however, the discussion will still refer to and explore some of the findings of these prior analyses. Overall, any comparison of the results across studies in this section should be read with these caveats in mind.

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Main Findings and Implications

The results of this meta-analysis are manifold. Ten findings, however, are of particular importance and warrant highlighting due to their potential impact on public education, clinical assessment, and future research.

First, this study estimated the overall prevalence rate of interpersonal violence among adults with mental disorders at 19.3% (95% CI = 15.7–23.5%, *k* = 68), a figure which was similar to the combined mean rate of "serious violence" (defined as any assault of another person) of 16.6% (95% CI = 12.9–21.3%, *k* = 8) found in patients experiencing the first episode of psychosis (Large & Nielssen, 2011).[10] Apparently, these two aggregated estimates were substantially lower than the one-year community follow-up of 27.5% (262/951) recorded in the benchmark primary study in the field, namely, the MacArthur Violence Risk Assessment Study (Monahan et al., 2001). Findings relating to fundamental information regarding prevalence or base rates are critical to risk assessment and management in that they offer practitioners and policy makers "a useful starting point to such difficult, yet crucial, ventures" (Vitacco et al., 2009, p.315). In fact, the significance of pooling prevalence rates with the use of relevant clinical information for improving violence prediction has long been recognized by experts in the field (e.g., Meehl & Rosen, 1955; Monahan, 1981a; Vitacco et al., 2009). For instance, Monahan (1981a) explicitly stated that "knowledge of the appropriate base rate is the most important single piece of information necessary to make an accurate prediction [of violent behavior]" (p.

[10] Although Large and Nielssen (2011) also reported the prevalence of "any violence" at 34.5% (95% CI = 26.8–45.1%, *k* = 6) in their study, such an estimate cannot be compared to the findings of this meta-analytic study in that it included non-interpersonal violence (e.g., physical violence against objects) for analysis. Most notably, the violence rates of 9.9% (1,832/18,423) presented in Fazel et al. (2009b) and of 18.5% (8,439/45,533) in Witt et al. (2013) were not even comparable with any available syntheses since they were simple count figures instead of the results from a formal meta-analysis of the point estimates. Furthermore, Witt et al. (2013) included non-interpersonal violence for investigation while Fazel et al. (2009b) provided no clear operational definition for the outcome of interest, although they briefly mentioned that "interpersonal violence and/or violent criminality [including homicide]" was their focus (p.1).

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60). Note that this is the first and largest meta-analysis with a representative sample of 68 studies for estimating the prevalence of violence among the psychiatric population. Also notable is that the World Health Organization (WHO) provides no (related) data or analyses for comparison. Although the World Health Assembly declared violence as one of the major public health issues in 1996 and published the *World Report on Violence and Health* in 2002 (Krug et al., 2002), it did not specifically address violence among mental health patients from a perpetrator perspective. Therefore, it is difficult to determine from a broader or more global stance if the present overall prevalence estimate of 19.3% is high, medium, or low.

Second, a series of analyses consistently demonstrated that there was no significant change in the violence rate among mentally disordered patients over the past 30 years. Indeed, there was a trend towards a decrease in the prevalence of violence over time, although the trend was not evident or statistically not significant. This strongly argues against the view that violence is getting more common among the psychiatric population and that the rate is increasing and also suggests that the implementation of tough policies to manage perceived risks and combat excessive public fear is done at the expense of the civil rights of an already severely disadvantaged group of individuals. This is consistent with numerous scientific investigations and/or reviews that observed that “public fear of violence on the street by persons with severe mental illness who are strangers is unwarranted or misdirected” (Boles & Johnson, 2001, p.167).

Third, a series of moderator tests at different levels indicates that variations in the prevalence estimates were largely due to the between-study differences in the measurement of the two main variables (“mental disorders” and “violence”) in that almost all tests for the measurement-level moderators (e.g., “time of psychiatric diagnosis” and “setting where violence occurred”) were statistically significant. In terms of the study-level moderators, “nature of the

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study," "country of data collection," and "duration of data collection" were found to have a significant moderating effect on the violence estimates.

Fourth, with the exception of "comorbid substance abuse" and "involuntary treatment," all the moderators relating to the clinical aspects of the patients were not significantly associated with the outcome of interest. Basically, the distribution of specific psychiatric diagnoses in the samples did not moderate the prevalence rates. Of particular importance is that "percent of patients with primary psychotic disorders in the sample" did not vary with the violence rates (β = -0.003, p = .429, k = 50, N = 146,129), suggesting that there is no relationship between psychotic disorders and violence. In addition, the negative sign of the regression coefficient implies that psychotic patients might less likely engage in violent behaviors than other groups. The findings were consistent with the result found in another independent or separate meta-analysis specifically aimed at evaluating the empirical status of the risk factor "psychotic disorders" for violence. Here, psychotic patients were observed to no more likely commit violence than others (OR = 1.021, p = .897, k = 19, N = 19,248). The same observation was also present in the MacArthur Violence Risk Assessment Study (Monahan & Appelbaum, 2000). Overall, these findings combined challenge the pervasive negative stereotype that patients suffering from psychotic disorders (e.g., schizophrenia) form a particularly violent group in the population.

Fifth, the moderator "experience of psychotic symptoms or features"[11] was not a significant covariate of the prevalence rates (β = 0.002, p = .605, k = 52, N = 46,510). This denotes that psychosis does not have an association with violence. Although it is not directly comparable (due to methodological and analytical differences), this finding is somewhat

[11] The difference between the variables "percent of patients with primary psychotic disorders in the sample" and "experience of psychotic symptoms or features" is that the former only consisted of persons with primary psychotic disorders while the latter also included individuals with other primary diagnoses, such as major depression with psychotic features.

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consistent with the meta-analysis of Bonta et al. (1998) in that they observed that psychosis was not positively related to the outcome of interest, or, specifically, psychosis was negatively associated with violent recidivism (Z_r = -0.04, k = 11, N = 3,891).[12] By contrast, based on the results of 166 independent data sets from 204 articles for quantitative review, Douglas et al. (2009) found a small significant average effect of psychosis contributing to interpersonal violence (r = 0.12, as derived from converting an *OR* of 1.49, which was back-transformed from the *Log OR* of 0.40).[13] This finding, however, must be read with caution since Douglas et al. (2009) used the non-weighted or raw mean estimate for discussion.[14] Also, this raw mean estimate consisted of both unadjusted and adjusted odds ratios (from primary studies) for calculation.[15] As such, it might not be an accurate or appropriate meta-analytic estimation since "partial correlations [or relationships] are not [normally] used in meta-analyses because the statistical theory underlying meta-analytic procedures assumes that one is working with raw (zero-order) correlations" (Anderson et al., 2010, p.159). Moreover, such an estimate of the relationship between psychosis and violence might be further biased by the fact that Douglas et al. (2009) included in the meta-analysis "individuals without a mental illness" or persons without a formal psychiatric diagnosis (p.686).[16] Equally important, the validity and reliability of computing an overall effect size per study or per data set should be questioned in that Douglas et

[12] It is unclear if Bonta et al. (1998) included non-interpersonal violence for quantitative synthesis since they just briefly mentioned that the term "[*v*]*iolent recidivism* is restricted to criminal re-offending of a violent nature" (p.126).

[13] Douglas, et al. (2009) did not report the number of patients in all analyses.

[14] Although Douglas et al. (2009) mentioned an unique way for weighting individual effect sizes in the Method section, they reported in the Results section that the overall estimates were unweighted in nature in that they considered "the median raw odds and both the mean and median [non-weighted] log odds ratios to be more accurate depictions of central tendency" (p.687).

[15] According to Douglas et al. (2009), "[f]orty-seven studies presented only adjusted odds ratios, which therefore were used in the main analyses. An adjusted odds ratio takes into account the influence of potential covariates (e.g., age) specified by the researcher on the association between the two variables of interest [i.e., psychosis and violence] that are used to form the odds ratio" (p.685).

[16] For instance, Douglas et al. (2009) included a study of persons with psychotic-like experiences (Mojtabai, 2006) for synthesis.

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al. (2009) stated that if a study reported multiple effect sizes (including adjusted estimates controlling for covariates), a single value was obtained by calculating "the median of effect sizes within that study or data set" (p.686). Another related issue of Douglas et al. (2009) is the use of median for conducting moderator tests which is not commonly seen in a classic or traditional meta-analytic study. This makes it difficult to directly compare their results with other quantitative reviews in the field. More problematically, all the moderator analyses in Douglas et al. (2009) might be biased in that they violated the assumption of independent observation since the unit of analysis was "number of effect sizes from all samples" instead of "number of effect sizes from independent samples." In view of the above observations, it is not surprising that Douglas et al. (2009) arrived at a conclusion opposite to that of Bonta et al. (1998) and the present study. Overall, this suggests that "psychosis" or "psychotic symptoms," among them, hallucinations and delusions, are not a robust predictor of violence. In fact, it should be stressed that in an independent meta-analysis of this study, "psychiatric symptoms" as a whole (including psychotic and non-psychotic symptoms) was found to have a significant albeit small impact on violence (OR = 1.859, k = 22). In order to disentangle the intricate relationship between violence and specific symptom constellations, moderator analyses will be carried out for the risk factor of interest and a separate manuscript will be prepared to thoroughly discuss the findings.

Sixth, the current study demonstrates that "sex (male)," "race (non-white)," "homeless," "criminal history," "history of violence," and "comorbid substance abuse" bear a statistically robust relationship with violence while "marital status" and "unemployment" are not predictive of violent behavior. This is borne out by the fact that, in terms of statistical significance, moderator tests for those variables on the effect of the prevalence rates yielded the same results as the independent meta-analyses of the specific risk factors. With the exception of "homeless,"

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these findings are completely consistent with those of the MacArthur Violence Risk Assessment Study. In fact, Bonta et al. (1998) also observed that "violent history" and the criminal history variables ("adult criminal history" as well as "nonviolent criminal history") were positively related to the outcome of interest. Although "mean age of the sample" and "percent of patients with psychiatric comorbidity in the sample" did not moderate the prevalence estimates, independent meta-analyses revealed that the risk factors "age (younger)" (k = 21) and "psychiatric comorbidity" (k = 22) have a significant association with violence. This conflicting finding might be primarily caused by missing values in the moderator analyses. Other possible explanations are differences in the measurement of the variables and discrepancies in the analytical strategy. In view of the number of studies for independent meta-analyses and the findings from some major studies in the field (e.g., Bonta et al., 1998; Monahan et al., 2001), it is a sound assumption that "younger age" and "psychiatric comorbidity" are significant predictors of violence.

Seventh, other significant risk factors that must be highlighted include "violent victimization," "childhood conduct disorder or problems," and "anger," especially since they are the three strongest predictors found in this review. However, they were all based on a small number of studies (k < 5) for synthesis and were estimated along with a medium to high level of heterogeneity. Accordingly, more research to further confirm this empirical finding is needed. More scientific attention should also be given to the variable "neurological impairment" since it was the only (significant) risk factor observed with no heterogeneity (I^2 =0.00); however, again, it was estimated with only a limited number of studies of k = 4.

Eighth, one of the interesting findings of this study is that "personality disorders" was not related to interpersonal violence. Specifically, several moderator tests revealed that the

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prevalence rates did not vary as a function of "percent of patients with a primary diagnosis of personality disorders in the sample" and "percent of patients with comorbid personality disorders in the sample." These results, however, may not be accurate due to the fact that the base rate of persons with (comorbid) personality disorders in the samples was either low or unclear. In particular, only 14 of the 68 studies reported that 1% to 25% of their participants had a primary diagnosis of a personality disorder. Similarly, only 13 of the 68 studies mentioned that their sample contained some individuals with comorbid personality disorders. As discussed earlier in the Results section, "psychiatric comorbidity in general" and "comorbid personality disorders in particular" were the two important pieces of information that were seldom clearly specified in the primary research reports. Researchers thus are encouraged to detail the figures in their future inquiries. With regard to an independent meta-analysis addressing the risk factor "personality disorders" specifically, the non-significant mean effect of $OR = 1.059$ was only derived from the findings of two studies in which, furthermore, no heterogeneity was observed ($I^2 = 0.00$). This, obviously, is not a rigorous estimate. In this context, it must be added that the MacArthur Study also found a non-significant relationship between "violence" and "personality disorder only" ($OR = 1.46$, $p = .471$) (Monahan et al., 2001, p.166). Overall, this area will benefit greatly from future research.

Ninth, in terms of the relative strength of association with violence, the mean effect size of the 36 risk factors under review was summarized in Table 14. Regardless of the number of studies for estimation and variations across studies, the majority of the potent factors belonged to the historical domain while the least predictive factors largely pertained to the clinical domain. Apart from providing significant information for violence risk assessment and management, this reveals that major predictors of violence among mentally disordered patients are similar to those

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identified in the general or non-disordered population. In fact, Bonta et al. (1998) also made the same observation in their meta-analysis of the prediction of violent recidivism among psychiatric offenders. As with the latter, this study does not deny the importance of some clinical factors to the contribution of violence. However, the problem is that risk assessment and management have long been dominated by the psychopathological models. Simply put, the clinical aspects of patients have been over-emphasized in practice and policy-making with respect to risk prediction and prevention. As a result, it is not surprising that the competence of clinicians in assessing risk has been widely criticized.

Finally, the lack of significance of the relationship between mental disorders and violence demonstrates that psychiatric patients do not post a higher risk of committing violence than the general population although this estimate was derived from a small number of studies ($k = 6$) which were associated with a high level of heterogeneity ($I^2 = 97.89$).[17] Most notably, this finding is supported by the major studies in the field in that they observed that mental disorders were either not significantly related to violence or negatively associated with violence (e.g., Appelbaum et al., 2000; Bonta et al., 1998; Monahan et al., 2001; Steadman et al., 1998). In particular, Bonta et al. (1998) concluded that "[t]he presence of a mental disorder was associated with less recidivism [both generally and violently], further supporting the view that those with

[17] Note that the present analysis did not include the finding from the MacArthur Violence Risk Assessment Study for estimation, since the assessment on the psychiatric status of the comparison group or community control might not be reliable and the weighting of the sample might create bias in meta-analytic procedures. Specifically, Steadman et al. (1998) stated that "[w]e could not disaggregate both samples [i.e., the patient group and the community control] by a diagnosis of substance abuse or dependence, because we did not administer the DSM-III-R checklist to the comparison group" (p.395). In addition, differences between the two groups were "adjusted by weighting subjects in the community sample to make the distributions equivalent. The community sample was [also] weighted…to conform to the 1990 US census distributions on sex, ethnicity, age, and education for the census tracts in which the patients resided during the 1-year follow-up" (Steadman et al., 1998, p.395). Another frequently cited study was also excluded from the current estimation since the researchers explicitly stated that it has methodological flaws and the analyses were based on some problematic assumptions (e.g., Swanson et al., 1990; Swanson, 1994).

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mental illnesses are not as dangerous, at least compared with non[-]disordered offenders, as the public perceives" (p.139).

Limitations and Future Research

The main limitation of this dissertation is the omission of moderator analyses for individual risk factors of interest. As mentioned earlier, such analyses are beyond the scope of the present inquiry but will be conducted and detailed in separate manuscripts for publication. Here, it should be noted that moderator tests of the prevalence estimates provided useful information to corroborate and justify the significant findings of some contentious variables in predicting violence. For instance, "male gender," "non-white race," "homeless," "criminal history," "history of violence," and "comorbid substance abuse" were consistently found to have a positive relationship with violence.

Although this study was able to compare the empirical status or predictive power of a wide variety of public health risk factors, some of the estimates were based on findings from a small number of studies (i.e., $k < 10$). Hence, more scientific attention should be directed at these under-researched factors. Moreover, the current review excluded domain-specific variables in neurobiological sciences. Only a few studies included such factors in their protocols for inquiry; however, since some of the variables (e.g., serotonin metabolite levels) are believed to be potent indicators of violence risk (Steadman et al., 1994), it is highly recommended that future research include them for investigation. Doing so will allow for the development of a parsimonious model of risk prediction which, in turn, substantially progresses the field.

A further limitation of this study is that some variations in the prevalence estimates of violence remain unexplained. This may be due to the fact that there was a considerable amount

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of missing data in some important covariates or moderator variables, such as “percent of patients with psychiatric comorbidity in the sample.” In fact, much basic information was not specified in the studies under review, which, in turn, precluded building an advanced model for conducting multivariate meta-regression analysis. In order to facilitate future quantitative synthesis, researchers are encouraged to report this information in a systematic and clear manner in their primary accounts. Equally important, the author is planning to conduct a survey to collect the missing data from the primary researchers so that more precise and robust estimates can be obtained by re-analyzing some of the data. For instance, with sufficient data in hand, structural equation modeling can be applied to this meta-analysis to disentangle the intricate relationship between mental disorders and violence from another level. To maximize the utility of the accumulated knowledge or evidence over time, the author strongly recommends the regular use of meta-analytic methods for future research. As demonstrated in this review, the application of such a sophisticated quantitative synthesis technique can provide an overall picture of the available information. This not only aids policy-makers but advances the development of risk-reduction strategies, in addition to identifying gaps in the extant literature for future study. Indeed, the importance of periodically updating quantitative reviews is widely recognized in the field.

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Chapter 6: Conclusions and New Direction

Assessment of risk for violence among mentally disordered patients is a global public health issue–one, which continues to pose a great challenge for societies worldwide. Thus, it is reasonable to assume that researchers will continue to conduct primary studies in this area and disseminate conflicting findings. In view of this, a "Global Public Health-Comprehensive Meta-Analysis" (GPH-CMA) approach is proposed as a new direction for risk assessment and management. With a mission to improve public health and social justice within and among nations, the GPH-CMA approach emphasizes the importance of transnational and multidisciplinary collaboration by using meta-analytic methods as a research strategy to address the pressing global challenges of violence risk assessment. In view of the intricate relationship between mental disorders and violence, it is critical to expand our traditional framework of public health to include investigatory variables from other disciplines that transcend the social sciences (e.g., neurobiological sciences). Also, due to the growing number of empirical studies replete with recurrent contradictory findings and the dearth of comprehensive meta-analytic research in this area, it is imperative to promote the application of this advanced quantitative synthesis method. Specifically, this will help refine existing hypotheses or prediction models through systematic integration and clarification, in addition to giving an overall picture of the issue across societies across time. By maximizing the aggregate knowledge from as many nations as possible, this collective and integrative approach is promising with respect to (1) developing a comprehensive theory of violence for risk assessment; (2) improving clinical prediction in different settings; and (3) proposing effective policies or strategies for risk

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reduction. In sum, this dissertation serves as the springboard for an initiative to establish a consortium for the foundational and systematic implementation of the GPH-CMA approach.

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Appendix A

Summary of the Keyword Searches in Ten Electronic Bibliographic Databases

No.	Database (Vendor)	Search Date (Time)	Search Method	Search String/Statement	Limiter/Expander	No. of citations yielded
1	PsycINFO (EBSCO Host)	June 20, 2010 (5:04:00 PM)	Advanced Search	(mental disorder* or mental illness* or psychos?s or psychotic disorder* or psychiatric disorder* or schizophreni* or affective disorder* or mood disorder* or personality disorder* or comorbid* or dual diagnos?s) and (violen* or violent crim* or violent behavio#r or homicide or criminal behavio#r) and (predict* or factor* or associat* or correlat*) not (suicid* or self destructive behavio#r or self injurious behavio#r)	Limiters Publication Date Range: 19700101–20100531 Language: English Age Groups: Adulthood (18 yrs & older) Methodology: Empirical Study Search modes: Boolean/Phrase	1609
2	PsycARTICLES (EBSCO Host)	June 20, 2010 (5:20:17 PM)	Advanced Search	(mental disorder* or mental illness* or psychos?s or psychotic disorder* or psychiatric disorder* or schizophreni* or affective disorder* or mood disorder* or personality disorder* or comorbid* or dual diagnos?s) and (violen* or violent crim* or violent behavio#r or homicide or criminal behavio#r) and (predict* or factor* or associat* or correlat*) not (suicid* or self destructive behavio#r or self injurious behavio#r)	Limiters Publication Date Range: 19700101–20100531 Age Groups: Adulthood (18 yrs & older) Search modes: Boolean/Phrase	91

(table continues)

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No.	Database (Vendor)	Search Date (Time)	Search Method	Search String/Statement	Limiter/Expander	No. of citations yielded
3	PsycEXTRA (EBSCO Host)	June 20, 2010 (5:31:28 PM)	Advanced Search	(mental disorder* or mental illness* or psychos?s or psychotic disorder* or psychiatric disorder* or schizophreni* or affective disorder* or mood disorder* or personality disorder* or comorbid* or dual diagnos?s) and (violen* or violent crim* or violent behavio#r or homicide or criminal behavio#r) and (predict* or factor* or associat* or correlat*) not (suicid* or self destructive behavio#r or self injurious behavio#r)	Limiters Publication Date Range: 19700101–20100531 Language: English Age Groups: Adulthood (18 yrs & older) Search modes: Boolean/Phrase	27
4	PsycBOOKS (EBSCO Host)	June 20, 2010 (5:47:51 PM)	Advanced Search	(mental disorder* or mental illness* or psychos?s or psychotic disorder* or psychiatric disorder* or schizophreni* or affective disorder* or mood disorder* or personality disorder* or comorbid* or dual diagnos?s) and (violen* or violent crim* or violent behavio#r or homicide or criminal behavio#r) and (predict* or factor* or associat* or correlat*) not (suicid* or self destructive behavio#r or self injurious behavio#r)	Limiters Publication Date Range: 19700101–20100531 Age Groups: Adulthood (18 yrs & older) Search modes: Boolean/Phrase	5

(table continues)

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No.	Database (Vendor)	Search Date (Time)	Search Method	Search String/Statement	Limiter/Expander	No. of citations yielded
5	Academic Search Complete (EBSCO Host)	June 24, 2010 (5:43:20 PM)	Advanced Search	(mental disorder* or mental illness* or psychos?s or psychotic disorder* or psychiatric disorder* or schizophreni* or affective disorder* or mood disorder* or personality disorder* or comorbid* or dual diagnos?s) and (violen* or violent crim* or violent behavio#r or homicide or criminal behavio#r) and (predict* or factor* or associat* or correlat*) not (suicid* or self-destructive behavio#r or self-injurious behavio#r)	Limiters Publication Date Range: 19700101–20100531 Publication Type: Periodical, Book, Primary Source Document, Educational Report, Health Report Document Type: Abstract, Article, Bibliography, Book Chapter, Case Study, Erratum, Proceeding, Report; Language: English Search modes: Boolean/Phrase	1206
6	SocINDEX with Full Text (EBSCO Host)	June 24, 2010 (6:33:24 PM)	Advanced Search	(mental disorder* or mental illness* or psychos?s or psychotic disorder* or psychiatric disorder* or schizophreni* or affective disorder* or mood disorder* or personality disorder* or comorbid* or dual diagnos?s) and (violen* or violent crim* or violent behavio#r or homicide or criminal behavio#r) and (predict* or factor* or associat* or correlat*) not (suicid* or self-destructive behavio#r or self-injurious behavio#r)	Limiters Publication Date Range: 19700101–20100531 Document Type: Abstract, Article, Bibliography, Book Chapter, Case Study, Conference Paper, Dissertation, Erratum, Essay, Proceeding, Report Search modes: Boolean/Phrase	892

(table continues)

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No.	Database (Vendor)	Search Date (Time)	Search Method	Search String/Statement	Limiter/Expander	No. of citations yielded
7	Criminal Justice Abstracts (CSA)	June 20, 2010 (7:26 PM)	Command Search	((mental disorder*) or (mental illness*) or psychos?s or (psychotic disorder*) or (psychiatric disorder*) or schizophreni* or (affective disorder*) or (mood disorder*) or (personality disorder*) or comorbid* or (dual diagnos?s)) and (violen* or (violent crim*) or (violent behavi*r) or homicide or manslaughter or (criminal behavi*r)) and (predict* or factor* or associat* or correlat*) and not (suicid* or (self harm) or (self injurious behavi*r) or (self destructive behavi*r))	Publication Date Range: 1970–2010 Language: English	493
8	Sociological Abstracts (CSA)	June 20, 2010 (7:50 PM)	Command Search	((mental disorder*) or (mental illness*) or psychos?s or (psychotic disorder*) or (psychiatric disorder*) or (psychiatric diagnos?s) or schizophreni* or (affective disorder*) or (affective illness*) or (mood disorder*) or (personality disorder*) or comorbid* or (dual diagnos?s)) and (violen* or (violent crim*) or (violent behavi*r) or homicide or (criminal behavi*r)) and (predict* or factor* or associat* or correlat*) and not (suicid* or (self injurious behavi*r) or (self destructive behavi*r))	Publication Date Range: 1970–2010 Language: English	1450

(table continues)

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No.	Database (Vendor)	Search Date (Time)	Search Method	Search String/Statement	Limiter/Expander	No. of citations yielded
9	Criminal Justice Periodicals Index (ProQuest)	June 27, 2010 (7:56 PM)	Advanced search	(mental disorder* or mental illness* or psychos?s or psychotic disorder* or psychiatric disorder* or schizophreni* or affective disorder* or mood disorder* or emotional disorder* or personality disorder* or comorbid* or dual diagnos?s) AND (violen* or violent crim* or murder* or homicide*) AND (predict* or factor* or associat* or correlat*) AND PDN(>1/1/1970) AND PDN(<5/31/2010) AND NOT (suicid* or "self destructive behavio*")	Terms search in citation and abstract Publication type: All Publication Date Range: 1/1/1970–5/31/2010	232
10	Dissertation Abstracts (ProQuest)	June 27, 2010 (8:58 PM)	Advanced search	(mental disorder* or mental illness* or psychos?s or psychotic disorder* or psychiatric disorder* or schizophreni* or affective disorder* or mood disorder* or personality disorder* or comorbid* or dual diagnos?s) AND (violen* or violent crim* or violent behavio* or homicide* or criminal behavio*) AND (predict* or factor* or associat* or correlat*) AND LN(EN) AND PDN(>1/1/1970) AND PDN(<5/31/2010) AND NOT DISVOL(mai) AND NOT (suicid*)	Terms search in citation and abstract Publication type: All Publication Date Range: 1/1/1970–5/31/2010 Language: English Only searched for “Doctoral dissertations”	271

Table Appendix A Summary of the Keyword Searches in Ten Electronic Bibliographic Databases

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Appendix B

Coding Book

Coder: _____
Date: _____

Section 1: Report Details

1. Coding No. : _____

2. Study ID: _____

3. Report ID: _____

4. (a) RefWork ID (if the source of the report is electronic database): _____
   (b) Reference ID (if the source of the report is reference list): _____

5. Source
   1. PsycINFO
   2. PsycARTICLES
   3. PsycEXTRA
   4. PsycBOOKS
   5. Academic Search Complete
   6. SocINDEX
   7. Criminal Justice Abstracts
   8. Sociological Abstracts
   9. Criminal Justice Periodicals
   10. Dissertation Abstracts
   11. Reference list (Douglas et al., 2009)
   12. Reference list (Bonta et al., 1998)
   13. Others:_____

6. Type of report
   1. Journal article Name of the journal: _____
   2. Book or book chapter
   3. Doctoral dissertation
   4. Conference paper/presentation
   5. Others: _____

7. Peer-reviewed report
   1. Yes 2. No 3. Unclear

8. Title: _____

9. Year of publication: _____

10. Author(s): _____

11. Status of funding support
    1. Yes 2. No 3. Unclear/Not specified

12. Source of funding support
    1. Academic institution
    2. Private organization/foundation
    3. Governmental entity
    4. Others: _____
    5. Mixed: _____
    6. Unclear
    7. Not applicable (Q.11 = No or Unclear/Not specified)

Details of funding sources (e.g., name of funding bodies and grant number if available):

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Section 2: General Methodological Features at Study Level

1. Basic study design
   1. Cross-sectional: Retrospective
   2. Longitudinal: Truly prospective
      (data was collected prior to the occurrence of the event/disease, e.g., follow-up observational study)
   3. Longitudinal: Pseudo-prospective
      (data was collected after the occurrence of the event/disease, e.g., archival cohort study where data was collected from relevant institutional records)
   4. Unclear

   Remarks (if any):

2. Nature of the study
   1. Archival 2. Non-archival 3. Mixed 4. Unclear

3. Sampling procedure
   1. Random
   2. Non-random
   3. Mixed
   4. Unclear

   Remarks (if any):

4. Location of the study
   1. USA (site, city, state if available): _____
   2. UK
   3. Other European countries: _____
   4. Canada
   5. Australia
   6. New Zealand
   7. Others: _____
   8. Unclear

5. Study/observation period (data collection period): _____

6. Duration of the study/observation period: _____

7. No. of waves of data collection, including baseline (follow-up study only): _____

8. Sample size

	Eligible N	Valid N						
		Non-follow-up study	Follow-up study					
			T1	T2	T3	T4	T5	T6
(a) Mentally disordered								
(b) Non-mentally disordered								
(c) Total								

T1 = Baseline; T2 = 1st follow-up; T3 = 2nd follow-up; T4 = 3rd follow-up; T5 = 4th follow-up; T6 = 5th follow-up

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Section 3: Data Characteristics at Report Level

1. This report used secondary data for analysis (i.e., data collected for another study)
   1. Yes: None of the objectives of the original study was to investigate the risk for violence among mentally disordered persons
   2. Yes: One of the objectives of the original study was to investigate the risk for violence among mentally disordered persons
   3. Yes: Unsure if one of the objectives of the original study was to investigate the risk for violence among mentally disordered persons
   4. No
   5. Unclear

2. If this report used secondary data for investigation, specify the project name and list all relevant citations:

3. Findings of the whole report were based on a subset of the full sample of the study
   1. Yes: Sub-sample selection criteria (e.g., sex and age): _____
   2. No: It used the full sample of the study for analysis
   3. Unclear

4. If this is a follow-up study, findings of the whole report were based on one or some wave(s) of observation
   1. Yes: (a) No. of waves of observation used for analysis: _____
      (b) Specific waves of observation used: _____
   2. No
   3. Unclear
   4. Not applicable

5. Nature of data analysis
   1. Cross-sectional: Retrospective
   2. Longitudinal: Truly prospective
   3. Longitudinal: Pseudo-prospective
   4. Mixed: _____
   5. Unclear

   Remarks (if any):

6. Valid sample size

	Non-follow-up study	Follow-up study					
		T1	T2	T3	T4	T5	T6
(a) Mentally disordered							
(b) Non-mentally disordered							
(c) Total							

T1 = Baseline; T2 = 1st follow-up; T3 = 2nd follow-up; T4 = 3rd follow-up; T5 = 4th follow-up; T6 = 5th follow-up

7. Data collection period: _____

8. Duration of data collection: _____

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Section 4: Sample Characteristics at Report Level

Repeat the whole section for sub-sample/s if needed

4.1 Socio-Demographic Characteristics

1. Sample ID (with type of sample at report level)
   1.0 Full sample 1.1 Sub-sample 1 1.2 Sub-sample 2 1.3 Sub-sample 3 1.4 Sub-sample-4
   1.5 Sub-sample 5 1.6 Sub-sample 6 1.7 Sub-sample 7 1.8 Sub-sample 8 1.9 Sub-sample-9

2. Brief description of the sub-sample (e.g., all female with psychotic disorders)

3. Valid sample size: _____

4. Mental health status N %
   1. Mentally disordered _____ _____
   2. Non-mentally disordered _____ _____

5. Age
   1. Mean: _____ SD: _____
   2. Median: _____
   3. Range: _____
   4. Unclear
   Remarks (if any):

6. Sex
   1. 100% Male
   2. 100% Female
   3. Mixed N %
      Male _____ _____
      Female _____ _____
   4. Unclear

7. Race
   1. 100% White
   2. 100% Non-white
   3. Mixed N %
      White _____ _____
      Non-white _____ _____
   4. Unclear

8. Marital status
   1. 100% Single (single, separated, divorced, widowed)
   2. 100% Non-single (married, re-married, cohabited, partnership)
   3. Mixed N %
      Single _____ _____
      Non-single _____ _____
   4. Unclear

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9. Education
   1. 100% Below high school
   2. 100% Above high school
   3. Mixed — N — %
      Below high school _____ _____
      Above high school _____ _____
   4. Unclear

Remarks (if any):

10. Unemployment
    1. 100% Yes
    2. 100% No
    3. Mixed — N — %
       Yes _____ _____
       No _____ _____
    4. Unclear

11. Homeless
    1. 100% Yes
    2. 100% No
    3. Mixed — N — %
       Yes _____ _____
       No _____ _____
    4. Unclear

12. Criminal history (prior criminal record)
    1. 100% Yes
    2. 100% No
    3. Mixed — N — %
       Yes _____ _____
       No _____ _____
    4. Unclear
    5. Not applicable

Remarks (if any):

13. History of violence (prior records of violence)
    1. 100% Yes
    2. 100% No
    3. Mixed — N — %
       Yes _____ _____
       No _____ _____
    4. Unclear
    5. Not applicable

Remarks (if any):

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14. Any substance use (including occasional use, use, misuse, problem, abuse, dependence, and disorders)
(If this was not reported as a single measure, e.g., having two independent variables of alcohol and drug abuse with some overlaps across groups, code the one with the highest frequency and specify all relevant information in the "Remarks" box)
1. 100% Yes
2. 100% No
3. Mixed N %
Yes _____ _____
No _____ _____
4. Unclear

Remarks (if any):

(a) The above information was estimated from the psychiatric diagnosis of substance abuse disorders
1. Yes 2. No

15. Child abuse victim
(If this was not reported as a single measure, e.g., having two independent variables of physical and sexual abuse with some overlaps across groups, code the one with the highest frequency and specify all relevant information in the "Remarks" box)
1. 100% Yes
2. 100% No
3. Mixed N %
Yes _____ _____
No _____ _____
4. Unclear

Remarks (if any):

(a) Type of child abuse: 1. 100% Physical 2. 100% Sexual 3. Mixed 4. Unclear

16. Victimization in adulthood
(If this was not reported as a single measure, e.g., having two independent variables of violent and crime victimization with some overlaps across groups, code the one with the highest frequency and specify all relevant information in the "Remarks" box)
1. 100% Yes
2. 100% No
3. Mixed N %
Yes _____ _____
No _____ _____
4. Unclear

Remarks (if any):

(a) Type of victimization:
1. 100% Violent 2. 100% Crime 3. Others: _____
4. Mixed: _____ 4. Unclear

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17. Source of participants
    1. General community households
    2. General correctional facilities (e.g., detention centers, jails, and prisons)
    3. Forensic inpatient facilities (e.g., hospitals and jails for mentally disordered offenders)
    4. Non-forensic inpatient facilities (e.g., general community psychiatric hospitals for civil patients)
    5. Non-inpatient mental health care units (e.g., non-forensic outpatient facilities or community treatment center)
    6. Non-mental health community treatment centers/units (e.g., substance abuse treatment centers)
    7. Others: _____
    8. Mixed: _____
    9. Unclear

18. Sampling procedure
    1. Random
    2. Non-random
    3. Mixed
    4. Unclear

Remarks (if any):

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4.2 Clinical Characteristics

1. Type of participants
(This refers to the status of participants at time of entering the study or at time of subject recruitment/enrollment. For archival studies, it pertains to the status of participants at the defined starting time/period of data collection.)

	N	%
1. Non-forensic psychiatric inpatients		
1. Voluntary		
2. Involuntary/civil/compulsory		
3. Unclear/Not specified		
2. Discharged/former non-forensic psychiatric inpatients		
1. Voluntary		
2. Involuntary/civil/compulsory		
3. Unclear/Not specified		
3. Non-forensic psychiatric outpatients		
1. Voluntary		
2. Involuntary (e.g., mandated/assisted outpatient treatment)		
3. Unclear/Not specified		
4. Former non-forensic psychiatric outpatients		
1. Voluntary		
2. Involuntary (e.g., mandated/assisted outpatient treatment)		
3. Unclear/Not specified		
5. Forensic psychiatric inpatients (Mentally disordered offenders serving a sentence in any correctional facilities or special secure units, such as those who have been found NGRI or incompetent to stand trial)		
6. Discharged/former forensic psychiatric inpatients		
7. Forensic psychiatric outpatients [(Discharged) mentally disordered offenders under the supervision of criminal justice personnel in the community, such as those on probation or parole]		
8. Former forensic psychiatric outpatients		
9. Mentally disordered suspects or arrestees (in custody) (e.g., those waiting for trial or pre-trial assessment in jails)		
10. Offenders with mental disorders in general correctional facilities not otherwise specified (e.g., inmates who had been transferred to the psychiatric unit of the facilities at time of serving their sentences in jails or prisons)		
11. Discharged/former offenders with mental disorders not otherwise specified		
12. Psychiatric patients not otherwise specified		
13. General community residents		
14. Others: _____		
15. Mixed: _____		
16. Unclear		

Remarks (if any):

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2. (Primary) psychiatric diagnosis

(a) Diagnostic categories are mutually exclusive (the sum of all frequencies is equal to the total sample size)
1. Yes 2. No 3. Not applicable

(b) Distribution of specific diagnoses

	N	%
1. Psychotic disorders		
1. Schizophrenia spectrum disorders		
1. Schizophrenia-Not specified		
2. Schizophrenia-Paranoid type		
3. Schizophrenia-Disorganized type		
4. Schizophrenia-Catatonic type		
5. Schizophrenia-Undifferentiated type		
6. Schizophrenia-Residual type		
7. Schizophreniform disorder		
8. Schizoaffective disorder		
9. Others: _____		
10. Mixed: _____		
11. Unclear		
2. Other psychotic disorders		
1. Delusional disorder		
2. Brief psychotic disorder		
3. Shared psychotic disorder		
4. Psychotic disorder due to a general medical condition		
5. Psychotic disorder not otherwise specified (NOS)		
6. Others: _____		
7. Mixed: _____		
8. Unclear		
3. Others: _____		
4. Mixed: _____		
5. Unclear		
2. Mood disorders		
1. Depressive disorders		
a) with psychotic features		
2. Bipolar disorders (e.g., single manic, Bipolar I & II)		
a) with psychotic features		
3. Mood disorders due to general medical condition		
a) with psychotic features		
4. Mood disorders NOS		
a) with psychotic features		
5. Others: _____		
a) with psychotic features		
6. Mixed: _____		
a) with psychotic features		
7. Unclear		

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	N	%
3. Anxiety disorders		
1. Generalized anxiety disorder		
2. Phobia		
3. Panic disorder		
4. Obsessive-compulsive disorder		
5. Post-traumatic stress disorder		
6. Anxiety disorder due to a general medical condition		
7. Anxiety disorder NOS		
8. Others: _____		
9. Mixed: _____		
10. Unclear		
4. Substance-related disorders		
1. Substance dependence/abuse		
1. Alcohol		
2. Non-alcohol		
3. Mixed		
4. Unclear		
2. Substance-induced disorders		
1. Substance-induced psychotic disorder or psychosis		
2. Other substance-induced disorders: _____		
3. Others: _____		
4. Mixed: _____		
5. Unclear		
5. Cognitive disorders or organic brain syndrome or mental disorders		
1. Delirium		
2. Dementia		
3. Amnestic		
4. Others: _____		
5. Mixed: _____		
6. Unclear		
6. Personality disorders		
1. Paranoid PD		
2. Schizoid PD		
3. Schizotypal PD		
4. Antisocial PD		
5. Borderline PD		
6. Histrionic PD		
7. Narcissistic PD		
8. Others: _____		
9. Mixed: _____		
10. Unclear		
7. Mental retardation		
8. Mental disorder due to a general medical condition		
9. Others: _____		
10. Mixed: _____		
11. Unclear		

Remarks (if any):

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3. Psychiatric comorbidity
   1. 100% Yes
   2. 100% No
   3. Mixed

	N	%
Yes		
No		

   4. Unclear/Not specified

4. Type of psychiatric comorbidity

   (a) Diagnostic categories are mutually exclusive (the sum of all frequencies is equal to the total sample size)
   1. Yes 2. No 3. Not applicable

   (b) Distribution of specific diagnoses

	N	%
1. Psychotic disorders		
1. Schizophrenia spectrum disorders		
1. Schizophrenia-Not specified		
2. Schizophrenia-Paranoid type		
3. Schizophrenia-Disorganized type		
4. Schizophrenia-Catatonic type		
5. Schizophrenia-Undifferentiated type		
6. Schizophrenia-Residual type		
7. Schizophreniform disorder		
8. Schizoaffective disorder		
9. Others: _____		
10. Mixed: _____		
11. Unclear		
2. Other psychotic disorders		
1. Delusional disorder		
2. Brief psychotic disorder		
3. Shared psychotic disorder		
4. Psychotic disorder due to a general medical condition		
5. Psychotic disorder not otherwise specified (NOS)		
6. Others: _____		
7. Mixed: _____		
8. Unclear		
3. Others: _____		
4. Mixed: _____		
5. Unclear		
2. Mood disorders		
1. Depressive disorders		
a) with psychotic features		
2. Bipolar disorders (e.g., single manic, Bipolar I & II)		
a) with psychotic features		
3. Mood disorders due to general medical condition		
a) with psychotic features		
4. Mood disorders NOS		
a) with psychotic features		
5. Others: _____		
a) with psychotic features		
6. Mixed: _____		
a) with psychotic features		
7. Unclear		

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	N	%
3. Anxiety disorders		
1. Generalized anxiety disorder		
2. Phobia		
3. Panic disorder		
4. Obsessive-compulsive disorder		
5. Post-traumatic stress disorder		
6. Anxiety disorder due to a general medical condition		
7. Anxiety disorder NOS		
8. Others: _____		
9. Mixed: _____		
10. Unclear		
4. Substance-related disorders		
1. Substance dependence/abuse		
1. Alcohol		
2. Non-alcohol		
3. Mixed		
4. Unclear		
2. Substance-induced disorders		
1. Substance-induced psychotic disorder or psychosis		
2. Other substance-induced disorders: _____		
3. Others: _____		
4. Mixed: _____		
5. Unclear		
5. Cognitive disorders or organic brain syndrome or mental disorders		
1. Delirium		
2. Dementia		
3. Amnestic		
4. Others: _____		
5. Mixed: _____		
6. Unclear		
6. Personality disorders		
1. Paranoid PD		
2. Schizoid PD		
3. Schizotypal PD		
4. Antisocial PD		
5. Borderline PD		
6. Histrionic PD		
7. Narcissistic PD		
8. Others: _____		
9. Mixed: _____		
10. Unclear		
7. Mental retardation		
8. Mental disorder due to a general medical condition		
9. Others: _____		
10. Mixed: _____		
11. Unclear		

Remarks (if any):

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5. Time diagnosed with mental disorders
   1. Before the occurrence of violence
   2. After the occurrence of violence
   3. Mixed
   5. Unclear

6. Experience of psychotic symptoms or features
   1. 100% Yes
   2. 100% No
   3. Mixed

	N	%
Yes	_____	_____
No	_____	_____

   4. Unclear

   (a) The above information or figures were estimated from the number of individuals with psychotic disorders and/or any disorders with psychotic features
   1. Yes 2. No

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Section 5: Operationalization of Mental Disorder at Report Level

1. Method for assessing mental disorder
   1. Archive of institutional records (e.g., mental health registers, court reports, and forensic reports)
   2. Direct interview/assessment by clinicians (psychiatrist or psychologist)
   3. Direct interview by lay or non-clinical interviewers (including student interviewers of the related disciplines)
   4. Others: _____
   5. Mixed: _____
   6. Unclear

2. Diagnostic reliability
   (Psychiatric diagnoses or status of participants with mental disorders was made or confirmed by clinicians or obtained from related institutional records, e.g., hospital records and clinical reports)
   1. Yes 2. No 3. Unclear

3. Diagnostic tool
   1. Any version/edition of Diagnostic and Statistical Manual of Mental Disorders (DSM): _____
   2. Any version of International Classification of Diseases & Related Health Problems (ICD): _____
   3. Any version of Diagnostic Interview Schedule (DIS): _____
   4. Others: _____
   5. Mixed: _____
   6. Unclear

Remarks (if any):

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Section 6: Operationalization of Violence at Report Level

1. Definition of violence

2. Measure of violence
   1. Standardized/validated scale:_____
   2. Non-validated scale or self-constructed scale
   3. Discrete violent incidents (specific violent behaviors or crimes)
      (a) Used specific item/s from standardized/validated scale
      1. Yes: _____ 2. No
   4. Others: _____
   5. Mixed: _____
   6. Unclear

   Remarks (if any):

3. Reliability of the measurement scale (if Q.2 = 1 or 2)

4. Type of violence
   (Criminal violence = a criminal record was produced as a result of engaging in the violent act; Non-criminal violence = no criminal record was produced as a result of engaging in the violent act)

1. 100% Criminal	3. 100% Non-criminal	5. Mixed
2. ≥ 80% Criminal	4. ≥ 80% Non-criminal	6. Unclear

5. Type of criminal record for violence
   1. 100% Violation of parole or probation
   2. ≥ 80% Violation of parole or probation
   3. 100% Arrest
   4. ≥ 80% Arrest
   5. 100% Conviction
   6. ≥ 80% Conviction
   7. 100% Incarceration
   8. ≥ 80% Incarceration
   9. 100% Hospitalization
   10. ≥ 80% Hospitalization
   11. Others: _____
   12. Mixed: _____
   13. Unclear
   14. Not applicable

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6. Nature of criminal violence
   1. 100% First-time
   2. ≥ 80% First-time
   3. 100% Recidivistic
   4. ≥ 80% Recidivistic
   5. Mixed
   6. Unclear
   7. Not applicable

7. Setting where violence occurred
   1. Community (home, workplace, and other public area)
   2. Institutions (inpatient settings, e.g., detention centers, jails, prisons, and psychiatric hospitals)
   3. Mixed
   4. Unclear

8. Victim of violence
   1. 100% Family/relatives
   2. ≥ 80% Family/relatives
   3. 100% Non-family/non-relatives
   4. ≥ 80% Non-family/non-relatives
   5. Mixed
   6. Unclear

9. Method of data collection for violence
   1. Self-report with any means (e.g., face-to-face interview and self-administrated questionnaire)
   2. Report/observation by clinicians (psychiatrists and psychologists)
   3. Report/observation by other mental health care professionals or social workers
   4. Report/observation by criminal justice professionals (e.g., police and correctional officers)
   5. Report/observation by family members (including partners and relatives)
   6. Report/observation by employers
   7. Report/observation by members of the research team (e.g., research assistants and independent observers)
   8. Archive of institution records (e.g., hospital records and crime registers)
   9. Others: _____
   10. Mixed: _____
   11. Unclear

Remarks (if any):

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Section 7: Effect Size Level Variables–Prevalence of Violence

Repeat the whole section for each independent sample/sub-sample if needed

1. Effect Size ID

Study ID	Report ID	Sample ID	Prevalence Rate No.	Independent Sample No.

2. Valid sample size: _____

3. No. of persons who committed violence: _____

4. Prevalence rate (Q.3/Q.2*100): _____

5. Nature of the sample
   1. Mentally disordered
   2. Non-mentally disordered
   3. Mixed

6. Length of observation on the outcome (i.e., violence): _____

   (a) Constant observation period (length of observation was the same for all participants)
   1. Yes 2. No 3. Unclear 4. Others: _____

7. Measure of violence
   1. Standardized/validated scale: _____
   2. Non-validated scale or self-constructed scale
   3. Discrete violent incidents (specific violent behaviors or crimes)
      (a) Used specific item/s from standardized/validated scale
      1. Yes: _____ 2. No
   4. Others: _____
   5. Mixed: _____
   6. Unclear

   Remarks (if any):

8. Reliability of the measurement scale (if Q.2 = 1 or 2)

9. Type of violence
   (Criminal violence = a criminal record was produced as a result of engaging in the violent act; Non-criminal violence = no criminal record was produced as a result of engaging in the violent act)
   1. 100% Criminal 3. 100% Non-criminal 5. Mixed
   2. ≥ 80% Criminal 4. ≥ 80% Non-criminal 6. Unclear

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10. Type of criminal record for violence
    1. 100% Violation of parole or probation
    2. ≥ 80% Violation of parole or probation
    3. 100% Arrest
    4. ≥ 80% Arrest
    5. 100% Conviction
    6. ≥ 80% Conviction
    7. 100% Incarceration
    8. ≥ 80% Incarceration
    9. 100% Hospitalization
    10. ≥ 80% Hospitalization
    11. Others: _____
    12. Mixed: _____
    13. Unclear
    14. Not applicable

11. Nature of criminal violence
    1. 100% First-time
    2. ≥ 80% First-time
    3. 100% Recidivistic
    4. ≥ 80% Recidivistic
    5. Mixed
    6. Unclear
    7. Not applicable

12. Method of data collection for violence
    1. Self-report with any means (e.g., face-to-face interview and self-administrated questionnaire)
    2. Report/observation by clinicians (psychiatrists and psychologists)
    3. Report/observation by other mental health care professionals or social workers
    4. Report/observation by criminal justice professionals (e.g., police and correctional officers)
    5. Report/observation by family members (including partners and relatives)
    6. Report/observation by employers
    7. Report/observation by members of the research team (e.g., research assistants and independent observers)
    8. Archive of institution records (e.g., hospital records and crime registers)
    9. Others: _____
    10. Mixed: _____
    11. Unclear

13. Type of analysis involved
    1. Overall estimate of the prevalence of violence and moderator variable of risk factors
    2. Moderator variable of risk factors only

Remarks (if any):

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Section 8: Effect Size Level Variables–Risk Factor for Violence

Repeat the whole section for each risk factor

8.1 Characteristics of the Effect Size

1. Effect Size ID

Study ID	Report ID	Sample ID	Effect Size No.	Independent Sample No.

2. This effect size refers to which factor in the "List of Risk Factors"
   (a) Factor ID in the "List of Risk Factors": _____
   (b) Factor name in the "List of Risk Factors": _____
   (c) Variable name used in the report: _____

3. Valid sample size: _____

4. A certain proportion of cases were excluded from the valid sample for estimation
   1. Yes
      (a) Number and percent: _____
      (b) Reason for the exclusion (circle all that apply)
         1. Missing on IV or DV
         2. Others: _____
         3. Unclear
   2. No
   3. Unclear

5. Way of extracting statistical information for calculating the effect size
   1. All information was directly copied from the report
   2. All information was estimated from the report (i.e., involving additional calculation/conversion of figures)
   3. Mixed

6. Relationship between basic study design and nature of data analysis
   1. Longitudinal design with longitudinal analysis (Truly prospective)
   2. Longitudinal design with longitudinalanalysis (Pseudo-prospective/retrospective)
   3. Longitudinal design but cross-sectional analysis (Retrospective)
   4. Cross-sectional design with cross-sectional analysis (Retrospective)
   5. Others: _____
   6. Unclear

7. Type of statistical technique applied
   1. One sample t-test
   2. Independent samples t-test
   3. Paired samples t-test
   4. Chi-square
   5. Correlations (r-related test, such as Kendall's Tau and Spearman's Rho): By using the statistical tables or mathematical procedures developed for conversion of the effect sizes (Gilpin, 1993; Walker, 2003), all r-related statistics were first converted to Pearson's r for calculating the selected common effect size of the odds ratio in CMA-2)
   6. ANOVA
   7. Logistic regression (Bivariate)
   8. Liner regression (Bivariate)
   9. Descriptive statistics
   10. Others: _____

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8.2 Statistical Information for Calculating the Effect Size

1. Count data for binary outcome and independent variable

Outcome	Risk factor:		Total
	Group 1:	Group 2:	
1. Violent			
0. Non-violent			
Total			

(a) Coder re-grouped/combined the original values of the independent variable 1. Yes 2. No
(b) Coder combined different violent outcomes 1. Yes 2. No
(c) Coder combined different non-violent outcomes 1. Yes 2. No
(d) Type of statistical test: _____
(e) Value of the test statistic: _____ (f) d.f. _____ (g) *p*-value: _____
(h) Direction of the relationship: _____

Remarks (if any):

2. Data for binary outcome with continuous independent variable

Risk factor:	Outcome	
	Violent	Non-violent
Mean		
Standard deviation		
Valid sample size		

(a) Type of statistical test: _____
(b) Value of the test statistic: _____ (c) d.f. _____ (d) *p*-value: _____
(e) Direction of the relationship: _____

Remarks (if any):

3. Data for continuous outcome with binary independent variable

Outcome	Risk factor:	
	Condition 0:	Condition 1:
Mean		
Standard deviation		
Valid sample size		

(a) Type of statistical test: _____
(b) Value of the test statistic: _____ (c) d.f. _____ (d) *p*-value: _____
(e) Direction of the relationship: _____

Remarks (if any):

4. Other data or statistics
(a) Type of statistical test: _____ (b) Type and value of the test statistic: _____
(c) Valid N: _____ (d) d.f. _____ (e) *p*-value: _____
(f) S.E. _____ (g) 95% CI: _____
(h) Direction of the relationship: _____

Remarks (if any):

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8.3 Characteristics of the Outcome Measure

1. Measure of violence
   1. Standardized/validated scale:_____
   2. Non-validated scale or self-constructed scale
   3. Discrete violent incidents (specific violent behaviors or crimes)
      (a) Used specific item/s from standardized/validated scale
         1. Yes: _____ 2. No
   4. Others: _____
   5. Mixed: _____
   6. Unclear

   Remarks (if any):

2. Reliability of the measurement scale (if Q.2 = 1 or 2)

3. Level of measurement
   (If values of the variable were re-grouped, circle the re-grouped one that corresponds to the effect size calculation)
   1. Binary 2. Continuous 3. Others 4. Unclear

4. Length of observation on the outcome (i.e., violence): _____

   (a) Constant observation period (length of observation was same for all participants)
      1. Yes 2. No 3. Unclear 4. Others:_____

5. Type of violence
   (Criminal violence = a criminal record was produced as a result of engaging in the violent act; Non-criminal violence = no criminal record was produced as a result of engaging in the violent act)
   1. 100% Criminal 3. 100% Non-criminal 5. Mixed
   2. ≥ 80% Criminal 4. ≥ 80% Non-criminal 6. Unclear

6. Type of criminal record for violence
   1. 100% Violation of parole or probation
   2. ≥ 80% Violation of parole or probation
   3. 100% Arrest
   4. ≥ 80% Arrest
   5. 100% Conviction
   6. ≥ 80% Conviction
   7. 100% Incarceration
   8. ≥ 80% Incarceration
   9. 100% Hospitalization
   10. ≥ 80% Hospitalization
   11. Others: _____
   12. Mixed: _____
   13. Unclear
   14. Not applicable

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7. Nature of criminal violence
   1. 100% First-time
   2. ≥ 80% First-time
   3. 100% Recidivistic
   4. ≥ 80% Recidivistic
   5. Mixed
   6. Unclear
   7. Not applicable

8. Method of data collection for violence
   1. Self-report with any means (e.g., face-to-face interview and self-administrated questionnaire)
   2. Report/observation by clinicians (psychiatrists and psychologists)
   3. Report/observation by other mental health care professionals or social workers
   4. Report/observation by criminal justice professionals (e.g., police and correctional officers)
   5. Report/observation by family members (including partners and relatives)
   6. Report/observation by employers
   7. Report/observation by members of the research team (e.g., research assistants and independent observers)
   8. Archive of institution records (e.g., hospital records and crime registers)
   9. Others: _____
   10. Mixed: _____
   11. Unclear

8.4 Characteristics of the Risk Factor

1. Level of measurement
   (If values of the variable were re-grouped, circle the re-grouped one that corresponds to the effect size calculation)
   1. Binary 2. Continuous 3. Others 4. Unclear

2. Other characteristics: Check the "List of Risk Factors" to see if additional characteristics of the risk factor should be coded. If yes, copy those items here and code them accordingly.

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Section 9: Coding Summary

1. No. of prevalence rates coded for the overall estimate (excluding those merely treated as moderator variable/s)
   (a) Mentally disordered participants: _____
   (b) Non-mentally disordered participants: _____

2. No. of risk factors coded: _____

3. Summary of the coded risk factors

Effect Size No. and Risk Factor	Factor ID in the "List of Risk Factors"

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List of Risk Factors

1. Sex (Group 1 = Male; Group 2 = Female)

2. Age (Group 1 = Younger; Group 2 = Older)

3. Race (Group 1 = Non-white; Group 2 = White)

4. Marital status (Group 1 = Single; Group 2 = Non-single)
   - Single = single, separated, divorced, widowed)
   - Non-single = married, re-married, cohabited, partnership

5. Education (Group 1 = Lower; Group 2 = Higher)

6. Income (Group 1 = Lower; Group 2 = Higher)

7. Socio-economic status (Group 1 = Lower; Group 2 = Higher)

8. Anger

9. Impulsiveness

10. Neurological impairment (Group 1 = Yes; Group 2 = No)

11. Unemployment (Group 1 = Yes; Group 2 = No)

    (a) Length of observation: _____

12. History of violence (Group 1 = Yes; Group 2 = No)

13. Self-harm behavior/thought (Group 1 = Yes; Group 2 = No)

    (a) Nature of the problem
    1. Self-harm behavior 2. Self-harm thought 3. Mixed 4. Unclear

14. Criminal history (Group 1 = Yes or more criminal records; Group 2 = No or fewer criminal records)

15. Onset of mental disorder (Group 1 = Earlier; Group 2 = Later)

16. Prior psychiatric hospitalization (Group 1 = Yes or more; Group 2 = No or fewer)

17. Involuntary psychiatric hospitalization (Group 1 = Yes; Group 2 = No)

18. Duration of psychiatric hospitalization (Group 1 = Longer; Group 2 = Shorter)

19. Violent victimization (Group 1 = Yes; Group 2 = No)

    (a) Length of observation: _____

20. Child abuse victim (Group 1 = Yes; Group 2 = No)

    (a) Type of child abuse
    1. Physical 2. Sexual 3. Mixed 4. Unclear

21. Childhood conduct disorder or problems (Group 1 = Yes; Group 2 = No)

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22. Homeless (Group 1 = Yes; Group 2 = No)

    (a) Length of observation: _____

23. Living with family/relatives (Group 1 = Yes; Group 2 = No)

    (a) Comparison group
    1. Living alone
    2. Living with non-family/relatives (e.g., friends, room-mate, and strangers)
    3. Mixed: _____
    4. Others: _____
    5. Unclear

24. Psychotic disorders (Group 1 = Psychotic disorders; Group 2 = Non-psychotic disorders)

(a) Types of psychotic disorders	N	%
1. Schizophrenia spectrum disorders		
1. Schizophrenia-Not specified		
2. Schizophrenia-Paranoid type		
3. Schizophrenia-Disorganized type		
4. Schizophrenia-Catatonic type		
5. Schizophrenia-Undifferentiated type		
6. Schizophrenia-Residual type		
7. Schizophreniform disorder		
8. Schizoaffective disorder		
9. Others: _____		
10. Mixed: _____		
11. Unclear		
2. Other psychotic disorders		
1. Delusional disorder		
2. Brief psychotic disorder		
3. Shared psychotic disorder		
4. Psychotic disorder due to a general medical condition		
5. Psychotic disorder not otherwise specified (NOS)		
6. Others: _____		
7. Mixed: _____		
8. Unclear		
3. Others: _____		
4. Mixed: _____		
5. Unclear		

(b) (Primary) diagnosis of the comparison group		
1. Mood disorders		
1. Depressive disorders		
a) with psychotic features		
2. Bipolar disorders (e.g., single manic, Bipolar I & II)		
a) with psychotic features		
3. Others: _____		
a) with psychotic features		
4. Mixed: _____		
a) with psychotic features		
5. Unclear		

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	N	%
2. Anxiety disorders		
1. Generalized anxiety disorder		
2. Phobia		
3. Panic disorder		
4. Obsessive-compulsive disorder		
5. Post-traumatic stress disorder		
6. Others: _____		
7. Mixed: _____		
8. Unclear		
3. Substance abuse disorders		
1. Alcohol		
2. Non-alcohol		
3. Mixed		
4. Unclear		
4. Personality disorders		
1. Paranoid PD		
2. Schizoid PD		
3. Schizotypal PD		
4. Antisocial PD		
5. Borderline PD		
6. Histrionic PD		
7. Narcissistic PD		
8. Others: _____		
9. Mixed: _____		
10. Unclear		
5. Others: _____		
6. Mixed: _____		
7. Unclear		

25. Mood disorders (Group 1 = Mood disorders; Group 2 = Non-mood disorders)

(a) Types of mood disorders	N	%
1. Depressive disorders		
a) with psychotic features		
2. Bipolar disorders (e.g., single manic, Bipolar I & II)		
a) with psychotic features		
3. Others: _____		
a) with psychotic features		
4. Mixed: _____		
a) with psychotic features		
5. Unclear		

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(b) (Primary) diagnosis of the comparison group — N — %

1. Psychotic disorders
    1. Schizophrenia spectrum disorders
        1. Schizophrenia-Not specified
        2. Schizophrenia-Paranoid type
        3. Schizophrenia-Disorganized type
        4. Schizophrenia-Catatonic type
        5. Schizophrenia-Undifferentiated type
        6. Schizophrenia-Residual type
        7. Schizophreniform disorder
        8. Schizoaffective disorder
        9. Others: _____
        10. Mixed: _____
        11. Unclear
    2. Other psychotic disorders
        1. Delusional disorder
        2. Brief psychotic disorder
        3. Shared psychotic disorder
        4. Psychotic disorder due to a general medical condition
        5. Psychotic disorder not otherwise specified (NOS)
        6. Others: _____
        7. Mixed: _____
        8. Unclear
    3. Others: _____
    4. Mixed: _____
    5. Unclear
2. Anxiety disorders
    1. Generalized anxiety disorder
    2. Phobia
    3. Panic disorder
    4. Obsessive-compulsive disorder
    5. Post-traumatic stress disorder
    6. Others: _____
    7. Mixed: _____
    8. Unclear
3. Substance abuse disorders
    1. Alcohol
    2. Non-alcohol
    3. Mixed
    4. Unclear
4. Personality disorders
    1. Paranoid PD
    2. Schizoid PD
    3. Schizotypal PD
    4. Antisocial PD
    5. Borderline PD
    6. Histrionic PD
    7. Narcissistic PD
    8. Others: _____
    9. Mixed: _____
    10. Unclear
5. Others: _____
6. Mixed: _____
7. Unclear

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26. Personality disorders (Group 1 = Personality disorders; Group 2 = Non-personality disorders)

(a) Types of personality disorders	N	%
1. Paranoid PD		
2. Schizoid PD		
3. Schizotypal PD		
4. Antisocial PD		
5. Borderline PD		
6. Histrionic PD		
7. Narcissistic PD		
8. Others: _____		
9. Mixed: _____		
10. Unclear		

(a) (Primary) diagnosis of the comparison group	N	%
1. Psychotic disorders		
1. Schizophrenia spectrum disorders		
1. Schizophrenia-Not specified		
2. Schizophrenia-Paranoid type		
3. Schizophrenia-Disorganized type		
4. Schizophrenia-Catatonic type		
5. Schizophrenia-Undifferentiated type		
6. Schizophrenia-Residual type		
7. Schizophreniform disorder		
8. Schizoaffective disorder		
9. Others: _____		
10. Mixed: _____		
11. Unclear		
2. Other psychotic disorders		
1. Delusional disorder		
2. Brief psychotic disorder		
3. Shared psychotic disorder		
4. Psychotic disorder due to a general medical condition		
5. Psychotic disorder not otherwise specified (NOS)		
6. Others: _____		
7. Mixed: _____		
8. Unclear		
3. Others: _____		
4. Mixed: _____		
5. Unclear		
2. Mood disorders		
1. Depressive disorders		
a) with psychotic features		
2. Bipolar disorders (e.g., single manic, Bipolar I & II)		
a) with psychotic features		
3. Others: _____		
a) with psychotic features		
4. Mixed: _____		
a) with psychotic features		
5. Unclear		

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	N	%
3. Anxiety disorders		
1. Generalized anxiety disorder		
2. Phobia		
3. Panic disorder		
4. Obsessive-compulsive disorder		
5. Post-traumatic stress disorder		
6. Others: _____		
7. Mixed: _____		
8. Unclear		
4. Substance abuse disorders		
1. Alcohol		
2. Non-alcohol		
3. Mixed		
4. Unclear		
5. Others: _____		
6. Mixed: _____		
7. Unclear		

27. Psychiatric comorbidity

(a) Type of psychiatric comorbidity

	N	%
1. Psychotic disorders		
1. Schizophrenia spectrum disorders		
1. Schizophrenia-Not specified		
2. Schizophrenia-Paranoid type		
3. Schizophrenia-Disorganized type		
4. Schizophrenia-Catatonic type		
5. Schizophrenia-Undifferentiated type		
6. Schizophrenia-Residual type		
7. Schizophreniform disorder		
8. Schizoaffective disorder		
9. Others: _____		
10. Mixed: _____		
11. Unclear		
2. Other psychotic disorders		
1. Delusional disorder		
2. Brief psychotic disorder		
3. Shared psychotic disorder		
4. Psychotic disorder due to a general medical condition		
5. Psychotic disorder not otherwise specified (NOS)		
6. Others: _____		
7. Mixed: _____		
8. Unclear		
3. Others: _____		
4. Mixed: _____		
5. Unclear		

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	N	%
2. Mood disorders		
1. Depressive disorders		
a) with psychotic features		
2. Bipolar disorders (e.g., single manic, Bipolar I & II)		
a) with psychotic features		
3. Others: _____		
a) with psychotic features		
4. Mixed: _____		
a) with psychotic features		
5. Unclear		
3. Anxiety disorders		
1. Generalized anxiety disorder		
2. Phobia		
3. Panic disorder		
4. Obsessive-compulsive disorder		
5. Post-traumatic stress disorder		
6. Others: _____		
7. Mixed: _____		
8. Unclear		
4. Substance abuse disorders		
1. Alcohol		
2. Non-alcohol		
3. Mixed		
4. Unclear		
5. Personality disorders		
1. Paranoid PD		
2. Schizoid PD		
3. Schizotypal PD		
4. Antisocial PD		
5. Borderline PD		
6. Histrionic PD		
7. Narcissistic PD		
8. Others: _____		
9. Mixed: _____		
10. Unclear		
6. Others: _____		
7. Mixed: _____		
8. Unclear		

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28. Psychiatric symptoms

(a) Nature of investigation
1. Prevalence 2. Symptom severity 3. Unclear

(b) Type of symptoms
1. Positive symptoms
[Behaviors or characteristics that are "additions to or distortions of normal functioning" (First et al., 2004, p.161) or "not normally found in normal people" (Thompson & Meltzer 1993, p.344), e.g., delusions, hallucinations, excitement/hyperactivity, grandiosity, suspiciousness/persecution, and hostility]

2. Negative symptoms
[Behaviors or characteristics that are "deficits in normal functioning" (First et al., 2004, p.161). They represent the absence of behaviors or characteristics typically found in normal people (Thompson & Meltzer 1993, p.344), e.g., blunted/flat affect, emotional withdrawal, poor rapport, passive/apathetic social withdrawal, difficulty in abstract thinking, lack of spontaneity and flow of conservation/thought, stereotyped thinking, poverty of speech (alogia), psychomotor retardation, loss of pleasure (anhedonia), loss of interest in activities (avolition), a decrement in affective or verbal expression and motivation]

3. Disorganized symptoms
[Behavior or characteristics that are "not clearly positive or clearly negative" (First et al., 2004, p.161; Thompson & Meltzer, 1993), e.g., conceptual disorganization, disorganized speech and behavior, inappropriate affect, and odd/bizarre motor movement (catatonia)]

4. Others: _____

5. Mixed: _____

6. Unclear

(c) Symptoms (measure of the symptoms) comprised of hallucinations and/or delusions
1. Yes: Hallucinations only
2. Yes: Delusions only
3. Yes: Hallucinations and delusions
4. No
5. Unclear

(d) Method of data collection
1. Archive of institutional records
2. Direct interview/assessment by clinicians (psychiatrist or psychologist)
3. Direct interview by lay or non-clinical interviewers
4. Indirect observation or report from clinicians
5. Indirect observation or report from lay or non-clinical interviewers
6. Indirect observation or report from collaterals (e.g., family members and case manager)
7. Others: _____
8. Mixed: _____
9. Unclear

(e) Diagnostic reliability
(Assessment was made or confirmed by clinicians or obtained from related institutional records)
1. Yes 2. No 3. Unclear

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(f) Measurement tool
1. Brief Psychiatric Rating Scale (BPRS)
2. The Positive and Negative Syndrome Scale (PANSS): Positive sub-scale
3. The Positive and Negative Syndrome Scale (PANSS): Negative sub-scale
4. The Positive and Negative Syndrome Scale (PANSS): General psychopathology sub-scale
5. Scale for the Assessment of Negative Symptoms (SANS)
6. Scale for the Assessment of Positive Symptoms (SAPS)
7. Schedule for Affective Disorders and Schizophrenia (SADS)
8. Schedule for Affective Disorders and Schizophrenia-Current (SADS-C)
9. Comprehensive Assessment of Symptoms and History (CASH)
10. Non-standardized/non-validated or self-constructed scale
11. Others: _____
12. Mixed: _____
13. General/unstructured observation without using any specific tool (e.g., impression from clinicians' daily interaction with patients)
14. Unclear

(g) Time diagnosed with the symptoms
1. Before the occurrence of violence
2. After the occurrence of violence
3. Mixed
4. Unclear

29. Psychopathy (Group 1 = Psychopath; Group 2 = Non-psychopath)

30. Level of functioning (Group 1 = Lower level; Group 2 = Higher level)

31. Severity of mental disorder (Group 1 = Higher severity level; Group 2 = Lower severity level)

32. Substance abuse

(a) Type of substance abused
1. Alcohol
2. Non-alcohol
3. Mixed
5. Unclear/Not specified

(b) Length of observation: _____

33. Insight on mental disorder (Group 1 = No or lower level; Group 2 = Yes or higher level)

34. Treatment non-compliance (Group 1 = Yes; Group 2 = No)

35. Perceived treatment need (Group 1 = No; Group 2 = Yes)

36. Duration of mental disorder

37. Mental health status (Group 1 = Mentally disordered; Group 2 = Non-mentally disordered)

38. Others: _____

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Appendix C

Full Citation of the 85 Reports Identified for Synthesis, Including Corresponding Study Name with Reference Number

No.	Report ID	Study ID	Study[a] name with reference number	Full citation
01	01	01	01.Rep/Std.01-Soyka.et.al.2007	Soyka, M., Graz, C., Bottlender, R., Dirschedl, P., & Schoech, H. (2007). Clinical correlates of later violence and criminal offences in schizophrenia. *Schizophrenia Research, 94*(1-3), 89–98.
02	02	02	02.Rep/Std.02-Bobes.et.al.2009	Bobes, J., Fillat, O., & Arango, C. (2009). Violence among schizophrenia out-patients compliant with medication: Prevalence and associated factors. *Acta Psychiatrica Scandinavica, 119*(3), 218–225.
03	03	03	03.Rep/Std.03-McDermott.et.al.2007	McDermott, B. E., Quanbeck, C. D., & Frye, M. A. (2007). Comorbid substance use disorder in women with bipolar disorder associated with criminal arrest. *Bipolar Disorders, 9*(5), 536–540.
04	04	04	04.Rep/Std.04-Joyal.et.al.2008	Joyal, C. C., Gendron, C., & Côté, G. (2008). Nature and frequency of aggressive behaviours among long-term inpatients with schizophrenia: A 6-month report using the Modified Overt Aggression Scale. *The Canadian Journal of Psychiatry, 53*(7), 478–481.
05	05	05	05.Rep/Std.05-Elbogen.et.al.2006	Elbogen, E. B., Van Dorn, R. A., Swanson, J. W., Swartz, M. S., & Monahan, J. (2006). Treatment engagement and violence risk in mental disorders. *British Journal of Psychiatry, 189*(4), 354–360.
06	06	06	06.Rep/Std.06-Elbogen.Johnson.2009	Elbogen, E. B., & Johnson, S. C. (2009). The intricate link between violence and mental disorder: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Archives of General Psychiatry, 66*(2), 152–161.
07	07	07	07.Rep/Std.07-Doyle.Dolan.2006	Doyle, M., & Dolan, M. (2006). Evaluating the validity of anger regulation problems, interpersonal style, and disturbed mental state for predicting inpatient violence. *Behavioral Sciences and the Law, 24*(6), 783–798.
08	08	08	08.Rep/Std.08-Hodgins.et.al.2008	Hodgins, S., Cree, A., Alderton, J., & Mak, T. (2008). From conduct disorder to severe mental illness: Associations with aggressive behaviour, crime, and victimization. *Psychological Medicine, 38*(7), 975–987.
09	09	08	09.Rep/Std.08-Hodgins.et.al.2007	Hodgins, S., Alderton, J., Cree, A., Aboud, A., & Mak, T. (2007). Aggressive behaviour, victimisation and crime among severely mentally ill patients requiring hospitalisation. *British Journal of Psychiatry, 191*(2), 343–350.
10	10	09	10.Rep/Std.09-Grossman.et.al.1995	Grossman, L. S., Haywood, T. W., Cavanaugh, J. L., Davis, J. M., & Lewis, D. A. (1995). State psychiatric hospital patients with past arrests for violent crimes. *Psychiatric Services, 46*(8), 790–795.
11	11	10	11.Rep/Std.10-Oulis.et.al.1996	Oulis, P., Lykouras, L., Dascalopoulou, E., & Psarros, C. (1996). Aggression among psychiatric inpatients in Greece. *Psychopathology, 29*(3), 174–180.

(table continues)

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No.	Report ID	Study ID	Study[a] name with reference number	Full citation
12	12	11	12.Rep/Std.11-Brown.et.al.1998	Brown, T. G., Werk, A., Caplan, T., Shields, N., & Seraganian, P. (1998). The incidence and characteristics of violent men in substance abuse treatment. *Addictive Behaviors, 23*(5), 573–586.
13	13	12	13.Rep/Std.12-Brennan.et.al.2000	Brennan, P. A., Mednick, S. A., & Hodgins, S. (2000). Major mental disorders and criminal violence in a Danish birth cohort. *Archives of General Psychiatry, 57*(5), 494–500.
14	14	13	14.Rep/Std.13-Novaco.1994.S1[b]	Novaco, R. W. (1994). Anger as a risk factor for violence among the mentally disordered. In J. Monahan, & H. J. Steadman (Eds.), *Violence and mental disorder: Developments in risk assessment* (pp. 21-59). Chicago, IL: University of Chicago Press.
15	14	13	14.Rep/Std.13-Novaco.1994.S2[b]	Ditto.
16	15	14	15.Rep/Std.14-Rabinowitz.Mark.1999	Rabinowitz, J., & Mark, M. (1999). Risk factors for violence among long-stay psychiatric patients: National study. *Acta Psychiatrica Scandinavica, 99*(5), 341–347.
17	16	15	16.Rep/Std.15-Myers.Dunner.1984	Myers, K. M., & Dunner, D. L. (1984). Self and other directed violence on a closed acute-care ward. *Psychiatric Quarterly, 56*(3), 178–188.
18	17	16	17.Rep/Std.16-Vitacco.et.al.2009	Vitacco, M. J., Van Rybroek, G. J., Rogstad, J. E., Yahr, L. E., Tomony, J. D., & Saewert, E. (2009). Predicting short-term institutional aggression in forensic patients: A multi-trait method for understanding subtypes of aggression. *Law and Human Behavior, 33*(4), 308–319.
19	18	17	18.Rep/Std.17-Egami.et.al.1996	Egami, Y., Ford, D. E., Greenfield, S. F., & Crum, R. M. (1996). Psychiatric profile and sociodemographic characteristics of adults who report physically abusing or neglecting children. *American Journal of Psychiatry, 153*(7), 921–928.
20	19	18	19.Rep/Std.18-Brekke.et.al.2001	Brekke, J. S., Prindle, C., Bae, S. W., & Long, J. D. (2001). Risks for individuals with schizophrenia who are living in the community. *Psychiatric Services, 52*(10), 1358–1366.
21	20	19	20.Rep/Std.19-Watts.et.al.2003	Watts, D., Leese, M., Thomas, S., Atakan, Z., & Wykes, T. (2003). The prediction of violence in acute psychiatric units. *International Journal of Forensic Mental Health, 2*(2), 173–180.
22	21	20	21.Rep/Std.20-Boles.Johnson.2001	Boles, S. M., & Johnson, P. B. (2001). Violence among comorbid and noncomorbid severely mentally ill adults: A pilot study. *Substance Abuse, 22*(3), 167–173.
23	22	21	22.Rep/Std.21-Monahan.et.al.2005	Monahan, J., Steadman, H. J., Robbins, P. C., Appelbaum, P., Banks, S., Grisso, T., Heilbrun, K., Mulvey, E. P., Roth, L., & Silver, E. (2005). An actuarial model of violence risk assessment for persons with mental disorders. *Psychiatric Services, 56*(7), 810–815.

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No.	Report ID	Study ID	Study[a] name with reference number	Full citation
24	23	22	23.Rep/Std.22-Lewis.et.al.2006	Lewis, C. F., Fields, C., & Rainey, E. (2006). A study of geriatric forensic evaluees: Who are the violent elderly? *Journal of the American Academy of Psychiatry and the Law*, *34*(3), 324–332.
25	24	23	24.Rep/Std.23-Swanson.et.al.2000	Swanson, J. W., Swartz, M. S., Borum, R., Hiday, V. A., Wagner, H. R., & Burns, B. J. (2000). Involuntary out-patient commitment and reduction of violent behaviour in persons with severe mental illness. *British Journal of Psychiatry*, *176*, 324–331.
26	25	24	25.Rep/Std.24-Swanson.et.al.2006	Swanson, J. W., Swartz, M. S., Van Dorn, R. A., Elbogen, E. B., Wagner, H. R., Rosenheck, R. A., Stroup, T. S., McEvoy, J. P., & Lieberman, J. A. (2006). A national study of violent behavior in persons with schizophrenia. *Archives of General Psychiatry*, *63*(5), 490–499.
27	26	25	26.Rep/Std.25-Tardiff.et.al.1997	Tardiff, K., Marzuk, P. M., Leon, A. C., Portera, L., & Weiner, C. (1997). Violence by patients admitted to a private psychiatric hospital. *American Journal of Psychiatry*, *154*(1), 88–93.
28	27	25	27.Rep/Std.25-Tardiff.et.al.1997	Tardiff, K., Marzuk, P. M., Leon, A. C., & Portera, L. (1997). A prospective study of violence by psychiatric patients after hospital discharge. *Psychiatric Services*, *48*(5), 678–681.
29	28	26	28.Rep/Std.26-Hodelet.2001	Hodelet, N. (2001). Psychosis and offending in British Columbia: Characteristics of a secure hospital population. *Criminal Behaviour and Mental Health*, *11*(3), 163–172.
30	29	27	29.Rep/Std.27-Erickson.2005	Erickson, S. K. (2005). A retrospective examination of outpatient commitment in New York. *Behavioral Sciences and the Law*, *23*(5), 627–645.
31	30	28	30.Rep/Std.28-Grevatt.et.al.2004	Grevatt, M., Thomas-Peter, B., & Hughes, G. (2004). Violence, mental disorder and risk assessment: Can structured clinical assessments predict the short-term risk of inpatient violence? *Journal of Forensic Psychiatry & Psychology*, *15*(2), 278–292.
32	31	29	31.Rep/Std.29-Murphy.et.al.2001	Murphy, C. M., O'Farrell, T. J., Fals-Stewart, W., & Feehan, M. (2001). Correlates of intimate partner violence among male alcoholic patients. *Journal of Consulting and Clinical Psychology*, *69*(3), 528–540.
33	32	30	32.Rep/Std.30-Scott.et.al.1998	Scott, H., Johnson, S., Menezes, P., Thornicroft, G., Marshall, J., Bindman, J., Bebbington, P., & Kuipers, E. (1998). Substance misuse and risk of aggression and offending among the severely mentally ill. *British Journal of Psychiatry*, *172*, 345–350.
34	33	31	33.Rep/Std.31-Ho.et.al.2009	Ho, H., Thomson, L., & Darjee, R. (2009). Violence risk assessment: The use of the PCL-SV, HCR-20, and VRAG to predict violence in mentally disordered offenders discharged from a medium secure unit in Scotland. *Journal of Forensic Psychiatry & Psychology*, *20*(4), 523–541.

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No.	Report ID	Study ID	Study[a] name with reference number	Full citation
35	34	32	34.Rep/Std.32-Troisi.et.al.2003	Troisi, A., Kustermann, S., Di Genio, M., & Siracusano, A. (2003). Hostility during admission interview as a short-term predictor of aggression in acute psychiatric male inpatients. *Journal of Clinical Psychiatry*, *64*, 1460–1464.
36	35	33	35.Rep/Std.33-Dickerson.et.al.1994	Dickerson, F., Ringel, N., Parente, F., & Boronow, J. (1994). Seclusion and restraint, assaultiveness, and patient performance in a token economy. *Hospital and Community Psychiatry*, *45*(2), 168–170.
37	36	34	36.Rep/Std.34-Leonard.et.al.2006	Leonard, R., Tinetti, M. E., Allore, H. G., & Drickamer, M. A. (2006). Potentially modifiable resident characteristics that are associated with physical or verbal aggression among nursing home residents with dementia. *Archives of Internal Medicine*, *166*, 1295–1300.
38	37	35	37.Rep/Std.35-Holcomb.Ahr.1988	Holcomb, W. R., & Ahr, P. R. (1988). Arrest rates among young adult psychiatric patients treated in inpatient and outpatient settings. *Hospital and Community Psychiatry*, *39*(1), 52–57.
39	38	36	38.Rep/Std.36-Thomas.et.al.2005	Thomas, S., Leese, M., Walsh, E., McCrone, P., Moran, P., Burns, T., Creed, F., Tyrer, P., & Fahy, T. (2005). A comparison of statistical models in predicting violence in psychotic illness. *Comprehensive Psychiatry*, *46*(4), 296–303.
40	39	36	39.Rep/Std.36-Moran.et.al.2003	Moran, P., Walsh, E., Tyrer, P., Burns, T., Creed, F., & Fahy, T. (2003). Impact of comorbid personality disorder on violence in psychosis: Report from the UK700 trial. *British Journal of Psychiatry*, *182*(2), 129–134.
41	40	36	40.Rep/Std.36-Dean.et.al.2006	Dean, K., Walsh, E., Moran, P., Tyrer, P., Creed, F., Byford, S., Burns, T., Murray, R., & Fahy, T. (2006). Violence in women with psychosis in the community: Prospective study. *British Journal of Psychiatry*, *188*(3), 264–270.
42	41	37	41.Rep/Std.37-Krakowski.Czobor.2004	Krakowski, M., & Czobor, P. (2004). Gender differences in violent behaviors: Relationship to clinical symptoms and psychosocial factors. *American Journal of Psychiatry*, *161*(3), 459–465.
43	42	38	42.Rep/Std.38-Blum.2003	Blum, F. M. (2003). *Psychopathy, psychosis, drug abuse, and reoffense among conditionally released offenders.* Unpublished doctoral dissertation, University of Southern California, The Graduate School, University Park, Los Angeles, CA.
44	43	39	43.Rep/Std.39-Steele.et.al.2003	Steele, J., Darjee, R., & Thomson, L. D. G. (2003). Substance dependence and schizophrenia in patients with dangerous, violent and criminal propensities: A comparison of co-morbid and non-co-morbid patients in a high-security setting. *Journal of Forensic Psychiatry & Psychology*, *14*(3), 569–584.

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No.	Report ID	Study ID	Study[a] name with reference number	Full citation
45	44	40	44.Rep/Std.40-Swanson.et.al.2002	Swanson, J. W., Swartz, M. S., Essock, S. M., Osher, F. C., Wagner, H. R., Goodman, L. A., Rosenberg, S. D., & Meador, K. G. (2002). The social-environmental context of violent behavior in persons treated for severe mental illness. *American Journal of Public Health, 92*(9), 1523–1531.
46	45	40	45.Rep/Std.40-Elbogen.et.al.2007	Elbogen, E. B., Mustillo, S., Van Dorn, R., Swanson, J. W., & Swartz, M. S. (2007). The impact of perceived need for treatment on risk of arrest and violence among people with severe mental illness. *Criminal Justice and Behavior, 34*(2), 197–210.
47	46	41	46.Rep/Std.41-Fulwiler.Ruthazer.1999	Fulwiler, C., & Ruthazer, R. (1999). Premorbid risk factors for violence in adult mental illness. *Comprehensive Psychiatry, 40*(2), 96–100.
48	47	41	47.Rep/Std.41-Fulwiler.et.al.1997	Fulwiler, C., Grossman, H., Forbes, C., & Ruthazer, R. (1997). Early-onset substance abuse and community violence by outpatients with chronic mental illness. *Psychiatric Services, 48*(9), 1181–1185.
49	48	42	48.Rep/Std.42-Hodgins.et.al.2002	Hodgins, S., Kratzer, L., & McNeil, T. F. (2002). Obstetrical complications, parenting practices and risk of criminal behaviour among persons who develop major mental disorders. *Acta Psychiatrica Scandinavica, 105*(3), 179–188.
50	49	43	49.Rep/Std.43-Mericle.Havassy.2008	Mericle, A. A., & Havassy, B. E. (2008). Characteristics of recent violence among entrants to acute mental health and substance abuse services. *Social Psychiatry and Psychiatric Epidemiology, 43*(5), 392–402.
51	50	44	50.Rep/Std.44-Buchanan.1998	Buchanan, A. (1998). Criminal conviction after discharge from special (high security) hospital: Incidence in the first 10 years. *British Journal of Psychiatry, 172*(6), 472–476.
52	51	45	51.Rep/Std.45-Ascher-Svanum.et.al.2006	Ascher-Svanum, H., Faries, D. E., Zhu, B., Ernst, F. R., Swartz, M. S., & Swanson, J. W. (2006). Medication adherence and long-term functional outcomes in the treatment of schizophrenia in usual care. *Journal of Clinical Psychiatry, 67*(3), 453–460.
53	52	46	52.Rep/Std.46-Cirincione.et.al.1992.S1[c]	Cirincione, C., Steadman, H. J., Robbins, P. C., & Monahan, J. (1992). Schizophrenia as a contingent risk factor for criminal violence. *International Journal of Law and Psychiatry, 15*(4), 347–358.
54	52	46	52.Rep/Std.46-Cirincione.et.al.1992.S2[c]	Ditto.
55	53	46	53.Rep/Std.46-Cirincione.et.al.1994.S1[d]	Cirincione, C., Steadman, H. J., Robbins, P. C., & Monahan, J. (1994). Mental illness as a factor in criminality: A study of prisoners and mental patients. *Criminal Behaviour and Mental Health, 4*(1), 33–47.
56	53	46	53.Rep/Std.46-Cirincione.et.al.1994.S2[d]	Ditto.

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No.	Report ID	Study ID	Study[a] name with reference number	Full citation
57	54	47	54.Rep/Std.47-Young.et.al.2003	Young, S., Gudjonsson, G., Ball, S., & Lam, J. (2003). Attention deficit hyperactivity disorder (ADHD) in personality disordered offenders and the association with disruptive behavioural problems. *Journal of Forensic Psychiatry & Psychology, 14*(3), 491–505.
58	55	48	55.Rep/Std.48-Bergman.Ericsson.1996	Bergman, B., & Ericsson, E. (1996). Family violence among psychiatric in-patients as measured by the Conflict Tactics Scale (CTS). *Acta Psychiatrica Scandinavica, 94*(3), 168–174.
59	56	49	56.Rep/Std.49-Arseneault.et.al.2000	Arseneault, L., Moffitt, T. E., Caspi, A., Taylor, P. J., & Silva, P. A. (2000). Mental disorders and violence in a total birth cohort: Results from the Dunedin study. *Archives of General Psychiatry, 57*(10), 979–986.
60	57	50	57.Rep/Std.50-Sims.1989	Sims, N. E. (1989). *The mentally disordered offender in the criminal justice system.* Unpublished doctoral dissertation, California Institute of Integral Studies, San Francisco, CA.
61	58	51	58.Rep/Std.51-Hildebrand.et.al.2004	Hildebrand, M., De Ruiter, C., & Nijman, H. (2004). PCL-R psychopathy predicts disruptive behavior among male offenders in a Dutch forensic psychiatric hospital. *Journal of Interpersonal Violence, 19*(1), 13–29.
62	59	52	59.Rep/Std.52-Shore.et.al.1989	Shore, D., Filson, C. R., Johnson, W. E., Rae, D. S., Muehrer, P., Kelley, D. J., Davis, T. S., Waldman, I. N., & Wyatt, R. J. (1989). Murder and assault arrests of White House Cases: Clinical and demographic correlates of violence subsequent to civil commitment. *American Journal of Psychiatry, 146*(5), 645–651.
63	60	53	60.Rep/Std.53-Yesavage.et.al.1981	Yesavage, J. A., Werner, P. D., Becker, J., Holman, C., & Mills, M. (1981). Inpatient evaluation of aggression in psychiatric patients. *Journal of Nervous and Mental Disease, 169*(5), 299–302.
64	61	53	61.Rep/Std.53-Yesavage.1983a	Yesavage, J. A. (1983a). Inpatient violence and the schizophrenic patient: A study of Brief Psychiatric Rating Scale scores and inpatient behavior. *Acta Psychiatrica Scandinavica, 67*(5), 353–357.
65	62	53	62.Rep/Std.53-Yesavage.1984	Yesavage, J. A. (1984). Correlates of dangerous behavior by schizophrenics in hospital. *Journal of Psychiatric Research, 18*(3), 225–231.
66	63	53	63.Rep/Std.53-Yesavage.1983b	Yesavage, J. A. (1983b). Bipolar illness: Correlates of dangerous inpatient behaviour. *British Journal of Psychiatry, 143*, 554–557.
67	64	54	64.Rep/Std.54-Rossi.et.al.1986	Rossi, A. M., Jacobs, M., Monteleone, M., Olsen, R., Surber, R. W., Winkler, E. L., & Wommack, A. (1986). Characteristics of psychiatric patients who engage in assaultive or other fear-inducing behaviors. *Journal of Nervous and Mental Disease, 174*(3), 154–160.
68	65	55	65.Rep/Std.55-Binder.McNiel.1986	Binder, R. L., & McNiel, D. E. (1986). Victims and families of violent psychiatric patients. *Bulletin of the American Academy of Psychiatry and the Law, 14*(2), 131–139.

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No.	Report ID	Study ID	Study[a] name with reference number	Full citation
69	66	55	66.Rep/Std.55-McNiel.et.al.1988	McNiel, D. E., Binder, R. L., & Greenfield, T. K (1988). Predictors of violence in civilly committed acute psychiatric patients. *American Journal of Psychiatry, 145*(8), 965–970.
70	67	55	67.Rep/Std.55-McNiel.Binder.1989	McNiel, D. E., & Binder, R. L. (1989). Relationship between preadmission threats and later violent behavior by acute psychiatric inpatients. *Hospital and Community Psychiatry, 40*(6), 605–608.
71	68	55	68.Rep/Std.55-McNiel.Binder.1986	McNiel, D. E., & Binder, R. L. (1986). Violence, civil commitment, and hospitalization. *Journal of Nervous and Mental Disease, 174*(2), 107–111.
72	69	56	69.Rep/Std.56-McNiel.et.al.2000	McNiel, D. E., Eisner, J. P., & Binder, R. L. (2000). The relationship between command hallucinations and violence. *Psychiatric Services, 51*(10), 1288–1292.
73	70	57	70.Rep/Std.57-Lamb.et.al.1995	Lamb, H. R., Shaner, R., Elliott, D. M., DeCuir, W. J., & Foltz, J. T. (1995). Outcome for psychiatric emergency patients seen by an outreach police-mental health team. *Psychiatric Services, 46*(12), 1267–1271.
74	71	58	71.Rep/Std.58-Kaliski.Zabow.1995	Kaliski, S. Z., & Zabow, T. (1995). Violence, sensation seeking, and impulsivity in schizophrenics found unfit to stand trial. *Bulletin of the American Academy of Psychiatry and Law, 23*(1), 147–155.
75	72	59	72.Rep/Std.59-Kravitz.et.al.2002	Kravitz, H. M., Cavanaugh, J. L., & Rigsbee, S. S. (2002). A cross-sectional study of psychosocial and criminal factors associated with arrest in mentally ill female detainees. *Journal of the American Academy of Psychiatry and the Law, 30*, 380–390.
76	73	60	73.Rep/Std.60-Lamb.Grant.1982	Lamb, H. R., & Grant, R. W. (1982). The mentally ill in an urban county jail. *Archives of General Psychiatry, 39*, 17–22.
77	74	61	74.Rep/Std.61-Modestin.Ammann.1995	Modestin, J., & Ammann, R. (1995). Mental disorders and criminal behaviour. *British Journal of Psychiatry, 166*, 667–675.
78	75	61	75.Rep/Std.61-Modestin.et.al.1996	Modestin, J., Berger, A., & Ammann, R. (1996). Mental disorder and criminality: Male alcoholism. *Journal of Nervous and Mental Disease, 184*(7), 393–402.
79	76	61	76.Rep/Std.61-Modestin.Ammann.1996	Modestin, J., & Ammann, R. (1996). Mental disorder and criminality: Male schizophrenia. *Schizophrenia Bulletin, 22*(1), 69–82.
80	77	61	77.Rep/Std.61-Modestin.et.al.1997	Modestin, J., Hug, A., & Ammann, R. (1997). Criminal behavior in males with affective disorders. *Journal of Affective Disorders, 42*, 29–38.
81	78	61	78.Rep/Std.61-Modestin.Wuermle.2005	Modestin, J., & Wuermle, O. (2005). Criminality in men with major mental disorder with and without comorbid substance abuse. *Psychiatry and Clinical Neurosciences, 59*, 25–29.

(table continues)

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No.	Report ID	Study ID	Study[a] name with reference number	Full citation
82	79	62	79.Rep/Std.62-Paradis.et.al.2000	Paradis, C., Broner, N., Maher, L., & O'Rourke, T. (2000). Mentally ill elderly jail detainees: Psychiatric, psychosocial and legal factors. *Journal of Offender Rehabilitation, 31*(1/2), 77–86.
83	80	63	80.Rep/Std.63-Sturgeon.Taylor.1980	Sturgeon, V. H., & Taylor, J. (1980). Report of a five-year follow-up study of mentally disordered sex offenders released from Atascadero State Hospital in 1973. *Criminal Justice Journal, 4*, 31–63.
84	81	64	81.Rep/Std.64-Estroff.Zimmer.1994	Estroff, S. E., & Zimmer, C. (1994). Social networks, social support, and violence among persons with severe, persistent mental illness. In J. Monahan & H. J. Steadman (Eds.*), Violence and mental disorder: Developments in risk assessment* (pp. 259–295). Chicago, IL: University of Chicago Press.
85	82	65	82.Rep/Std.65-Robbins.et.al.2003	Robbins, P. C., Monahan, J., & Silver, E. (2003). Mental disorder, violence, and gender. *Law and Human Behavior, 27*(6), 561–571.
86	83	65	83.Rep/Std.65-Grisso.et.al.2000	Grisso, T., Davis, J., Vesselinov, R., Appelbaum, P. S., & Monahan, J. (2000). Violent thoughts and violent behavior following hospitalization for mental disorder. *Journal of Consulting and Clinical Psychology, 68*(3), 388–398.
87	84	65	84.Rep/Std.65-Skeem.Mulvey.2001	Skeem, J. L., & Mulvey, E. P. (2001). Psychopathy and community violence among civil psychiatric patients: Results from the MacArthur Violence Risk Assessment Study. *Journal of Consulting and Clinical Psychology, 69*(3), 358–374.
88	85	65	85.Rep/Std.65-Monahan.et.al.2001	Monahan, J., Steadman, H. J., Silver, E., Appelbaum, P. S., Robbins, P. C., Mulvey, E. P., Roth, L. H., Grisso, T., & Banks, S. (2001). *Rethinking risk assessment: The MacArthur study of mental disorder and violence*. New York, NY: Oxford University Press.

Note. [a] A *study* refers to an independent sample from which an effect size was calculated.
[b, c, d] Independent sub-samples from the same report.

Table Appendix C Full Citation of the 85 Reports Identified for Synthesis, Including Corresponding Study Name with Reference Number

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Appendix D

Descriptive Statistics of the Prevalence Rates of Violence

Model	Study name	Prevalence rate	95% CI		*p*	N
			Lower limit	Upper limit		
	73.Rep/Std.60-Lamb.Grant.1982	0.784	0.694	0.854	0.000	102
	28.Rep/Std.26-Hodelet.2001	0.720	0.649	0.782	0.000	175
	57.Rep/Std.50-Sims.1989	0.653	0.536	0.753	0.011	72
	79.Rep/Std.62-Paradis.et.al.2000	0.630	0.520	0.727	0.021	81
	70.Rep/Std.57-Lamb.et.al.1995	0.624	0.526	0.713	0.014	101
	23.Rep/Std.22-Lewis.et.al.2006	0.606	0.507	0.697	0.036	99
	31.Rep/Std.29-Murphy.et.al.2001	0.604	0.548	0.658	0.000	303
	47.Rep/Std.41-Fulwiler.et.al.1997	0.578	0.455	0.692	0.213	64
	12.Rep/Std.11-Brown.et.al.1998	0.576	0.448	0.695	0.243	59
	14.Rep/Std.13-Novaco.1994.S1	0.461	0.439	0.484	0.001	1895
	71.Rep/Std.58-Kaliski.Zabow.1995	0.449	0.317	0.589	0.476	49
	33.Rep/Std.31-Ho.et.al.2009	0.448	0.347	0.554	0.335	87
	69.Rep/Std.56-McNiel.et.al.2000	0.447	0.354	0.543	0.279	103
	21.Rep/Std.20-Boles.Johnson.2001	0.429	0.289	0.580	0.356	42
	24.Rep/Std.23-Swanson.et.al.2000	0.382	0.325	0.442	0.000	262
	81.Rep/Std.64-Estroff.Zimmer.1994	0.357	0.286	0.435	0.000	157
	09.Rep/Std.08-Hodgins.et.al.2007	0.332	0.271	0.399	0.000	205
	20.Rep/Std.19-Watts.et.al.2003	0.320	0.236	0.417	0.000	100
	04.Rep/Std.04-Joyal.et.al.2008	0.311	0.231	0.405	0.000	106
	30.Rep/Std.28-Grevatt.et.al.2004	0.295	0.180	0.445	0.009	44
	17.Rep/Std.16-Vitacco.et.al.2009	0.289	0.223	0.366	0.000	152
	42.Rep/Std.38-Blum.2003	0.283	0.178	0.418	0.002	53
	82.Rep/Std.65-Robbins.et.al.2003	0.275	0.248	0.305	0.000	951
	10.Rep/Std.09-Grossman.et.al.1995	0.273	0.212	0.345	0.000	172
	72.Rep/Std.59-Kravitz.et.al.2002	0.271	0.191	0.368	0.000	96
	35.Rep/Std.33-Dickerson.et.al.1994	0.250	0.181	0.335	0.000	120
	07.Rep/Std.07-Doyle.Dolan.2006	0.234	0.159	0.330	0.000	94
	60.Rep/Std.53-Yesavage.et.al.1981	0.231	0.108	0.428	0.010	26
	15.Rep/Std.14-Rabinowitz.Mark.1999	0.228	0.213	0.244	0.000	2946
	38.Rep/Std.36-Thomas.et.al.2005	0.223	0.194	0.255	0.000	708
	49.Rep/Std.43-Mericle.Havassy.2008	0.208	0.171	0.249	0.000	419
	03.Rep/Std.03-McDermott.et.al.2007	0.204	0.113	0.339	0.000	49
	64.Rep/Std.54-Rossi.et.al.1986	0.202	0.184	0.222	0.000	1687
	05.Rep/Std.05-Elbogen.et.al.2006	0.197	0.173	0.222	0.000	1011
	25.Rep/Std.24-Swanson.et.al.2006	0.191	0.172	0.213	0.000	1410
	37.Rep/Std.35-Holcomb.Ahr.1988	0.188	0.159	0.221	0.000	611
	29.Rep/Std.27-Erickson.2005	0.180	0.116	0.268	0.000	100
	22.Rep/Std.21-Monahan.et.al.2005	0.178	0.126	0.246	0.000	157
	67.Rep/Std.55-McNiel.Binder.1989	0.174	0.132	0.226	0.000	253
	48.Rep/Std.42-Hodgins.et.al.2002	0.155	0.107	0.220	0.000	161
	80.Rep/Std.63-Sturgeon.Taylor.1980	0.154	0.115	0.203	0.000	260
	50.Rep/Std.44-Buchanan.1998	0.151	0.120	0.188	0.000	425
	59.Rep/Std.52-Shore.et.al.1989	0.143	0.102	0.196	0.000	217
	26.Rep/Std.25-Tardiff.et.al.1997	0.142	0.119	0.168	0.000	763
	56.Rep/Std.49-Arseneault.et.al.2000	0.141	0.110	0.180	0.000	389
	14.Rep/Std.13-Novaco.1994.S2	0.141	0.127	0.155	0.000	2389

(table continues)

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Model	Study name	Prevalence rate	95% CI		*p*	N
			Lower limit	Upper limit		
	44.Rep/Std.40-Swanson.et.al.2002	0.136	0.114	0.161	0.000	802
	41.Rep/Std.37-Krakowski.Czobor.2004	0.127	0.111	0.145	0.000	1487
	68.Rep/Std.55-McNiel.Binder.1986	0.127	0.082	0.190	0.000	150
	43.Rep/Std.39-Steele.et.al.2003	0.118	0.078	0.176	0.000	169
	52.Rep/Std.46-Cirincione.et.al.1992.S2	0.110	0.080	0.149	0.000	327
	52.Rep/Std.46-Cirincione.et.al.1992.S1	0.098	0.067	0.141	0.000	255
	75.Rep/Std.61-Modestin.et.al.1996	0.097	0.071	0.132	0.000	360
	36.Rep/Std.34-Leonard.et.al.2006	0.069	0.067	0.070	0.000	103344
	13.Rep/Std.12-Brennan.et.al.2000	0.064	0.059	0.069	0.000	7962
	51.Rep/Std.45-Ascher-Svanum.et.al.2006	0.060	0.050	0.071	0.000	1906
	11.Rep/Std.10-Oulis.et.al.1996	0.059	0.030	0.113	0.000	136
	32.Rep/Std.30-Scott.et.al.1998	0.054	0.023	0.124	0.000	92
	76.Rep/Std.61-Modestin.Ammann.1996	0.053	0.032	0.086	0.000	282
	06.Rep/Std.06-Elbogen.Johnson.2009	0.048	0.045	0.052	0.000	14315
	77.Rep/Std.61-Modestin.et.al.1997	0.046	0.026	0.079	0.000	261
	01.Rep/Std.01-Soyka.et.al.2007	0.037	0.029	0.048	0.000	1662
	55.Rep/Std.48-Bergman.Ericsson.1996	0.036	0.009	0.134	0.000	55
	18.Rep/Std.17-Egami.et.al.1996	0.025	0.021	0.031	0.000	3394
	34.Rep/Std.32-Troisi.et.al.2003	0.025	0.006	0.094	0.000	80
	19.Rep/Std.18-Brekke.et.al.2001	0.023	0.009	0.060	0.000	172
	02.Rep/Std.02-Bobes.et.al.2009	0.019	0.012	0.030	0.000	895
	16.Rep/Std.15-Myers.Dunner.1984	0.011	0.007	0.016	0.000	2375
Random		0.193	0.157	0.235	0.000	160206

Note. CI = confidence interval; N = sample size.

Table Appendix D Descriptive Statistics of the Prevalence Rates of Violence

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