



Schizophrenia and Violence: A Bibliometric Review

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Abstract

This bibliometric review study aims to describe the intellectual structure of the field, main research themes and potential research areas that could benefit from further investigation within the field of schizophrenia and violence. Results for keyword co-occurrence analysis, co-citation networks and bibliographic coupling indicate that the research has emerged from a “core” with a focus on schizophrenia, violence and mainly male populations. The field consisted of forensic, epidemiological and developmental perspectives, with the most cited publications being either cohort studies or meta-analyses, or research on violence risk assessments. Taken as a whole, these studies have been mainly concerned with quantifying the relationship between schizophrenia and violence, describing the trends and assessing the role of comorbidity. The findings also show how research priorities shifted over time. Early work mainly centered around clinical and diagnostic issues, whereas more recent studies have investigated the role of gender, age, and substance use disorders. The network analyses identify several interconnected research traditions, including forensic psychiatry, structured risk assessment and population based epidemiology, and other smaller bodies of work which investigate neurobiological and psychological mechanisms. Although these approaches are different, they all converge to a similar conclusion: schizophrenia is associated with an increased risk of violent behavior, but the significance of this association is heavily influenced by factors such as substance misuse, a history of offending and developmental issues. Despite substantial progress in the field, there are several important gaps that remain. Much of the existing evidence comes from studies of adult men, this means that older adults, adolescents and developmental changes across lifespans are relatively understudied. Research on schizophrenia with co-occurring psychiatric disorders also remains limited. Future research should prioritize longitudinal and developmental designs, widen representation beyond traditionally studied populations and strengthen integration across clinical, biological and psychosocial domains. Such efforts may improve understanding of violence risk in schizophrenia and inform effective prevention, intervention and clinical risk assessment strategies.

Keywords: Schizophrenia; Violence; Bibliometric Analysis; Forensic Psychiatry; Risk Assessment; Substance Use Comorbidity

1. Introduction

1.1 Background

Schizophrenia continues to be one of the most complex and debilitating challenges that modern psychiatry is yet to overcome. A severe disruption of cognition, perception, and emotional response, resulting in severe impairments of daily, social, and occupational functioning, schizophrenia is a chronic disorder that affects about 23 million people worldwide, or about 1 in 345 people (World Health Organization: WHO, 2025). Typically, psychotic symptoms of schizophrenia appear between late adolescence and mid 30s and is rare for it to appear before adolescence. The age of onset of the first psychotic episode occurs in the early to mid 20s for males and the late 20s for females. It is thought that the majority of people experience a slow and gradual development of a variety of signs and symptoms of schizophrenia, with half of these people complaining of having depressive symptoms (American Psychiatric Association, 2022). Cognitive deficits are symptoms of the disturbance and changes in cognition are evident during the development of the illness before the psychotic symptoms begin. Beyond its clinical description, schizophrenia is known to be one of the main contributors to disability on a global scale: profound disruptions in behavior, emotions and cognitions causing severe dysfunctions in daily life, severe marginalization and stigmatization of those affected by this disorder, suicide being largest contributor to premature

death in individuals with the disorder, as well as a higher prevalence of suicidal thoughts and attempts (Allebeck, 1986; Montross et al., 2005; C. I. Cohen et al., 2010). The societal burden of people affected by schizophrenia is a very sad reality, as those afflicted often suffer a double burden: the main symptoms of the disorder, and the damaging impact of social stigma.

The most common and persistent misconception that exists in society is that there is a direct link between schizophrenic disorders and violent behavior. The popular press and entertainment media, in their pursuit of engaging content, often leverage the inherently unpredictable nature of psychotic disorders to create a link between “madness” and “badness”. Researchers studied 11 contemporary films in a content analysis in 2012 to find that negative stereotypes surrounding the disorder are often used in entertainment, with 83% of all characters exhibiting violent behavior, and a great emphasis placed on the positive symptoms of schizophrenia. The public representations of the disorder, frequently involving Caucasian male characters with an unrealistic socioeconomic status, further reinforce the public stigma and fear of the disorder (Owen, 2012). The idea that having a schizophrenia diagnosis leads to criminal behaviour, which seems to be a presumed link, is harmful to society. Although there is some evidence in the statistics that this population has a greater relative risk of violence than the general population, it is important to note that relative risk is not absolute risk and that the absolute risk is actually quite low. In a large meta analysis of 24 longitudinal studies that included more than 50,000 people across 15 countries, Whiting et al, (2021) determined that the relative risk of violence in people with schizophrenia spectrum disorder is higher than the risk in the general population, but the absolute risk of violence is still low, indicating that the majority of people with schizophrenia are very unlikely to be violent. The majority of risk usually falls in a narrow range of people who also frequently have other risk factors like substance abuse comorbidity, past criminal history and untreated acute symptoms like poor impulse control.

1.2 Rationale

Since there are many false and harmful ideas about schizophrenia and violence, it is important that the relationship between schizophrenia and criminal behaviour be explored in a systematic review of the literature. Although the public tends to equate a causal relationship between schizophrenia and violence, academic studies indicate that there are intricate relationships between a number of factors, such as environmental factors, social risk factors and clinical factors. Such disparities between the public mind's expectations and reality emphasizes the need for a synthesis of available studies to arrive at a clearer understanding of the understanding of schizophrenia in relation to violent and non-violent criminal activity.

One of the reasons for this literature review is to see if there are any significant findings as to whether or not psychotic symptoms are, in themselves, significant factors in determining if someone will commit a crime. The basic classification of schizophrenia is based on positive symptoms (delusions, hallucinatory experiences) , negative symptoms (flat affect, avolition and social withdrawal) and major cognitive impairments involving executive functions and decision making. These symptoms can potentially impact the person's impulse control, understanding of social cues and threats, and so on. Perceptions of danger, such as those associated with specific types of psychotic experiences (e.g. persecutory delusions, command hallucinations) have historically been thought to be associated with increased risk for reactive or defensive aggression. It is important to discuss how the symptoms have been interpreted in the context of criminology and psychiatry, and where they have been seen as markers of violence, and where they have been seen as markers of broader social and psychosocial issues.

1.3 Defining Schizophrenia: Diagnostic Frameworks

In order to examine the relationship between schizophrenia and crime, a strong diagnostic base is required. Modern psychiatry utilizes two taxonomies to classify this disorder: the Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR), and the International Classification of Diseases (ICD-11).

The DSM-5-TR Perspective

The DSM-5-TR defines schizophrenia (Diagnostic Criteria 295.90 F20.9), through a set of “Criteria A” symptoms. A diagnosis requires at least 2 of the following, each present for a significant period of time during a one-month period. At least one of the following symptoms must be (1), (2), or (3):

1. Delusions
2. Hallucinations
3. Disorganized speech (e.g. frequent derailment or incoherence)
4. Grossly disorganized or catatonic behavior
5. Negative symptoms (i.e. diminished emotional expression or avolition)

In agreement with “Criterion B”. For a significant period of time since the onset of the disturbance, level of functioning in one or more major areas, e.g., work, interpersonal relations, or self care, is noticeably below the level achieved prior to the onset. Continuous signs of these disturbances must persist for at least 6 months. The 6-month period must include at least 1 month of the symptoms (or less if successfully treated) meeting “Criterion A” listed above. These may also include periods of prodromal or residual symptoms. During these periods, the signs of the disturbance may be displayed only by negative symptoms or by two or more symptoms listed in “Criterion A” in an attenuated form (e.g., unusual perceptual experiences, odd beliefs). The DSM-5-TR also states that the disorder is not attributable to the physiological effects of a substance (e.g. a drug of abuse, a medication) or another medical condition. The severity of the condition is rated via a quantitative assessment of primary symptoms: psychosis, delusions, hallucinations, disorganized speech, abnormal psychomotor behavior (e.g., comorbid catatonia associated with schizophrenia: Code 293.89 F06.1) and negative symptoms. Each of the symptoms may be rated for its current severity (last 7 days) on a 5 point scale from 0 (not present) to 4 (present and severe). However, the diagnosis of schizophrenia can be made without the severity specifier.

Specifically, for the purposes of criminology, the DSM-5-TR emphasizes that disorganized behavior may lead to legal issues not necessarily out of malice but rather due to inability in following social norms, or instructions from law enforcement officers.

The ICD-11 Perspective

The ICD-11 published by the World Health Organization provides an internationally standardized diagnostic criteria for schizophrenia within a broader category of schizophrenia spectrum disorder and other primary psychotic disorders (Coded 6A20). The ICD-11 classifies schizophrenia as a heterogeneous syndrome characterized by persistent disturbances in cognitive processes, perception, self experience and behavior. According to the ICD-11 framework, a diagnosis requires the presence of core psychotic symptoms for a large period of time within a month, including persistent delusions and hallucinations (most commonly auditory), disorganized speech or thinking, experiences of influence or passivity (where an individual believes their actions or thoughts are controlled by external forces), disturbances of self experiences and noticeable disorganized or abnormal behavior.

The ICD-11 also recognizes the negative symptoms of the disorder such as a blunted or flattened affect, avolition, social withdrawal, and alogia, which frequently and significantly contributes to long term functional impairment. Importantly, the disorder must involve clinically substantial disruptions in personal, educational, social or occupational functioning, and symptoms cannot be better explained by mood disorders with psychotic features, substance intoxication, neurological diseases or other medical conditions. From a criminological and research perspective, the emphasis on symptoms domains by the ICD-11 is relevant, as it allows investigators to examine how specific symptoms such as: persecutory delusions, impaired impulse control or severe disorganization may interact with social conditions and environmental stressors/triggers.

1.4 Core Psychotic Symptoms Relevant to Criminal Behaviour

In forensic psychology, psychiatry and criminology, it is recognized that there are a variety of psychotic symptoms which influence aggressive, but also nonaggressive criminal behavior. Positive symptoms are often linked to criminal, aggressive behavior, specifically hallucinations and delusions are believed to be major drivers of crime. In forensic psychiatric research these symptoms have gained recognition and attention as they may distort threat perception in individuals and lead them to interpret previously neutral situations as hostile or dangerous.

A symptom regarded as a potential driver of crime are command hallucinations, these are a subtype of auditory verbal hallucinations and are characterized by hearing instructions to perform certain actions. These can range from mundane task directives like “sit down”, to violent or dangerous commands such as “kill them”, self punishment commands include the voice ordering the individual to perform harmful acts against themselves, and paranoid commands which are driven by delusions. The voices are often described as recognizable and people may feel motivated to obey these voices, as there is research that shows voice-hearers often perceive their voices as having a higher social rank and omnipotence, and individuals are more likely to submit to the voice when describing the voice to be more dominant, powerful and authoritative (Birchwood et al., 2000). Patients often describe auditory experiences not merely as sounds, but as interactions with entities with significant influence, power, or supernatural beings, 61% reported hearing the voices of God, the Devil and robots, and 84% reporting that angry voices were typically louder, with a personality that exerted significant influence over them (Nayani & David, 1996). These are prevalent in the schizophrenia population with one half of participants with auditory hallucinations reporting command hallucinations in particular, frequently being violent in nature (Zisook et al., 1995).

While command hallucinations provide a direct auditory drive for action - this could be violent or non violent, they rarely occur in isolation, and are intensified by a wider framework of persecutory delusions. These fixed, false beliefs of being targeted, spied on, harassed, or conspired against are the most consistent and common predictors of violence in schizophrenia (Douglas et al., 2009; Witt et al., 2013). In forensic literature, this relationship is often understood through the Threat/Control-Override (TCO) model, suggesting that criminal acts occur when an individual perceives an immediate external threat (Threat) or feels their internal agency has been hijacked by an external force (Control-Override) (Link & Stueve, 1994; Stompe et al., 2004). This suggests that violence in schizophrenia is often a “rational response to an irrational belief” (Junginger, 1996; Junginger et al., 1998). It is important to note that the transition from delusional thought to criminal conduct is often mediated by affective distress. Data from the MacArthur Violence Risk Assessment Study shows that persecutory delusions, specifically those involving being spied on or conspired against have the highest criminogenic potential when they provoke intense anger or fear (Appelbaum et al., 2000; Ullrich et al., 2014; Ullrich et al., 2018).

1.5 Theoretical Pathways Linking Psychosis and Crime

There are many suggestions relevant to crime commission in schizophrenia, which include: symptom based, psychosocial, developmental, life course, and neurocognitive emotional models. While research shows that a large majority of individuals diagnosed with the disturbance do not engage in violent behavior, and are actually frequently victims rather than perpetrators of crime (Arsenault et al., 2000) a small but significant group exhibit increased risks for offending (Fazel et al., 2009). However, this risk is not a direct byproduct of a diagnosis itself, but rather the result of an intersection of symptomatic, psychosocial and developmental factors (Hodgins, 1992).

1. Symptom based pathway. A common driver of violence is the symptomatic model, which assumes that specific delusions and hallucinations can directly cause aggressive behavior. Importantly, the Threat/Control-Override (TCO) hypothesis mentioned above plays a role in how individuals perceive threats in the environment, which may cause aggressive acts as a rational response to an albeit irrational threat. Research shows that positive symptoms, especially persecutory and grandiose ideation, substantially elevate risks of serious violence, whereas negative symptoms like social withdrawal may potentially be protective factors by reducing interpersonal contact (Swanson et al., 2006). Additionally, command hallucinations to harm others play a crucial role in violence perpetration, especially when the individual perceives the voice as a credible authority figure, dead relative or a supernatural deity and experiences a high degree of obedience with the commands (Braithwaite et al., 2010). Motives for offending in these types of populations are often tied to internal psychotic experiences rather than for traditional criminal gain (Tyler, 1985).

2. Psychosocial and socioenvironmental pathways. Criminological research consistently shows that the schizophrenia-violence association is often and heavily mediated by factors shared with the larger offender population. Comorbid substance abuse is arguably the most powerful mediator, while schizophrenia alone does indeed carry a modest risk for criminal behavior, substance misuse and substance use disorders increase the risk of violent crimes committed by nearly fourfold (Fazel et al., 2009). The failure of inhibition of illogical, immediate thoughts or actions, and social instability of a drug using lifestyle play a significant role in criminal behavior. The social environment also plays a critical role, according to the social drift hypothesis - functional impairment associated with schizophrenia leads individuals to “drift” into disorganized and high poverty neighborhoods (Silver et al., 1999c). In this context, environmental stressors or triggers paired with social division are often more powerful predictors of violence than the disturbance itself (Elbogen & Johnson, 2009). Therefore, systemic socioeconomic deprivation and a lack of community support are important in understanding criminal trajectories of many individuals with schizophrenia.

3. Developmental and life-course suggestions. A developmental perspective uses a typology to distinguish between individuals based on timing of antisocial behavior. “Early start” offenders exhibit stable patterns of aggression and conduct problems during childhood or adolescence long before manifestation of psychotic symptoms. This group is often characterized by personality pathology such as psychopathy, and is usually resistant to standard antipsychotic medication for aggression (Tengstrom et al., 2001). Conversely, “late start” offenders only begin criminal involvement after the onset of the active illness (Tengstrom et al., 2001). For these persons, violence is most common during the First Episode of Psychosis (FEP) which is a period characterized by untreated symptoms and elevated emotional distress (Nielssen & Large, 2010). Childhood indicators, specifically Conduct Disorder before the age of 15 continue to be important predictors of adult violence regardless of the psychiatric diagnosis (Swanson et al., 2008). Moreover, maltreatment and early childhood trauma can impair neurological development and stimulate paranoid worldviews, which may later interact with psychotic symptoms to produce aggression (Neria et al., 2002; Oakley et al., 2016).

4. Neurocognitive and emotional processing models. Neuropsychological data and neuroimaging reveals that violent patients typically suffer from impairments in response inhibition, which is the inability to suppress immediate, impulsive urges. These deficits are often linked to functional and structural abnormalities in the orbitofrontal and prefrontal cortex (Barkataki et al., 2005). Neuroimaging examining the region of the prefrontal cortex, which mediates executive functions and social conduct, and exerting inhibitory influences on behaviors like aggression, have shown structural abnormalities (Damasio, 1995; Buchanan et al., 1998; Barkataki et al., 2005). Schizophrenia patients have also demonstrated deficits in a plethora of cognitive domains such as attention, cognitive processing speed and IQ according to neuropsychological assessments (Sharma and Antonova, 2003; Goldberg and Gold, 1995). In the schizophrenia population, individuals with a history of violence demonstrate deficits on the Luria-Nebraska tests and the Weschler Adult Intelligence Scale (WAIS) (Adams et al., 1990; Krakowski et al., 1989). Compromises in the interpretation of social cues may also produce aggressive behaviors in this population. Patients may potentially misinterpret neutral facial expressions as threatening or hostile, a phenomenon known as a negative emotional bias. This poor recognition of negative emotions has been associated with an increase in violence and aggression in schizophrenia (Harris and Picchioni, 2013; Weiss et al., 2006).

2. Methodology

The literature search was conducted using the Scopus database. The search terms “schizophrenia AND crime AND violent behaviour” were entered, returning an initial pool of 260 documents. This pool was then screened and filtered along several dimensions. By subject area, the relevant documents were distributed across psychology (n = 46), social sciences (n = 33), neuroscience (n = 31), and arts and humanities (n = 6). By document type, the pool consisted of articles (n = 82), reviews (n = 14), book chapters (n = 4), and books (n = 1). By source type, the documents were drawn from journals (n = 95) and books (n = 5). The search was further restricted to English-language publications, yielding a final working dataset of 100 documents. This dataset formed the basis for all subsequent bibliometric analyses, which were conducted using VOSviewer software and comprised three complementary techniques: keyword co-occurrence analysis, to map the conceptual structure of the field; bibliographic coupling of documents, to identify clusters of publications that draw on shared source material; and co-citation analysis of authors, to identify influential scholars and intellectual traditions within the literature.

3. Findings of the study

3.1 Co-occurrence

Table 1. Top 10 Co-occurring Keywords by Frequency and Link Strength

Keyword	Occurrences	Total Link Strength
schizophrenia	80	931
violence	77	958
male	72	985
adult	60	828
crime	55	738
female	54	743
major clinical study	51	734
controlled study	39	567
criminal behavior	34	491
mental disease	30	411

Keywords are ranked in descending order based on occurrences. Total link strength reflects the degree of co-occurrence connectivity with other keywords.

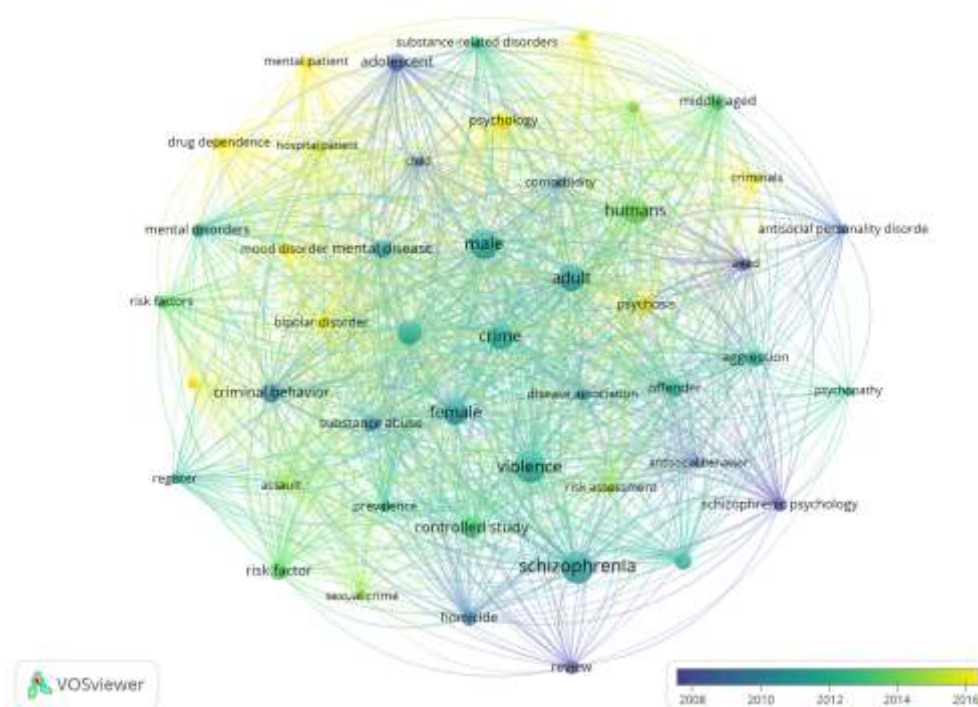


Figure 1. Co-occurrence Network Map of Keywords (VOSviewer)

Out of the entire keyword pool, 50 keywords were found to satisfy the requirement, which was to co-occur with the unit of analysis (all keywords that occurred at least 10 times). Screening for duplicates and irrelevant terms, 10 keywords were selected for analysis. “Schizophrenia” is the keyword that was found most often (80), followed by “violence” (77) and “male” (72). Considering total link strength (a measure of how connected the term is with other terms in relation to the amount of co-occurrence) the strongest connectivity was with the term 'male' (985), followed by 'violence' (958) and 'schizophrenia' (931), suggesting that these three terms represent the literature's dense conceptual core.

The overlay visualization map (Figure 1) showed that the period of trending of the most common keywords occurred from around 2008 to 2016. The data collected during this time frame spans a large range of research development in the field of schizophrenia and violent criminal behavior. During this initial period (2008–2010), the terms criminal behavior, mental disease, and controlled study were in vogue. This implies that the basic studies in this field were predominantly clinical and diagnostic, with the aim of providing a psychiatric explanation for criminal behavior, and of giving the field a methodological foundation with controlled designs.

During the intermediate period (around 2011–2013), the terms “crime,” “females,” and “major clinical study” started to appear in the literature, indicating a wider inclusion of gender-based analysis and of larger and more extensive clinical study. This change reflects a recent trend in the literature to examine criminal behaviour among men and women with schizophrenia and to move beyond a male focus.

In the later stage (c. 2014–2016) the words “violence”, “adult” and “schizophrenia” themselves were trending prominently. The more recent literature, with its focus on both general diagnostic and behavioural terms, indicates a development of the field that led to integrative and comparative research in which schizophrenia was placed in a wider perspective of adult violence and risk.

Interestingly, the overlay map shows that the volume of research activity has significantly dropped off after 2016, as only a small number of keywords are found in the yellow to bright yellow colour spectrum (most recent publications in the data set). Few words are common across all these articles: substance-related disorders; adolescent; psychology; middle-aged. These terms sit on the edges of the main network, indicating that, although they have gained some scholarly interest, they are far from being as well studied as the terms clustered around the schizophrenia–violence–crime nexus.

This is an area of the literature that has not been covered in the recent past, and is also one that provides a very valid space for future research. The recent use of "substance-related disorders" as a keyword highlights the need for research focusing on the specific link between comorbid substance use and schizophrenia and criminal and violent behavior, both of which are clinically relevant, but for which the combined effects are not well understood.

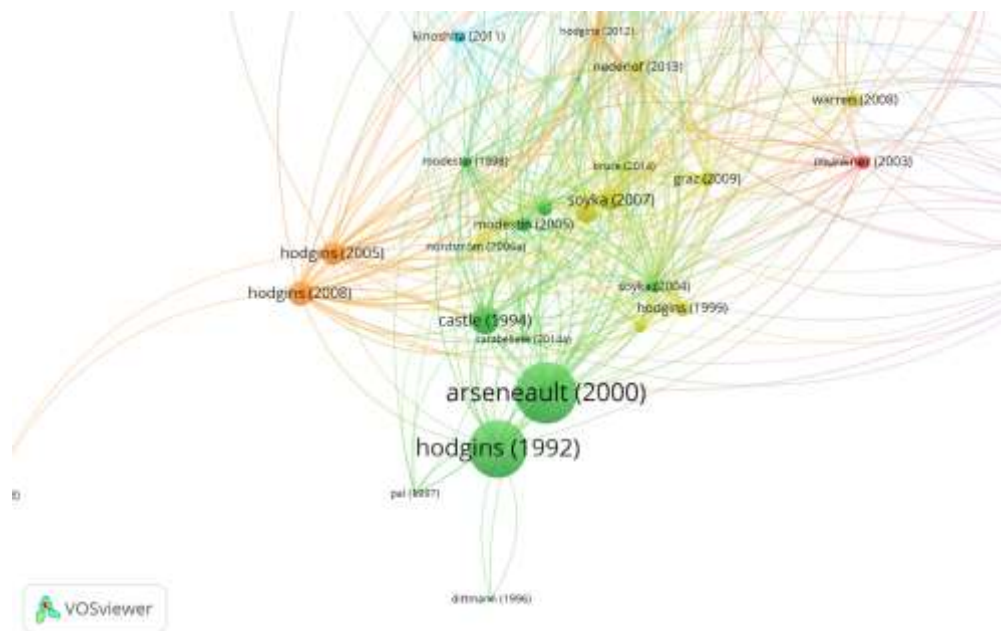


Figure 3. Bibliographic Coupling Network Map — Detailed Cluster View

The number of documents that fulfilled the bibliographic coupling criteria ($n \geq 5$) was 72, of which the top 10 most cited documents were chosen for analysis. Arseneault (2000) has been cited the most at 647 citations, followed by Hodgins (1992) with 585 citations and Bonta (2014) with 256 citations. Hodgins (2008) was the most high-strength document, with a total link strength of 139, followed by Hodgins (2005) (96) and Castle (1994) (55), respectively. Seven clusters were found in the VOSviewer network visualization (Figures 2 and 3), each representing a coherent intellectual tradition in the larger area of schizophrenia and violent criminal behavior.

Arseneault (2000) and his co-authors (Castle (1994); Hodgins (1999); Hodgins (2005); Carabellese (2014a); Pal (1997); Dittmann (1996); Pieri (2008)) form the core of the epidemiological research front of the field, the green cluster. Arseneault (2000) is the largest and most integrated node in the entire data set, and forms a cornerstone for population-level research that has demonstrated the statistical connection between schizophrenia and violent behavior. The documents in this cluster are mainly related to prevalence rates, to the identification of demographic risk factors and to the integration of schizophrenia in the broader picture of psychiatric disorders and crime. Castle (1994) and Hodgins (1999) provide the epidemiological underpinning to this cluster, the former by examining the gender differences and the latter by looking at the offending trajectories, while the latter research of Hodgins (2005) and Pieri (2008) takes the tradition further, with more sophisticated longitudinal and cross-national comparisons, respectively. As a group, this cluster sees the relationship between schizophrenia and violence as a population level public health phenomenon, and thus seeks larger scale observational and register-based designs.

The "risk assessment and forensic psychiatry" research front, led by Bonta (2014) and Fazel (2014), along with Way (2005), Bjorkenstam (2014), Cederlof (2017), Sarjaslan (2016), Krebs (2020), Lundstrom (2014), Sarsegundo (2018), Sellaba (2020), Swann (2011), Van Buitenen (2021), and Yee (2020), shows a different intellectual trajectory than the epidemiological cluster. The green cluster focuses on establishing base rates and prevalence; the red cluster is mainly focussed on prediction, risk stratification and structured clinical tools for identification of individuals with a psychotic disorder who are at risk for violence. The literature on violence risk in psychosis has evolved to include substance use, antisocial personality features, and previous offending as important factors that influence violence risk; and has been anchored by seminal works from Bonta (2014) and Fazel (2014), both of which have concentrated on the meta-analysis of the violence risk literature. The most contemporary of these works are the more recent documents in this cluster, such as Van Buitenen (2021) and Yee (2020), indicating that risk assessment work has continued to develop in the 2020s.

One cluster of papers (blue; Latalova 2014; Dietrich 2006; Luukkainen 2012; Barlati 2023; Battaglia 2022; Bruce 2015; Buchanan 2023; Cashman 2017; Honkonen 2004; Walter 2019) seems to form the comorbidity and disorder-subtype literature. Latalova (2014), a popular review of violent behaviour in psychiatric disorders, and Dietrich (2006), which investigates schizophrenia subtypes and aggression, form part of a tradition that has focused on the internal schizophrenia heterogeneity and the different violence risk attributed to co-occurring psychiatric diagnosis, such as mood disorders, substance dependence, and personality disorders. This cluster is also notable

because of the presence of more recent documents such as Barlati (2023) and Buchanan (2023) – these papers suggest that the investigation of comorbidity is one of the newer strands of research occupying the field, alongside the general trend of increased recognition that schizophrenia rarely occurs in isolation in a forensic setting.

The Cluster 6 grouping (Cho 2019, Dam 2021, Harris 2013, Kachouchi 2018, Kaltiala-Heino 2014, Kinoshita 2011, Ntounas 2018) is a new research tradition that is cross-cultural and adolescent focused. The inclusion of Kaltiala-Heino (2014), in addition to Kinoshita (2011) and Cho (2019), indicates that this group is specifically interested in early onset psychosis and juvenile forensic populations in different national settings, a focus that trails the mainstream research stream which focuses on adults. Cluster 7 is a methodological sub-cluster comprising of all Hodgins (2005), Hodgins (2008), Hodgins (2012) and Pieri (2008), which is a tight cluster, indicative of the cumulative and self-referential nature of programme research in the Hodgins tradition.

One interesting bibliometric finding is that Strous (1997) is almost entirely isolated in the network, with only 2 links, and is linked to only two other papers, both of them with a very low number of links. Despite the large number of citations (230) Strous (1997) is still quite separate from the epidemiology/forensic psychiatry stream of the data set. This is not a coincidence; Strous (1997), which deals with the neurobiological basics of aggression in schizophrenia (the effect of dehydroepiandrosterone and neuroactive steroids on the population level and on risk) is part of an intellectual tradition that stems from biological psychiatry and neuroscience and which has not meaningfully crossed-fertilized with the population-level and risk-oriented streams. This is an important area of the literature that is missing. The neurobiological determinants of violence in schizophrenia have been largely disconnected from the forensic and epidemiological literature, and further research that unites them, such as studies on the interaction between neurobiological vulnerability factors and social/environmental risk factors identified in the red and green clusters, would be a truly novel and integrative contribution to the field.

3.3 Co-citation

Minimum number of citation of an author is 8, and out of 2720 authors, 58 meet the threshold

Table 3. Top 10 Authors by Citations and Link Strength (Co-citation Analysis)

Author	Citations	Total Link Strength
Hodgins S.	96	1562
Fazel S.	47	346
Grann M.	41	492
Langstrom N.	28	305
Moring J.	28	483
Lichtenstein P.	32	355
Taylor P.J.	32	410
Monahan J.	24	328
Allebeck P.	21	224
Silva P.A.	21	352

Authors are ranked in descending order based on citation count. Total link strength reflects co-citation connectivity within the network.

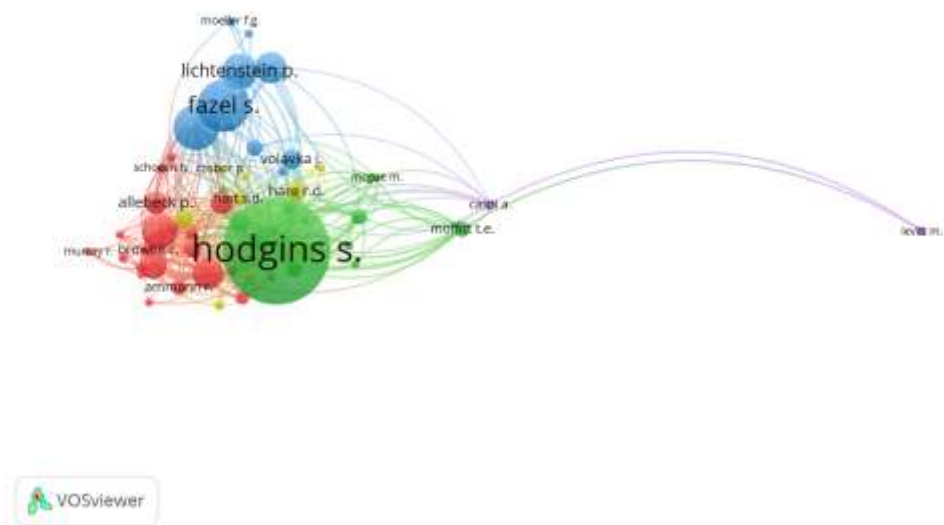


Figure 4. Co-citation Network Map — Overview

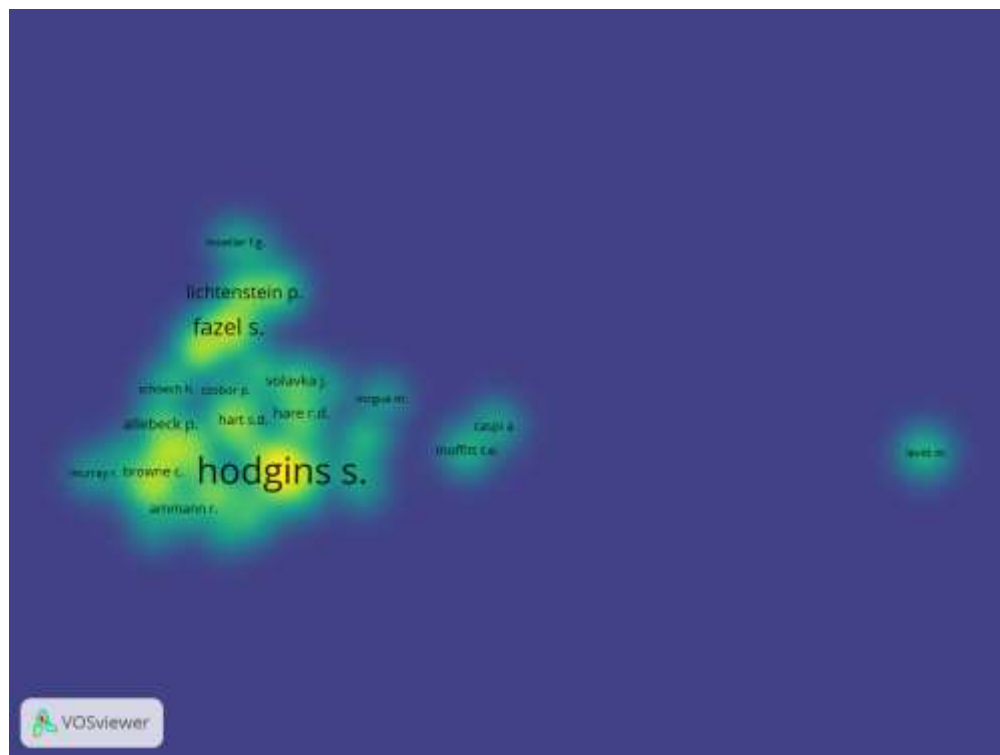


Figure 5. Co-citation Density Visualization Map

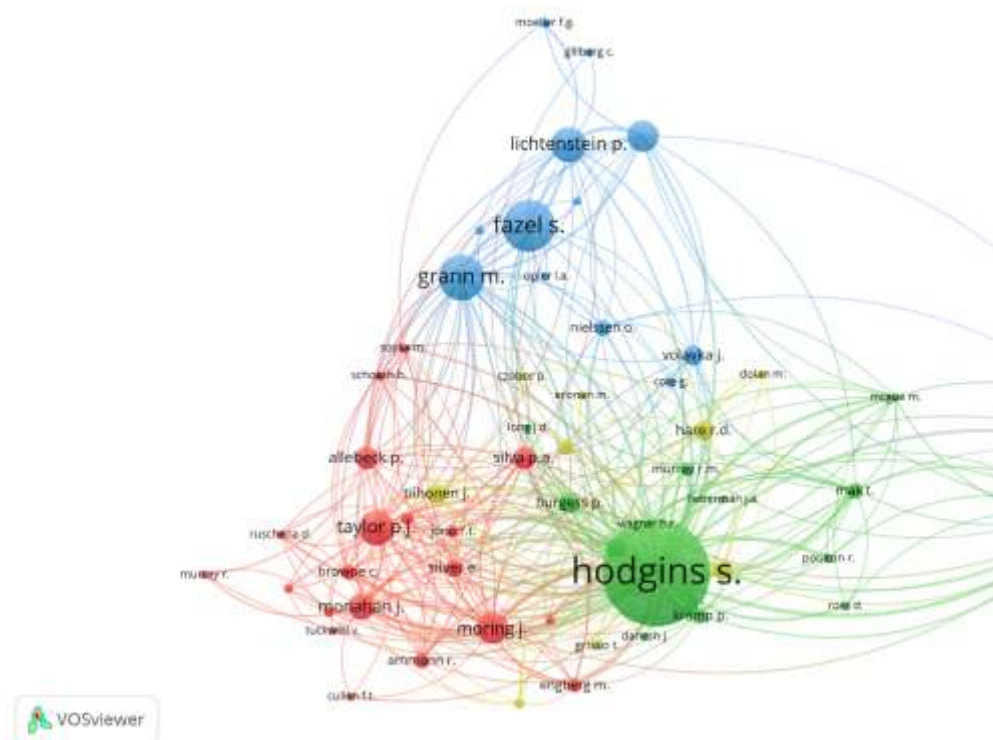


Figure 6. Co-citation Network Map — Detailed Cluster View

Using a co-citation analysis with a minimum of 8 citations, 58 authors were identified that reached the threshold out of 2,720 authors, forming five distinct clusters. Hodgins (1992, 1999, 2005, 2008, 2012, 2014, 2019) emerged as the most cited with 96 citations, followed by Fazel (2014, 2016, 2019) with 47 and Grann (2009) with 41 citations respectively. In terms of total link strength, Hodgins (1992, 1999, 2005, 2008, 2012, 2014, 2019) demonstrated the highest co-citation connectivity with 1,562, followed by Grann (2009) with 492 and Moring (1999) with 483, underscoring that Hodgins (1992, 1999, 2005, 2008, 2012, 2014, 2019) functions as a dominant anchor of the entire field. The density map (Figure 5) highlights a lot of activity around Hodgins, Fazel, and Lichtenstein whereas figures like Caspi, Moffitt and Levitt occupy the peripheral nodes with sparse co-citation links, suggesting that the core research community is quite interlinked, while certain research remains disconnected from the main network.

The green cluster is the largest in the network with 20 items, including Hodgins (1992), Allebeck (2002), Ammann (1996), Browne (1998), Burns (2003), Cullen (1992), Gunn (1984), Hakola (1996), Jono (1990), Junginger (1995), Monahan (2000), Moring (1999), Murray (1987), Ruschena (1998), Schoech (1986), Silva (1992), Silver (2002), Soyka (2000), Taylor (1984), and Tuckwell (1980). This cluster represents the epidemiological and population-level research tradition which is the foundational intellectual core of the field. Hodgins (1992), as the most cited and most connected author in the entire dataset, has anchored this tradition through decades of register-based and longitudinal work establishing the elevated rates of violent offending among individuals with schizophrenia and other severe mental disorders. For example, Fazel et al. (2014) found that within 5 years of first diagnosis, 10.7% of males and 2.7% of females with schizophrenia had been convicted of a violent crime, which corresponds to an approximate 4.8 fold and 6.6 fold higher rates compared to matched controls. Similarly, a Swedish cohort study reported individuals with schizophrenia had 4 times the rate of violent offences compared to the general population. These findings show the public health orientation of this cluster, schizophrenia related violence is seen as a social epidemiological phenomenon which requires population level evidence. Research by Scandinavian scholars (Allebeck (2002), Moring (1999), and Murray (1986, 1981, 1983, 1984)) has been particularly influential due to their access to national registers, enabling large-scale population comparisons. Forensic psychiatrists Taylor (1984), Monahan (2000), and Silva (1992), extend this lens into forensic and legal contexts, examining how psychiatric diagnosis intersects with criminal justice outcomes. Collectively, the green cluster treats violence in schizophrenia as a demographic/public concern, which requires broad quantitative evidence to inform prevention.

The blue cluster features Fazel (2009), Lichtenstein (2009), Grann (2009), Langstrom (2009), Large (2011), Moeller (1998), Nielssen (2011), Opler (2000), Simonsen (1996), Cote (1996), Gillberg (1988), and Volavka

(2000). This cluster represents genetic epidemiology, meta-analytic, and neuropsychiatric research. Fazel (2014, 2016, 2019) and Lichtenstein (2009) are both prominent in Swedish register-based research and have anchored a body of work that has largely examined the genetic and familial confounds underlying the schizophrenia-violence association. In one large cohort, 13.2% of individuals with schizophrenia had committed a violent crime vs 5.3% from the general population, importantly, comorbid alcohol or drug abuse accounted for much of the excess rate. This implies that shared behavioral or genetic factors e.g., antisocial predispositions or substance use risk, potentially drive the association more than psychosis itself. Grann (2009) and Langstrom (2009) contribute a risk stratification and recidivism perspective, while Volavka (2000) and Moeller (1998) introduce a neurobiological and pharmacological perspective, examining impulsivity, aggression dysregulation, and treatment response. The presence of Gillberg (1988) in this cluster is notable, pointing to an emerging thread linking neurodevelopmental disorders e.g., ADHD, autism to the schizophrenia-violence association, a connection that remains underexplored in the mainstream literature. Overall, the blue cluster uses family designs and meta analytic research to parse genetic, familial and neurodevelopmental contributions to violence.

The red cluster, with 14 items, includes Hodgins (1992, 1999, 2005, 2008, 2012, 2014, 2019), Burgess (2008, 2021), Danesh (2002, 2008), Fahy (2002, 2015), Kramp (2003), Lieberman (1992, 2005), Long (2001), Mak (2008, 2022), McGue (2002, 2005, 2009, 2010), Moffitt (2000), Murray (1987, 2012), Poulton (2003), Ross (2005), and Wagner (2006). This cluster corresponds to developmental psychopathology and to the longitudinal cohort approach. Here, Moffitt (2000) and Caspi (2000) stand out in their groundbreaking research on antisocial behaviours along the life course. The developmental precursors of both schizophrenia and criminality, such as early conduct problems, cognitive deficits, and gene–environment interactions, are highlighted by the presence of McGue (2002, 2005, 2009, 2010) and Murray (1987, 2012) in this cluster with Moffitt (2000). This tradition can be considered characteristic of longitudinal cohort methodology as currently practiced by Long (2001) and Poulton (2003). Importantly, this cluster places schizophrenia-related violence in the context of the broader developmental pathways, indicating that the origins of forensic risk may be linked to developmental vulnerabilities that precede the onset of psychosis, rather than solely being linked to schizophrenia itself.

The fourth cluster, comprising Czobor (2012), Dolan (2006), Eronen (1996), Grisso (1996), Hare (1991, 2003), Hart (1995, 2003), Kullgren (1988), Link (1987), and Tiihonen (2004, 2005), represents the forensic risk assessment and psychopathy tradition. Hare (1991, 2003) and Hart (1995, 2003), the inventors of the Psychopathy Checklist, have established a literature about the co-occurrence of psychopathic traits and schizophrenia spectrum disorders and the amplified risk of violence from antisocial personality features. Tiihonen (2004, 2005) provides a Nordic forensic psychiatry angle on homicide, severe violence and aggression treatment with medication. Grisso (1996) and Link (1987) take the cluster further into the field of legal competency and the social factors that contribute to stigma. This cluster is more directed towards clinical risk at the individual level, as opposed to epidemiology on the population level, and is also the intellectual source most directly relevant to forensic practice and structured professional judgment tools, unlike the green and blue clusters. It is in use with instruments such as the HCR-20 and VRAG, developed by Hart, Hare etc., which predict violence based on psychopathy, criminal history, and other clinical factors.

One aspect of the co-citation network is that a few scholars, such as Caspi, Moffitt, and Levitt, appear to be relatively far removed from the rest of the network. In contrast, Caspi and Moffitt have more consistently been cited in the literature on developmental psychopathology or the life course, though they do not have the same number of co-citations as they do with the core schizophrenia and violence literature. Levitt appears even more isolated, occupying a near standalone position with minimal connections to the main network.

This pattern suggests that certain research traditions, particularly those regarding development, criminological perspectives, and broader social explanations of offending have not been fully integrated into the psychiatric and forensic frameworks that dominate the field. In contrast, the core of the co-citation network is heavily centred on forensic psychiatry and violence risk assessment. The relative separation of these authors may therefore reflect an ongoing disciplinary divide between clinical approaches to schizophrenia-related violence and broader theories of criminal behaviour and social development. Therefore, combining these perspectives could provide a more comprehensive understanding of the pathways linking schizophrenia, violence, and offending, representing a more important direction for future research.

4. Discussion and Conclusion

4.1 Key findings

Based on the bibliometric analysis, existing research on schizophrenia and its relation to violence has a clear focus. The keywords "violence", "schizophrenia" and "male" appeared the most and with the highest connectivity,

meaning most studies focus on the violent outcomes among males with schizophrenia. This matches with epidemiological evidence that being a young male is a stronger predictor of violence than a diagnosis with the condition. Author co-citation and coupling show distinct intellectual clusters. As an example, the cluster anchored by Hodgins, Allebeck, Fazel, Lichtenstein and others, emphasize the large scale registry studies which show higher violence rates in schizophrenia (e.g. 13.2% of Swedish patients vs 5.3% of controls). The genetic/comorbidity cluster (Fazel, Lichtenstein, Grann) uses family and meta analytic designs to break down and analyze familial confounds, these studies consistently find that most excess violence is mediated by substance abuse comorbidity. The developmental cluster consisting of Moffitt, Caspi, McGue, Murray etc. underlines early life risk factors and life course trajectories. The forensic psychopathy cluster made up of Hare, Hart, Tiihonen and Grisso focuses on the individual clinical risk and psychopathy assessments. The bibliographic coupling analysis uncovered similar streams: the core population-health stream (Arsenault et al., 2000) which is concerned with prevalence and demographics, as well as a risk assessment stream (Bonta, Fazel) which focuses on prediction tools and moderating factors (substance use, antisocial traits etc.). Importantly, the small, mostly disconnected neurobiological stream (Strous et al., 1997) emerged, this indicates that biological psychiatry approaches such as hormonal or neural mechanisms of aggression still remain isolated from the larger field.

4.2 Major Themes and Trends

The co-occurrence analysis revealed a clear and hopeful evolution in the literature. In the early years (2008-2010), the trending keywords like "criminal behavior", "mental disease" and "controlled study" suggest the foundation of clinical examinations into psychiatric diagnoses. By the early 2010s (2011-2013), the appearance of keywords like "female", "crime" and "major clinical study" shows widening to gender analyses and more large scale designs, which is consistent with meta analytic findings that women with a schizophrenia diagnosis also show an elevated violence risk, and that the study size greatly improved within this time frame. In the mid 2010s (2014-2016), general terms like "adult", "violence" and "schizophrenia" became increasingly popular, this indicates a phase focusing on adult populations with schizophrenia. In addition, key players in population and registry research began emphasizing that although relative risk may be high, absolute risk remains low (approx 1 in 4 men, approx 1 in 10 women over decades) (Fazel et al., 2014). The co-occurrence diagram highlights rapid growth from ~2008-2016, with a noticeable slowdown post 2016 as very few bright yellow recent keywords appeared. Terms like "substance-related disorders", "adolescent", "middle-aged" and "psychology" are seen around the border of the diagram, indicating emerging interests in the field. For example, "substance-related disorders" in the latest literature supports the idea that co-occurring drug/alcohol misuse roughly doubles the risk of violence in schizophrenia patients. The keyword "adolescent" and "child" gives hope about future research in younger schizophrenia populations and signals growing, but still limited focus on the youth with early onset psychosis, this aligns with reports that violence is elevated in older adolescents and adults with schizophrenia, however little is known about younger children (Ross et al., 2013). The keywords "middle-aged" and "adult" brings attention to age stratification, recognizing that risk may shift across the lifespan even though research has been primarily centered around young adults. Finally, the keyword "psychology" trending over "psychiatry" hints at a shift in the area of study, more recent work began to appeal to cognitive and emotional mechanisms, such as theory of mind deficits and dysfunctions in emotional regulation to explain violence beyond the traditional diagnostic model.

4.3 Underexplored Areas

The analysis has flagged several gaps. The outer positioning of keywords such as "substance-related disorders" and "adolescent" indicates that youth and comorbidity have not been fully merged into the mainstream literature. Although many studies acknowledge substance abuse, few longitudinally analyze how substance use, mental illness and violence interact over periods of time. Nor has the widespread use of tobacco, alcohol or drugs been translated into focused violence-prevention trials. Despite evidence that schizophrenia often begins during adolescence, there is surprisingly little on how very early onset psychosis may influence violent behavior. The bibliographic coupling analysis revealed an emergent but small cross-cultural/juvenile cluster (e.g., Kaltiala-Heino 2014, Cho 2019) this suggests that these questions are only beginning to be addressed. Another gap is the incorporation of developmental criminology, the prominent life course researchers, Caspi and Moffitt, are co cited only peripherally, meaning that more sophisticated models of antisocial paths have only partly entered the schizophrenia research. Similarly, the basically isolated biopsychological cluster (Strous 1997) shows that biologically centered work on aggression, such as neural or hormonal factors, has not yet joined the dominant forensic and epidemiological fields. Finally, the keyword "female" trended early (~2010-2012) but has appeared less in the more recent years, this indicates that gender differences in schizophrenia related violence may require

more attention, as some findings hint that women's risk, while lower in absolute terms, may also be influenced by other, unique factors that are not yet fully understood.

Implications and Future Directions

The findings suggest multiple directions. Firstly, clinical practices and preventions should identify, and directly address the risk moderators. The crucial role of substance abuse shows that combining addiction treatment with psychiatric care could substantially reduce violence, as shown by Oxford researchers noting that managing comorbid drug/alcohol use problems roughly halves the risk of violence perpetration in individuals with severe mental illness. Additionally, there is evidence that appropriately prescribed antipsychotic medication has a protective effect, which calls for ensuring treatment adherence as well as early intervention. Secondly, risk assessment and policy should develop. The forensic cluster stresses the value of structured tools such as the HCR-20, VRAG etc., that include the history of violence and psychopathic traits, but the analysis also calls for these tools to include environmental and developmental factors. As an example, childhood conduct problems and social adversity should be considered in risk models. Thirdly, research integration is important, bridging gaps between clinical psychology, forensic psychiatry and epidemiology could provide a more useful, holistic perspective on violence in schizophrenia. Lastly, interdisciplinary studies could offer new insights, for example by combining neuroimaging and genetic data with longitudinal population registers, this would help uncover how biological differences interact with life-course risk (substance use, trauma, social marginalization). For example, as shown by the co-occurrence analysis, the emerging interest in "psychology" over "psychiatry" suggests work on cognitive models of violence, eg, hostile attribution bias.

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