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Cognitive predictors of violence in schizophrenia: a meta-analytic review

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ABSTRACT

Background: Aggression committed by patients with schizophrenia and other serious and persistent mental illnesses represents a major public health concern affecting patients, their families, treating clinicians as well as the community at large. Cortical dysfunction has been implicated as an anatomical correlate of acts of aggression as well as a fundamental feature associated with individuals with schizophrenia (SZ). As a result, examination of neurocognitive deficits may serves as a natural experiment to explore the relationship between cognition and aggression committed by SZ patients. Past studies, however, have yielded inconsistent and complex results regarding the relevance of cognitive impairment to aggressive behavior.
Objective: Despite a fair number of studies in the literature, there have been no statistical reviews conducted to date examining the association between cognitive deficits and aggression in SZ. The present meta-analytic study examined the relationship between cognitive impairment and SZ acts of aggression.
Methods: Electronic databases were searched up to April 2013 using the words and word stems "aggress*, psychotic, risk, cognit*, neurocognit*, and neurobiological." The search resulted in 29 studies with independent samples. Information was extracted regarding study sample and methodological characteristics in addition to aggression prediction, and comprehensive meta-analytic procedures were performed. Inter-rater reliability for coding was good to excellent.
Results: The meta-analysis (4764 participants) demonstrated heterogeneous results, leading to follow-up comparisons. Results revealed that SZ cognitive impairment exerted a significant risk for aggression, across studies with differing methodologies. Global cognitive impairment and lack of insight emerged as significant risk indicators for aggression, accounting for 2% of the variance.
Conclusions: It was concluded that measurement of patients' global cognitive ability adds incremental variance in the comprehensive assessment and prediction of SZ violence risk.

1. Introduction

Aggression committed by individuals with schizophrenia and related disorders (SZ) represents a major challenge for mental health professionals and has become a focus of increased attention and research in recent years (e.g., Wehring and Carpenter, 2011). SZ violence in the community and at hospital based settings poses a significant public health concern with psychological, financial and broad societal consequences. SZ patients show increased risk for committing acts of aggression relative to the general public as well as patients with other psychiatric conditions (Barlow et al., 2000; Colasanti et al., 2010; Fottrell, 1980; Serper, 2011; Serper et al., 2005) and aggression is a major contributor to poor SZ outcome (White et al., 1997, 2006). Studies examining demographic and clinical predictors of SZ aggression have been complex and have yielded conflicting results (e.g., Appelbaum et al., 2000; Arseneault et al., 2000; Lussier et al., 2010; Newton et al., 2012; Palmstierna and Wistedt, 1988; Serper et al., 2005).

Cortical dysfunction has been implicated as a possible anatomical correlate of certain acts of aggressive behavior (e.g., Brower and Price, 2001; Davidson et al., 2000; Hoptman et al., 2002) and has been speculated to be a core feature underlying SZ illness (e.g., Barch et al., 2001; Lewis, 2012). Damage to the prefrontal cortical area, for example, has been hypothesized to be associated with heightened aggression, emotional outbursts, disorganization, and impulsive, risk-taking and aggressive behavior (Raine et al., 1998; New et al., 2004). Since cortical dysfunction is believed to underlie aggression as well as contribute to SZ illness, examination of cognition and aggression in SZ may be seen as a natural experiment aimed at examining a common denominator implicated in both. The association between cognitive impairment and aggression committed by SZ patients, however, is complex. Past studies have yielded mixed results regarding the significance of SZ cognitive impairment as a risk factor for aggression, with some supporting (e.g., Barkataki et al., 2005; Hoptman et al., 2002; Krakowski and

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Czobor, 2012; Serper et al., 2005, 2008); and others failing to find an association between SZ aggressive behavior and cognitive dysfunction (e.g., Harris et al., 2010; Huber et al., 2012; Lapierre et al., 1995; Rasmussen et al., 1995; Silver et al., 2005).

Methodological differences may account for inconsistent findings across studies. Differing factors such as the specific diagnoses investigated (e.g., use of SZ, Schizoaffective, Bipolar patients), the setting of the study (hospital vs. community), the operational definition used to define aggression, and the types of cognitive measures employed have made it difficult to get a clear understanding of the neurocognitive correlates to violence committed by SZ patients.

1.1. Current examination

To date, no meta-analytic reviews have investigated the cognitive predictors of aggression in SZ patients. There is a need to better understand the factors that lead to aggressive behavior in this population in order to address the needs of these individuals and to prevent future acts of violence toward family members, hospital staff, and communities as a whole. The present meta-analysis examines a range of general and specific neurocognitive measures.

2. Method

2.1. Procedure

A search was conducted using the EBSCO Host meta-search engine on April 16, 2013, from which were selected the PsycInfo and Medline search engines. The following terms were used as Boolean keywords in the search: aggress*, psychotic, risk, cognit*, neurocognit*, and neurobiological. The data from the papers that meet the inclusion and exclusion criteria below were put into Comprehensive Meta-Analysis (Borenstein et al., 2011) in order to assess cognitive effects on aggression across all samples.

2.2. Inclusion criteria and exclusion criteria

To be included in this review, studies needed to have an outcome measure that assesses aggression, and a predictor variable that can be considered cognitive or neurocognitive. To be considered cognitive, the predictor variable must measure an operation performed within the brain, or the capacity for such an operation. This can range from global measures that attempt to summarize an individual's capacity to perform mental operations, to specific measures that pinpoint the ability for a specific mental task. Studies were not included if: the participants had psychosis of a clear biological origin; original neurocognitive data was not presented; or if comparisons were not made between the neurocognitive variables and the aggression variables.

The original search resulted in 426 articles. From these, 382 did not meet the inclusion criteria or focused on neurobiologically-caused psychosis; a further 11 did not present original data; and four did not make the necessary comparisons. This resulted in 29 articles, which are presented with their characterizing details in Table 2, below.

2.3. Data extraction

From each study, data was entered as reported into the CMA program. Across all 29 studies, data was presented in a variety of manners, including independent groups, odds ratios, correlations, student T-tests, and frequencies. Given the observational nature of most of the studies, all data was converted to correlation coefficients for comparison. The following qualitative descriptors are used to define effect ranges: minimal (<.10); small (.10-.29); medium (.30–.49); large (.50–.69); very large (.70+) (Cohen, 1988).

2.3.1. Statistics

This meta-analysis used a fixed-effects model. Heterogeneity of variance among the studies was assessed using the I^2 statistic, which describes the percentage of variance due to among-study factors. When a set of studies was associated with significant ($p<.05$) heterogeneity, the set was broken into smaller theoretically meaningful groups based on the above breakdown, until a group of studies' variance was homogeneous, or until there were no theoretically sound factors to break the characteristic into. No further breakdowns were computed in order to minimize the likelihood of researcher bias or "fishing." To assess for publication bias, a Classic Fail-Safe N test was performed. The Fail-Safe N test evaluates whether this risk is relevant by estimating how many hypothetical unpublished or un-submitted studies would have to be added in order to eliminate an overall significant effect.

2.4. Inter-rater reliability

Prior to analysis, each study was characterized and coded based on certain dimensions by two of the authors (JR and GR). These dimensions are based on theoretically and clinically meaningful factors, as in previous meta-analyses (e.g. Witt et al., 2013), and reflect the wide variation in the study design and measurement. A full break-down of coding can be found in Appendix A.

For classification into these categories, inter-rater reliability was calculated for the two raters (JR and GR). Reliability by coding dimension is given in Table 1. Reliability levels ranged from adequate to excellent. Any discrepancies were discussed and a final decision was reached. These dimensions were subsequently used for a priori sub-groupings. They were then used for hierarchical selection of data within a study, whereby a higher categorization was used over a lower one (e.g. a behavioral measurement over a self-report). This was not done for theoretical cognitive domains, however, as there is no valid basis for ranking. When different cognitive measures were used within a study, the CMA program was set to average the data.

3. Results

3.1. Qualitative results organization

For best comprehension and accuracy, the authors of this review have organized the description of the included studies into categories that describe sample characteristics, study setting and chronology, cognitive predictors, and aggression measure characteristics, followed by statistical results.

3.2. Sample characteristics

Study samples ranged from 14 to 1662 individuals, for a total of 4764 participants. Individual article characteristics are presented in Table 2. Studies averaged 164 participants (median = 96); the mean is skewed by one study with 1662 individuals. Participants were recruited from 14 different nations across North America, Europe, Asia, and Australia, with the United States as the greatest national representation (n = 10; 34.48%). The age of most participants fell between 18 and 60 or 65 years old. Three studies used participants who were currently in their first episode of psychosis, and so these also included adolescent participants (Foley et al., 2005; Harris et al., 2010; Huber et al., 2012).

Table 1
Inter-rater reliability.

Category	Cohen's κ
Diagnostic inclusion	0.84
Method of collection of cognitive variable	0.81
Chronology of aggression	0.94
Location of aggression	0.95
Aggression severity	0.79
Theoretical cognitive domain	0.95