

The Prevalence of Self-injurious Behavior in Patients With Schizophrenia Spectrum Disorders: A Systematic Review and Meta-analysis

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Background and Hypothesis. In patients with schizophrenia spectrum disorder (SSD), the lifetime prevalence of self-harm (SH) and non-suicidal self-injury (NSSI) is currently uncertain. The primary aim of this review was to provide a synthesis of the existing literature concerning the prevalence of SH/NSSI in individuals with SSD, and individuals at clinical high risk of psychosis (CHR-P). Secondary aims were to investigate methods, severity, and functions of self-injurious behavior in these populations. **Study Design:** Studies quantifying the prevalence of SH/NSSI in individuals with SSD or at CHR-P were included in this review. MEDLINE, EMBASE, and PsycInfo were searched for eligible studies June 10, 2022 and systematically screened by two independent reviewers. Risk of bias was assessed using the Joana Briggs Institute Critical Appraisal Checklist for Prevalence Studies by two independent reviewers. A meta-analysis of the lifetime prevalence of SH/NSSI was conducted using generalized linear mixed model with the logit transformation. **Study Results:** Thirty-two studies were included in this review ($n = 15\,440$), 4 of which included individuals at CHR-P ($n = 397$). The meta-analysis showed a pooled lifetime prevalence of SH of 31.0% (95% CI: 22.1%; 41.6%) in individuals with SSD ($n = 2822$) and 39.7% (95% CI: 17.5%; 70.0%) in individuals at CHR-P ($n = 397$). These estimates should be interpreted with caution due to substantial heterogeneity. Cutting was the most frequent method of SH/NSSI and SH command hallucinations may be an overlooked cause of self-injurious behavior in these patients. **Conclusions:** Self-injurious behavior is a highly prevalent, and possibly overlooked concern, in individuals with SSD and at CHR-P.

Key words: non-suicidal self-injury/self-injury/deliberate self-harm/psychosis/psychotic disorders/schizophrenia

Introduction

Schizophrenia is a prevalent psychotic disorder with an annual incidence rate of 0.2–0.4/1000 and a lifetime prevalence of 1%–2%.^{1–3} The illness constitutes 1.1% of the total disability adjusted life years worldwide and 2.8% of the years lived with disability worldwide,⁴ posing a detrimental health care burden.⁵

Self-injurious behavior is likewise a serious public health concern with a suggested prevalence of 6% in adults⁶ and 16%–18% in adolescents⁷ in the general population, however, the prevalence may be as high as 40%–80% in clinical psychiatric populations.⁸ Self-injurious behavior is linked to an increased risk of suicidal ideation,⁹ suicide attempts,¹⁰ and suicide.¹¹ Conversely, suicidal behavior in individuals with psychotic disorders, in particular schizophrenia, has been thoroughly examined, displaying a high risk of lifetime risk of suicidal ideation,¹² suicide attempt,¹³ and suicide.¹⁴ Thus, in addition to numerous deleterious consequences including severe scarring, contraction of infectious diseases, and accidental death, self-injurious behavior may facilitate genuine suicidal behavior in individuals with schizophrenia.¹⁵

A diverse terminology concerning the concept of self-injurious behavior has appeared in past literature, eg, syndrome of self-cutting, deliberate self-harm (SH), self-wounding, and self-mutilation.¹⁶ Sometimes different terms have been used interchangeably to reference a single concept, while other times a single term has been

used to reference several different concepts. This lack of consensus regarding the terminology has limited the quantification and understanding of self-injurious behavior.¹⁷ This review will distinguish between two main concepts: non-suicidal self-injury (NSSI) and SH. NSSI is defined as “the deliberate, self-inflicted damage of body tissue without suicidal intent and for purposes not socially or culturally sanctioned”.¹⁸ Most individuals engaged in NSSI employ multiple methods of self-injury—primarily skin-cutting (70%–90%), head banging/hitting (21%–44%), and self-burning (15–35%).¹⁵ SH is understood as “self-poisoning or self-injury, irrespective of the apparent purpose of the act”¹⁹ and consequently does not discriminate between self-injurious behavior with and without suicidal intent. Although some overlapping features exist between NSSI and suicidal behavior, recognition of NSSI and suicidal behavior as discrete entities is evidenced by significant differences in terms of etiology, psychiatric impairment, psychological function, method of self-injury, and outcome.^{15,20}

Previous studies have suggested that self-injurious behavior is prevalent among individuals with schizophrenia,^{21,22} however, to the knowledge of the authors, no systematic review or meta-analysis examining the prevalence of NSSI in this patient group exists. Understanding the association between schizophrenia and self-injurious behavior could help identify subgroups of patients with schizophrenia that are responsive to different treatment modalities including pharmacological and psychosocial treatment as well as psychotherapy.

Aim

The primary aim of this study is to provide a systematic review and meta-analysis of the lifetime prevalence of self-injurious behavior, including in relation to compliance with SH command hallucinations, in individuals diagnosed with a schizophrenia spectrum disorder (SSD) and individuals at clinical high risk of psychosis (CHR-P), respectively.

The secondary aims are to investigate methods, severity, and functions of self-injurious behavior in these populations.

Methods

Protocol and Registration

The study protocol was registered at the International Prospective Register of Systematic Reviews (PROSPERO) (ID: CRD42021264713), and the review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 guidelines (PRISMA 2020) and the Meta-analysis of Observational Studies in Epidemiology 2000 checklist (MOOSE) (see checklists in [supplementary materials 1 and 2](#)). PRISMA

2020 is an evidence-based checklist of items aimed at aiding transparent and complete reporting in systematic reviews.²³ Amendments to the study protocol are stated in [supplementary material 3](#).

Search Strategy

The following electronic bibliographic databases were searched for relevant studies: MEDLINE (PubMed), EMBASE, and PsycInfo. A comprehensive search was conducted on October 6, 2022, using keywords and medical subject headings for self-injurious behavior, eg, self-injur* and “Self Mutilation”[Mesh], which were cross-referenced with keywords and medical subject headings for schizophrenia, eg, schizophren* and “Schizophrenia”[Mesh] (Full search strategy is available in [supplementary material 4](#)). The search was limited to articles in the English language. Furthermore, references within relevant previously published reviews on the subject were hand-searched for additional eligible studies. Endnote was used to merge retrieved references.

Abstracts and titles retrieved from the systematic search and those retrieved from additional sources were screened for eligibility by two independent reviewers (EAL and JNK) using the software Covidence.²⁴ The full texts of studies deemed potentially eligible were independently evaluated by the two reviewers (EAL and JNK). Any disagreements between the two reviews were resolved by discussion. If no consensus could be reached, a third reviewer decided on the matter (OM).

Eligibility Criteria

Studies were eligible for the review if (1) participants were adults (18 years or older) meeting any recognized diagnostic criteria (eg, ICD-10 or DSM-V) for an SSD, ie, non-organic, non-affective psychotic disorder (thus excluding schizoaffective disorders), or meeting the criteria for CHR-P assessed using the Comprehensive Assessment of At-Risk Mental States (CAARMS),²⁵ (2) if either SH or NSSI was quantified in the study by either a SH questionnaire, a single item in a questionnaire, or a structured/semi-structured interview, and (3) if the article was in the English language. All study designs were included in the review.

Studies were excluded if (1) more than 25% of participants did not have an SSD, eg, schizoaffective disorder or bipolar affective disorder, or were not at CHR-P, (2) participants were co-diagnosed with a severe intellectual disability, (3) self-injury was considered stereotyped self-injurious behavior as seen in autistic spectrum disorder, and (4) or self-injury data was quantified solely through chart review. The decision to include individuals at CHR-P and to include studies with at least 75% of participants with SSD was made post hoc.

Data Extraction

Data were extracted using a standardized data-collection form. From all studies, the prevalence of self-injurious behavior, independent of the period-of-interest, was extracted, however, only lifetime prevalence was included in the meta-analysis. In studies where the prevalence of self-injurious behavior was reported solely as a percentage, the numerator and denominator were estimated using the sample size. Additional extracted data included: Study characteristics (authors, country, year of study publication, study design [including possible follow-up time], sample source, sample size, and a possible comparison sample); methods, functions and severity of self-injurious behavior; demographic variables possibly correlating to SH/NSSI (sample age, sample sex, family history of SH, alcohol abuse, and substance abuse); and clinical variables possibly correlating to self-injurious behavior (global assessment of functioning-score, assessment of negative symptoms (eg, Scale for the Assessment of Negative Symptoms,²⁶ Positive and negative Syndrome Scale [PANSS] negative subscale),²⁷ assessment of positive symptoms (eg, PANSS positive subscale),²⁷ and assessment of depressive symptoms (eg, Calgary Depression Scale for Schizophrenia).²⁸

If insufficient data were reported, the authors were contacted by e-mail to retrieve any missing data granted that the study was no more than 10 years old. If no data were available after request, the study was excluded. Extraction of data was performed and recorded in a pre-defined data-collection form by EAL.

Risk of Bias Assessment

In the included studies, the risk of bias was independently assessed by two independent reviewers [Eva Amanda Lorentzen (EAL) and Jesper Nørgaard Kjær (JNK)]. Any disagreements between the two reviews were resolved by discussion. If no consensus could be reached, a third reviewer decided on the matter [Ole Mors (OM)]. Risk of bias was assessed using the Joana Briggs Institute Critical Appraisal Checklist for Prevalence Studies.²⁹ Through a nine-item checklist, it takes into consideration the following characteristics: (1) appropriate study size, setting, and sampling, (2) sufficient coverage of the identified sample in data analysis, (3) validity and reliability of methods for identification and measurement of the study condition, (4) appropriate statistical analysis, and (5) adequate response rate. This tool was chosen, as it is applicable to observational studies.^{29,30}

Risk of publication bias across studies was investigated using a funnel plot. Egger's linear regression was used to quantitatively analyze a possible asymmetry, where a P value $<.1$ suggests a statistically significant risk of publication bias.³¹

Data Synthesis and Analysis

A meta-analysis of the lifetime prevalence of SH and NSSI was conducted. The lifetime prevalence of self-injurious behavior was pooled using generalized linear mixed model with the logit transformation in the groups with an SSD and CHR-P, respectively. An outlier analysis was conducted for both meta-analyses. The decision to use a generalized linear mixed model was made post hoc. Due to a lack of consensus on the area, the prevalence estimate pooled using the inverse variance method with the Freeman-Tukey transformation was also performed. Also, to control for possible confounding a subgroup analysis was performed for the lifetime prevalence of self-injurious behavior in the group with an SSD with stratification into 2 groups: (1) NSSI and (2) self-injurious behavior excluding NSSI. Forest plots were created for all meta-analyses to provide a graphical overview of the data. Due to scarcity of data more elaborate subgroup or meta-regression analyses could not be performed. Percentage of variability due to heterogeneity rather than a sampling error was judged using the I^2 statistic with a I^2 -value of 25%, 50%, and 75% respectively representing low, medium, and high level of heterogeneity.³² All analyses were conducted using R studio "Ghost Orchid" Release (077589bcad3467ae79f318afe8641a1899a51606, 2021-09-20) for macOS.³³ The following packages were used: "tidyverse", "meta", and "devtools".

Results

Study Selection

An overview of the study selection process is provided in [figure 1](#). The search of electronic databases (MEDLINE [PubMed], EMBASE, and PsycInfo) yielded 2328 articles after duplicate removal, which were screened for eligibility by title and abstract. In the initial screening 2156 articles were deemed irrelevant leaving 172 articles to be assessed in full text. Of those who did 130 articles did not meet the eligibility criteria and were thus excluded. Further 3 articles were excluded due to a large proportion of the study population not meeting the criterium of SSD.³⁴⁻³⁶ Ten articles^{35,37-45} reported insufficient data and the authors were contacted by e-mail requesting additional data. The most common causes for missing data were a population with mixed diagnoses and self-injurious behavior reported as a score rather than a proportion. Of these, two provided data^{38,41} with the remaining articles not being able to supply the missing data or not responding to our requests. One additional article⁴⁶ was found through hand-searching references from previously published reviews. The search strategy yielded a total of 32 included articles.^{37,38,41-44,46-69}

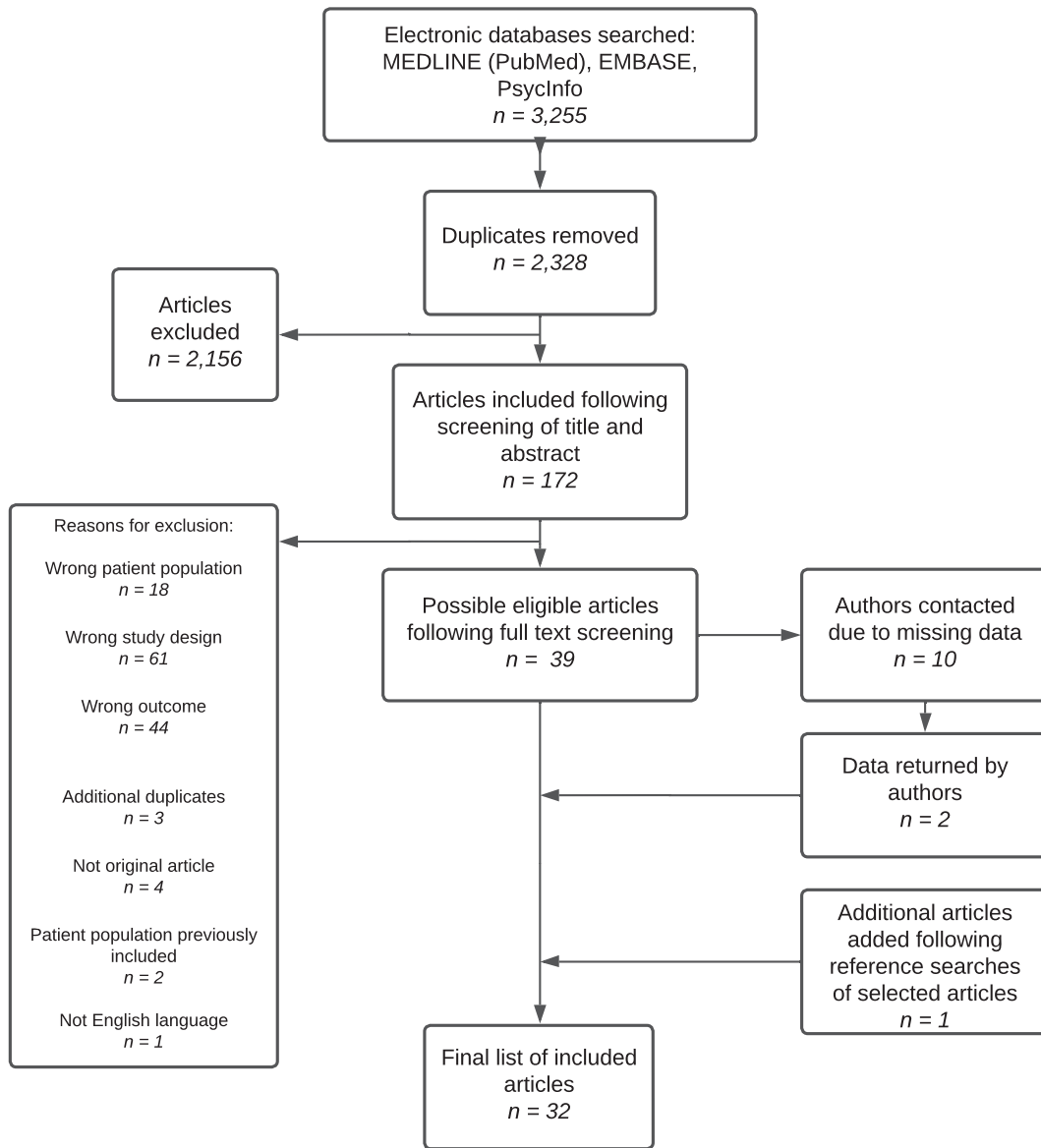


Fig. 1. Flow chart of the selection and screening of studies for review and meta-analysis.

Study Characteristics

All included studies are described in [Table 1](#). A total of 15 440 individuals were included. Eleven studies included solely individuals with an schizophrenia, and the remaining studies included populations with a mixed diagnostic composition. The most frequent diagnoses, apart from schizophrenia, were schizoaffective disorder, bipolar disorder, and psychosis not otherwise specified. Four studies included CHR-P individuals. Three of the included studies included data on methods, severity, and functions of self-injurious behavior. Three studies only examined self-injurious behavior in relation to compliance with SH command hallucinations. Twenty-six of the included studies were conducted in Western countries and seven studies were conducted in Non-western countries. Studies were overwhelmingly cross-sectional, and participants were mostly males stemming from

inpatient, outpatient, and prison populations. Seventeen of the included studies clearly stated the instrument used to quantify self-injurious behavior.

The lifetime prevalence of SH in individuals with SSD ranged from 7.7% to 68.0%, whereas the lifetime prevalence of NSSI ranged from 14.1% to 57.1%. The 12-month prevalence of SH ranged from 1.9% to 11.9%. In individuals at CHR-P the lifetime prevalence of SH ranged from 25.0% to 64.8%.

Risk of Bias Assessment

Bias assessment of all studies is displayed in [Table 2](#). Of the included studies, none were without remarks on the Joana Briggs Institute Critical Appraisal Checklist for Prevalence Studies. Several studies had issues regarding

Table 1. Characteristics of all included studies.

Author Year, Country	Design	Sample Source	N	Diagnostic Composition	Age	% Male	Definition of Self-injurious Behavior	Self-injury Instrument	Self-injury Time Period	Prevalence of Self-injurious Behavior
Barrowcliff 2010, United Kingdom ⁴⁶	Cross-sectional	Community, inpatients	29	Schizophrenia or schizoaffective disorder with documented reports of auditory hallucinations in the previous month	36.7 (11.8) (all individuals with command hallucinations)	59.2% (all individuals with command hallucinations)	Compliance with last self-harm command hallucination	Command Hallucination Interview (CHI)	—	31.0% (9/29)
Barrowclough 2010, United Kingdom ⁴⁷	Randomized controlled trial (data from control arm)	Patients with contact to NHS mental health trusts	135	Schizophrenia 81.7%; schizoaffective disorder 1.2%; psychosis NOS 8.9%; schizoaffective disorder 8.3% (at baseline)	38.3 (10.0)	84.0%	SH	Brief structured interview (not clearly specified)	Past 12 mo	11.9% (16/135)
Biswas 2006, India ⁴⁸	Cross-sectional	Outpatients	20	Schizophrenia only	31.5 (8.4)	50.0%	Self mutilatory/injurious behavior; not otherwise specified (SH)	Non-psychotic domain of Interview for the Retrospective Assessment of the Onset and Course of Schizophrenia and Other Psychoses (IRAOS)	—	15.0% (3/20)
Dugré 2017, Canada ³⁷	Cross-sectional	Inpatients	29	Schizophrenia spectrum disorder	30.28 (5.99) (all individuals in study)	34.15% (all individuals in study)	Compliance with self-harm command hallucinations	Auditory hallucinations schedule (AHS)	Past 2 mo	27.6% (8/29)
Grattan 2019, United States ³⁸	Cross-sectional	Outpatients	99	Schizophrenia spectrum disorder	12–35	72.2% (all individuals in study)	NSSI	Columbia-Suicide Severity Scale (C-SSRS)	Lifetime	14.1% (14/99)
Güney 2020, Turkey ⁴⁹	Cross-sectional	Inpatients, outpatients, patienting contacting emergency psychiatric services	165	Schizophrenia 46.7% (77/165); psychosis NOS 35.8% (59/165); schizoaffective disorder 13.3% (22/165), substance-induced psychosis 4.2% (69/165)	No NSSI: 20–65 (min-max); 40 (median); NSSI: 18–60 (min-max) 33 (median)	72.2% (all individuals in study)	NSSI	Inventory of Statements about Self-injury (ISAS)	Lifetime	43.6% (72/165)
Guo 2021, China ⁷⁰	Cross-sectional	Forensic Psychiatric Hospital	389	Schizophrenia 91.2% (372/408)	44.3 (9.1)	73.8%	SH	A standard questionnaire (not clearly specified)	Lifetime	7.7% (30/389)

Table 1. Continued

Author Year, Country	Design	Sample Source	N	Diagnostic Composition	Age	% Male	Definition of Self-injurious Behavior	Self-injury Instrument	Self-injury Time Period	Prevalence of Self-injurious Behavior
Haining 2020, United Kingdom ⁵⁰	Cross-sectional	Youth Mental Health Risk and Resilience study (YouR)	145	CHR-P: 89.7%; first episode of psychosis (FEP): 10.3%	CHR-P: 21.6 (4.3); FEP: 23.7 (4.8)	CHR-P: 6.0%; FEP: 90.0%	SH, suicide attempts included	Comprehensive Assessment of At-Risk Mental States (CAARMS)	Lifetime Past month	CHR-P: 28.5% (38/130); FEP: 60.0% (9/15) CHR-P: 5.4% (7/130); FEP: 20.0% (3/15)
Harvey 2008, United Kingdom ⁵¹	Cross-sectional	ÆSOP (Aetiology and Ethnicity in Schizophrenia and Other Psychoses)	496	Schizophrenia spectrum disorder 72.2%; 27.8% mania or depressive psychosis	30.8 (10.8)	57.7%	Attempted suicide or bodily harm	Psychiatric and Personal History Schedule (PPHS)	Lifetime Between the onset of their psychotic symptoms and their first presentation to services	5.83% (29/496) (entire population) 9.21% (45/496) (schizophrenia spectrum disorder only)
Heslin 2016, United Kingdom ⁵²	Prospective (including baseline cross-sectional data)	ÆSOP (Aetiology and Ethnicity in Schizophrenia and Other Psychoses)	163	Schizophrenia only	29 (median)	64.2%	SH	WHO life chart	Lifetime	12.9% (21/163)
Hunter 2009, United Kingdom ⁵³	Prospective (including baseline cross-sectional data)	NHS Health Boards in Scotland	1015	Schizophrenia 93.1%; schizotypal disorder, persistent delusional disorders, acute and transient psychotic disorders, and induced delusional disorder 2.0%; schizoaffective disorder 4.9%	43 (11)	70.0%	SH	Health of the Nation Outcome Scales (HONOS)	Past 12 mo	8.9% (90/1015)
Jakhar 2015, India ⁵⁰	Cross-sectional	Inpatients	270	Schizophrenia only	34.01 (9.883)	64.8%	SH	Ram Manohar Lohia Risk Assessment Interview	—	31.4% (85/270)
Jarret 2016, United Kingdom ⁵⁴	Cross-sectional	Inmates in local London Prisons	61	CHR-P: 63.8%; FEP: 26.0%	CHR-P: 27.5 (5.8); FEP: 27.7 (5.6)	100.0%	SH	Comprehensive Assessment of At-Risk Mental States (CAARMS)	Lifetime Past 12 mos	CHR-P: 25.0% (11/44); FEP: 32.0% (8/25) CHR-P: 9.1% (4/44); FEP: 16.0% (4/25)
Koyanagi 2015, Japan ⁴⁴	Cross-sectional	Adult Psychiatric Morbidity Survey 2007	7403	Self-reported symptoms of mania/hypomania, thought control, paranoia, strange experiences, and auditory hallucinations	16–34: 30.7%; 35–59: 42.9%; >60: 26.4%	48.6% (all individuals)	NSSI	—	Lifetime	Mania/hypomania 20.5%; paranoia 25.5%; strange experience 21.1%; auditory hallucination 32.5%

Table 1. Continued

Author Year, Country	Design	Sample Source	N	Diagnostic Composition	Age	% Male	Definition of Self-injurious Behavior	Self-injury Instrument	Self-injury Time Period	Prevalence of Self-injurious Behavior
Laporte 2021, Sweden ⁷¹	Cross-sectional	Forensic psychiatric patients	70	Schizophrenia spectrum and other psychotic disorders	34.9 (10.7) (all individuals)	86.7% (all individuals)	SH	Inventory of Statements About Self-injury (ISAS) 10-item risk assessment inventory (not clearly specified)	Lifetime	46/70 (65.7%)
Lee 2012, China ⁵⁵	Cross-sectional	Taiwan's NHI program with a diagnosis of schizophrenia	1655	Self-reported schizophrenia only	43.9 (12.2) (all individuals)	59.2% (all individuals)	SH		Past 12 mo	1.9% (32/1655)
Lee 2004, Singapore ⁵⁶	Cross-sectional	Inpatients	53	Schizophrenia with command hallucinations in the past 6 mo only	39.1 (9.7) (all individuals)	45%	Self-injurious acts in compliance with command hallucinations	Semi-structured questionnaire (not clearly specified)	Past 6 mo	11.3% (6/53)
Markovitz 1991, United States ⁵⁷	Prospective (including baseline cross-sectional data)	Outpatients	14	Schizophrenia personality disorder only 28.6% (4/14); Schizotypal personality disorder and borderline personality disorder 71.4% (10/14)	34.4 (6.9) (all individuals)	40.9% (all individuals)	Cutting only	Short questionnaire (not clearly specified)	Past 6 wk	Schizotypal disorder: 50.0% (2/4) Schizotypal disorder and borderline personality disorder: 70.0% (7/10) 29.0% (46/160)
Miles 2003, United Kingdom ⁵⁸	Cross-sectional	COMO randomized controlled trial	160	71.50% schizophrenia spectrum disorder; 11.21% bipolar affective disorder; 17.29% other psychosis	39 (11.1)	83.2%	SH	—	Lifetime	
Monahan 2017, United States ⁴¹	Prospective (including baseline cross-sectional data)	MacArthur Violence Risk Assessment Study	177	Schizophrenia only	18–40 (all individuals)	57.6% (all individuals)	NSSI and SH	Structured interview (not clearly specified)	2 mo prior to baseline 12 mo follow up	NSSI: 7.3% (13/177) Deliberate self-harm: 15.8% (28/177)
Mork 2013, Norway ⁷²	Cross-sectional	Thematically Organized Psychosis (TOP) Study	251	Schizophrenia spectrum disorder	30.1 (9.8)	85.0%	NSSI and SH	Questionnaire adapted from CASE-study	Lifetime	NSSI: 29.9% (75/251); SH: 14.3% (36/251)
Mork 2012, Norway ⁵⁹	Cross-sectional	TOP Study	388	Schizophrenia 76.2%; schizophreniform disorder 8.2%; schizoaffective disorder 15.5%	31 (9.9)	57.2%	SH	Questionnaire adapted from CASE-study	Lifetime	At least one life-time episode of SH: 48.5% (188/388); Multiple episodes of SH: 28.1% (109/388) 43.0% (9/21)
Neeleman 1994, United States ⁶⁰	Cross-sectional	Outpatients	21	Schizophrenia only	45 (12.6)	48.0%	SH	—	—	
Nijman 1999, Netherlands ⁶¹	Cross-sectional	Inpatients	14	Schizophrenia only	37.5 (12.4) (all individuals)	52.0% (all individuals)	NSSI	—	Lifetime	57.1% (8/14)

Table 1. Continued

Author Year, Country	Design	Sample Source	N	Diagnostic Composition	Age	% Male	Definition of Self-injurious Behavior	Self-injury Instrument	Self-injury Time Period	Prevalence of Self-injurious Behavior
Ose 2021, Norway ⁶²	Cross-sectional	Outpatients	1635	Schizophrenia only	—	37.0%	NSSI	—	Past month	7.2% (117/1635)
Phillips 2009, Australia ⁴⁵	Randomized controlled trial (including baseline cross-sectional data)	PACE clinic	193	CHR-P only	Cogther + risp: 17.6 (3.0); CogTher + placebo 18.0 (2.7); Supp + placebo 18.8 (3.7); monitoring 17.8 (2.6)	39.4%	SH	—	Lifetime	64.8% (125/193)
Pluck 2012, United Kingdom ⁶³	Cross-sectional	Community, inpatients	87	Schizophrenia only	Self-harm group: 40.1 (11.0); non-self-harm group: 9.3 (12.7)	90%	SH	Deliberate Self-Harm Inventory (SHI)	Lifetime	68.0% (59/87)
Salim 2021, Lebanon ⁷¹	Cross-sectional	Outpatients	93	Schizophrenia only with command hallucinations	55.9 (11.3)	64.5%	SH	Aggression scale (not clearly specified)	—	23.7% (22/93)
Simms 2007, United Kingdom ⁶⁵	Cross-sectional	Inpatients	33	Schizophrenia only	Self-harm group: 37.5 (8.4); non-self-harm group: 32.8 (14.7)	66.7%	SH	—	Lifetime	51.5% (17/33)
Uphegrove 2010, United Kingdom ⁶⁶	Cross-sectional	Early Intervention Service (EIS)	92	Schizophrenia 70.0%; delusional disorder 4.3%; acute and transient psychotic disorder 8.7%; other non-organic psychotic disorder 3.3%; schizoaffective disorder 2.2%; mania with psychotic symptoms 7.6%; depressive disorder severe with psychotic symptoms 3.3%	22.5 (4.8)	75.0%	SH	Suicide attempt-self-injury interview II (SAS-II)	Lifetime 12 mo following the first episode of psychosis	33.0% (30/92) 6.5% (6/92)
Verdolini 2017, Italy ⁴³	Cross-sectional	Inmates in Spoleto Prison	25	Schizophrenia spectrum disorder	18 and older	100.0%	SH	Deliberate Self-Harm Inventory (SHI)	Lifetime	32.0% (8/25)
Zimbrón 2013, United Kingdom ⁶⁷	Cross-sectional	Cameo Early Intervention Services	60	CHR-P 50.0%; FEP 50.0%	CHR-P: 21.7 (4.2); FEP: 22.0 (4.2)	60.0%	SH	—	Lifetime	CHR-P: 40.0% (12/30); FEP: 23.3% (7/30)

Table 2. Overview of the risk of bias assessment for all included studies.

	1) Was the Sample Frame Appropriate to Address the Target Population?	2) Were Study Participants Recruited in an Appropriate Way?	3) Was the Sample Size Adequate?	4) Were the Study Subjects and Setting Described in Detail?	5) Was Data Analysis Conducted With Sufficient Coverage of the Identified Sample?	6) Were Valid Methods Used for the Identification of the Condition?	7) Was the condition Measured in a Standard, Reliable Way for All Participants?	8) Was There Appropriate Statistical Analysis?	9) Was the Response Rate Adequate, and if Not, was the Low Response Rate Managed Appropriately?
Barrowcliff 2010 ⁴⁶	Yes	No	No	Yes	Unclear	Yes	No	Yes	Unclear
Barrowclough 2010 ⁴⁷	Yes	No	No	Yes	Not app.	No	No	Yes	Yes
Biswas 2005 ⁴⁸	Yes	No	No	Yes	Not app	Yes	No	No	Not app
Dugré 2017 ³⁷	Yes	No	No	Yes	Not app	Yes	Yes	Yes	Not app
Grattan 2019 ³⁸	Yes	No	No	Yes	Not app	Yes	Yes	Yes	Not app
Guiney 2020 ⁴⁹	Yes	No	No	Yes	Not app	Yes	No	Yes	Not app
Guo 2021 ⁷⁰	Yes	No	Yes	Yes	Yes	Yes	Unclear	Yes	Yes
Haining 2020 ⁵⁰	Yes	No	No	Yes	Not app	Yes	Yes	Yes	Not app
Harvey 2008 ⁵¹	Yes	Yes	Yes	Yes	Not app	No	No	Yes	No ^a
Heslin 2016 ⁵²	Yes	No	No	Yes	Not app	Yes	No	Yes	No ^a
Hunter 2009 ⁵³	Yes	Yes	Yes	Yes	Not app	Yes	Yes	Yes	Not app
Jakhar 2015 ⁵⁰	Yes	No	No	Yes	Not app	Yes	No	No	Not app
Jarrett 2016 ⁵⁴	Yes	Yes	No	Yes	Not app	No	No	Yes	Yes
Koyanagi 2015 ⁴⁴	Yes	Yes	Yes	Yes	Not app	No	Yes	Yes	Not app
Laporte 2021 ⁷¹	Yes	No	No	Yes	Not app	Yes	Yes	Yes	No
Lee 2012 ⁵⁵	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Lee 2004 ⁵⁶	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes
Markovitz 1991 ⁵⁷	Yes	No	No	Yes	Not app	No	No	Yes	Not app
Miles 2003 ⁵⁸	Yes	Yes	No	No	Not app	No	No	Yes	Not app
Monahan 2017 ⁴¹	Yes	Yes	No	Yes	Not app	No	No	Yes	Yes
Mork 2013 ⁴²	Yes	No	No	No	Not app	Yes	No	Yes	Not app
Mork 2012 ⁵⁹	Yes	No	No	Yes	Not app	No	Yes	Yes	Not app
Neeleman 1994 ⁶⁰	Not clear	No	Yes	Yes	Not app	No	No	No	Not app
Nijman 1999 ⁶¹	Yes	No	No	Yes	Not app	No	No	Yes	Not app
Ose 2020 ⁶²	Yes	Yes	Yes	Yes	Unclear	No	No	Unclear	Unclear
Phillips 2009 ⁴⁵	Yes	No	No	Yes	Not app	Yes	No	Yes	Not app
Pluck 2013 ⁶³	Yes	No	No	Yes	Not app	Yes	Yes	Yes	Not app
Salim 2021 ⁷¹	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Simms 2007 ⁶⁵	Yes	Yes	No	Yes	Not app	Yes	Unclear	Yes	Not app
Uphthegrove 2010 ⁶⁶	Yes	Yes	No	Yes	Unclear	No	Yes	Yes	Yes
Verdolini 2017 ⁴⁵	Yes	Yes	No	Yes	Unclear	Yes	Yes	Yes	Unclear
Zimbrón 2013 ⁶⁷	Yes	Yes	No	Yes	Not app	Yes	No	Yes	Not app

^aNo evidence of systematic differences by age, sex, ethnicity, duration of untreated psychosis, baseline employment, baseline diagnosis, mode of initial contact with mental health services or study center between participants and individuals lost to follow-up.

recruitment (59.4%) and insufficient sample sizes (78.1%) due to the use of convenience sampling and small study sizes (questions 2 and 3). A principal issue for several studies was the lack of valid (46.9%) and reliable (59.4%) reporting of self-injurious behavior (questions 6 and 7).

Synthesis of Data

Meta-analysis was conducted on the lifetime prevalence of any self-injurious behavior. Separate meta-analyses were conducted for the group with an SSD and the group at CHR-P. Due to lack of studies and heterogeneity, no meta-analysis was conducted for self-injurious behavior in relation to SH command hallucinations.

Twenty studies with a total sample size of 2822 were included in the main meta-analysis of self-injurious behavior (including both NSSI and SH) in individuals with an SSD. The pooled prevalence of all self-injurious behavior was 31.0% (95% CI: 22.1%; 41.6%) (figure 2).

The estimate showed a high and statistically significant degree of heterogeneity ($I^2 = 94.9%$ [95% CI: 93.3%; 96.1%] $P < .0001$), which was further supported by the outlier analysis that found 6 outlier-studies.^{52,53,60,64,70,71} Exclusion of outlying studies, however, did not markedly change the pooled prevalence estimate (33.0% [95% CI:

26.4%; 40.3%]), but did lower the degree of heterogeneity ($I^2 = 69.8%$ [95% CI: 47.6%; 82.5%], $P < .0001$). When pooling data using the inverse variance method with the Freeman–Tukey transformation, pooled prevalence of all self-injurious behavior was 32.5% (95% CI: 23.6%; 42.1%), which did not substantially differ from the generalized linear mixed model method. A subgroup analysis was conducted for the lifetime prevalence of SH and NSSI, showing a pooled prevalence of 30.5% ([95% CI: 20.2%; 43.2%]; $I^2 = 94.6%$) and 32.6% ([95% CI: 13.3%; 60.4%]; $I^2 = 90.3%$), respectively. Both subgroup analyses showed a high degree of heterogeneity. There was no statistically significant difference between the 2 subgroups of self-injurious behavior ($Q = 0.05$; $d.f. = 1$, $P = .83$). All studies from the primary meta-analysis were included in a funnel plot, see [supplementary material 5](#), which showed some visual asymmetry. Eggers’ test, however, did not indicate the presence of statistically significant funnel plot asymmetry (*intercept*: -0.917; 95% CI: -5.28; 3.45, $P = .69$).

Four studies with a total sample size of 397 were included in the meta-analysis of self-injurious behavior (including both NSSI and SH) in individuals at CHR-P. The pooled lifetime prevalence of self-injurious behavior in individuals at CHR-P was 39.7% (95% CI: 17.5%; 70.0%,

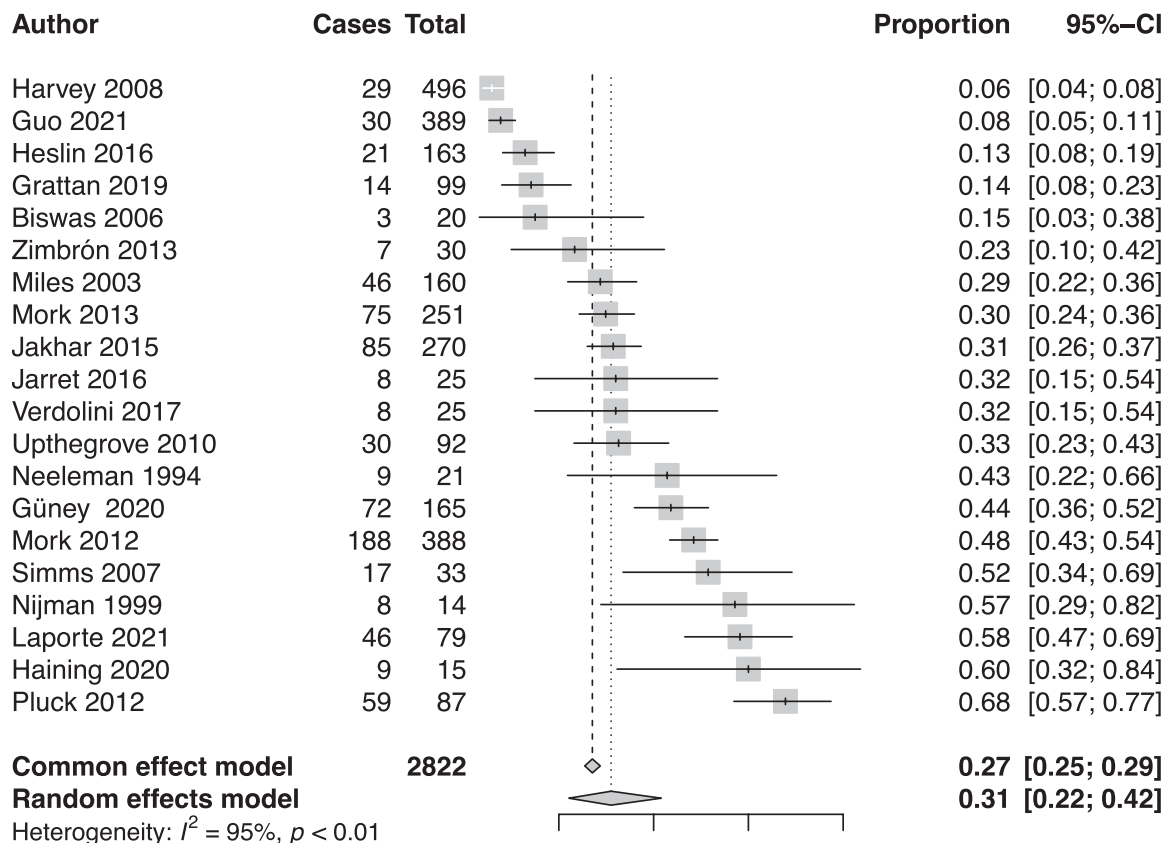


Fig. 2. Forest plot of the lifetime prevalence of self-injurious behavior in individuals with a schizophrenia spectrum disorder (SSD). The overall pooled lifetime prevalence of self-injurious behavior regardless of suicidal intent is shown at the bottom of the forest plot marked with a diamond. All prevalence are shown as proportions.

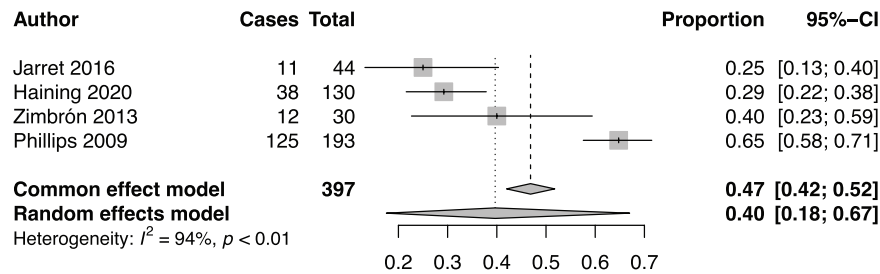


Fig. 3. Forest plot of the lifetime prevalence of self-injurious behavior in individuals at clinical high risk of psychosis. All prevalence are shown as proportions.

$I^2 = 93.7\%$, $P = <.0001$). Results are graphically displayed in figure 3. The I^2 -value indicated a high degree of heterogeneity; however, no outliers were identified in the outlier analysis. When pooling data using the inverse variance method with the Freeman–Tukey transformation, pooled prevalence of all self-injurious behavior was 40.0% (95% CI: 13.9%; 69.5%), which did not substantially differ from the generalized linear mixed model method. The generated funnel plot showed no sign of asymmetry and thus no indication of publication bias. Egger’s test was not conducted due to a lack of sufficient statistical power to detect bias.

Characteristics of Self-injurious Behavior in SSD

Güney et al⁵⁰ found that the most common forms of NSSI were cutting (37.5%), hair pulling (11.1%) and scratching (11.1%). 23.8% of the self-harming group used multiple forms of NSSI. Intrapersonal functions of self-injurious behavior (total score for intrapersonal functions in Inventory of Statements About Self-injury [ISAS]⁷²: 7.11 [3.963]), eg, affect regulation, self-punishment, and marking distress, were found to be more common than social functions of self-injurious behavior (total score for social functions in ISAS: 6.33 [5.720]), eg, revenge, self-care, and sensation seeking. Mork et al⁴² found that in 96% of individuals the last recent incident of NSSI had little or no risk of death, most NSSI-acts been planned for less than 1 hour (65%), and that the most common method was cutting (78%). Harvey et al⁵² investigated SH, finding that individuals engaged in self-injurious behavior had primarily taken an overdose (29%) or engaged in cutting (30%). Three of the included studies examined SH command hallucinations, finding a compliance rate of 11.3%–31.0%.^{37,47,57}

Discussion

This study presents a meta-analysis on the lifetime prevalence of self-injurious behavior in individuals with an SSD, and is, to the best of our knowledge, the first meta-analysis on the prevalence of NSSI in this patient group. The meta-analysis showed a pooled lifetime prevalence of self-injurious behavior irrespective of suicidal intent in

the SSD group of 31.0% (95% CI: 22.1%; 41.6%), which was corrected to 33.0% (95% CI: 26.4%; 40.3%), upon exclusion of outlying studies. In studies reporting NSSI only there was a pooled prevalence of self-injurious behavior of 32.6% ((95% CI: 13.3%; 60.4%); $I^2 = 90.3\%$), whereas in studies reporting SH excluding NSSI-only studies there are a pooled prevalence of 30.5% ((95% CI: 20.2%; 43.2%); $I^2 = 94.6\%$). The 2 subgroups were not statistically significantly different. The pooled prevalence of self-injurious behavior regardless of suicidal intent was 39.7% (95% CI: 17.5%; 70.0%, $I^2 = 93.7\%$, $P = <.0001$) for individuals at CHR-P.

The pooled prevalence estimates for the group with an SSD and at CHR-P both displayed some degree of heterogeneity. The generated funnel plot for the group with an SSD showed a significant degree of visual asymmetry, suggesting a leftward skew of data. Egger’s test was, however, non-significant and did not suggest publication bias. Studies with small or non-significant findings are more often subject to delayed publication than studies showing large or significant results.^{73,74} Though possible, it is therefore unlikely that the observed asymmetry was due to publication bias favoring an underestimation of the true prevalence of self-injurious behavior. A funnel plot may also appear asymmetric due to heterogeneity in data, which may derive from the lack of reliable and validated tools for quantification of self-injurious behavior or the inclusion of mixed diagnostic populations in the meta-analysis, as self-injurious behavior previously has shown an association to a range of disorders including depression, anxiety, borderline personality disorder, and post-traumatic stress disorder.^{16,75} Likewise, only English-language articles were included in this review, favoring studies conducted in Western countries, and possibly introducing bias. The I^2 -statistic for the CHR-P group showed a high degree of heterogeneity, which was not reflected in the generated funnel plot, and consequently may be a result of poor statistical power.

The results of the current meta-analysis slightly deviated from estimates found in similar meta-analyses. In their meta-analysis on the prevalence of SH prior to treatment of psychosis, Challis et al²² found a pooled prevalence of 18.4% (95% CI: 14.4; 23.3). The current study’s pooled

prevalence may be significantly higher due to multiple factors. The interest in lifetime SH prolongs the period-of-interest, plausibly resulting in a higher prevalence of SH. As suggested by Upthegrove et al,⁶⁶ the incidence of self-injurious behavior may be high during the period of early symptomatology. Exclusion of the early-treatment period in the prevalence measure may falsely curtail SH-prevalence. The inclusion of chart reviews may underestimate the true prevalence of self-injurious behavior. Taylor et al²¹ found a pooled lifetime prevalence of SH of 49.38% (95% CI 33.08–65.74) in individuals at CHR-P, which did not significantly differ from our estimate. In both studies, 4 studies were included in the meta-analysis. Taylor et al included 4 studies of which 2 studies^{46,67} were also included in the current meta-analysis. Taylor et al included chart review in their meta-analysis and utilized a Freeman–Tukey transformation rather than the logit transformation in their meta-analysis.

Limitations

First, given the substantial heterogeneity in the point estimates of the meta-analysis, the findings in the current review should be interpreted with caution. Variance in definition and quantification method of self-injurious behavior may have contributed to heterogeneity in this review. As indicated by the risk of bias assessment, over half of the included studies had concerns with the validity and/or reliability of their quantification of self-injurious behavior, which may massively contribute to heterogeneity. Studies support that assessment methods of self-injurious behavior largely influence prevalence measures, finding a higher prevalence estimates when employing checklists rather than single items questions.¹⁶ Consequently, not only the definition of self-injurious behavior, but also the manner in which it is verified largely impacts the recorded prevalence, plausibly leading to heterogeneity. Also, multiple studies support NSSI and suicide attempts as distinct phenomena,^{15,16} still it has also been argued that suicidal intent should be regarded as a spectrum with no easily identifiable cut-offs.⁷⁶ Addressing self-injurious behavior through a strict NSSI-definition may underestimate the true prevalence of self-injurious behavior, eg, self-poisoning can by definition not be viewed as NSSI, however, may often occur without suicidal intent.^{17,77} Conversely, solely applying a broad definition of SH will inevitably include actions with clear suicidal intent. Only studies with a clear definition of self-injurious behavior without suicidal intent were placed into the NSSI-category in the meta-analysis. Presumably, this underestimated the true prevalence of NSSI, as some studies may use SH-terminology, when actually employing a NSSI-definition.

Second, heterogeneity in the current review may also have arisen due to differences in sample composition and

cultural differences, which may have been accentuated by the use of convenience sampling in many studies (see Table 2). As displayed in Table 1, there was a significant variance in the origin of the samples in the included studies, ie, outpatient and inpatient samples, which may present a proxy measure for both the severity and level of chronicity of SSD and thus the prevalence of self-injurious behavior. Likewise, the distribution of gender differs from study to study. NSSI is assumed more common among women than men and is sometimes solely referred to as self-cutting, which is more common with women than with men.⁷⁸ Characteristics, functions, and gender-specific patterns of self-injurious behavior differ between Western and Non-western countries.⁷⁹ Therefore the inclusion of studies from both Western and Non-western countries may have contributed to the heterogeneity. Although several causes for heterogeneity have been scrutinized in this review, a comprehensive investigation of the sources of this heterogeneity should be conducted in future studies, eg, via subgroup analyses. Subgroup analysis was not possible in this study due to scarcity of data.

Third, the current study was carried out using a broad search of electronic databases with the purpose of conducting an extensive literature search, however, studies with data concerning self-injurious behavior obtained solely from chart review-data were excluded. This resulted in the exclusion of many articles that had been included in previous reviews,^{21,22} and may have omitted relevant articles and weakened statistical power. The approach was, however, chosen to increase homogeneity in the dataset, as it was deemed that chart reviews inevitably would underestimate the true prevalence of self-injurious behavior.

Fourth, contradictory recommendations of the transformations of proportions in meta-analysis have been published. Barendregt et al⁸⁰ recommended the use of the Freeman–Tukey transformation (arcsine square root transformation) prior to pooling of data to adjust for variance instability. Schwarzer et al⁸¹ and Warton & Hui⁸² found misleading results with the back-transformation of the Freeman–Tukey transformation and advised the use of a generalized linear mixed model with the logit transformation instead. The current lack of consensus on a golden standard for statistical methods in prevalence meta-analysis challenges the cogency of the current estimates, however, no significant differences in the pooled prevalence estimates were seen when using the Freeman–Tukey transformation.

Fifth, only 3 of the included studies presented data on methods, severity, and functions of self-injurious behavior, displaying a possible gap in the current knowledge. Güney et al⁵⁰ was the only study that examined the functions of self-injurious behavior using ISAS,⁷² which does not examine functions of SH of a psychotic nature, eg, SH command hallucinations. Included studies examining command hallucinations suggest that SH command hallucinations are a frequent cause

of self-injurious behavior in individuals with psychosis experiencing command hallucinations. The absence of self-injury questionnaires relevant to individuals with psychotic disorders may disregard facets of self-injurious behavior concerning methods and functions.

Conclusions

The meta-analysis found a pooled lifetime prevalence of self-injurious behavior irrespective of suicidal intent of 31.0% (95% CI: 22.1%; 41.6%) in individuals with an SSD and 39.7% (95% CI: 17.5%; 70.0%) in individuals at CHR-P. Data on methods, severity, and functions of self-injurious behavior in individuals with SSD was scarce, indicating a possible gap in the current knowledge. However, the most commonly observed method was cutting and incidents overwhelmingly exhibited a low level of lethality. Intrapersonal functions were more common than social functions, however, SH command hallucinations may be an overlooked cause due to the lack of self-injury instruments relevant to individuals with schizophrenia spectrum disorder. Larger studies regarding methods, severity, and functions of self-injurious behavior in individuals with psychosis are needed.

Supplementary Material

Supplementary data are available at *Schizophrenia Bulletin* Open online.

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