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High rates of suicidality and parasuicidal behavior in individuals at clinical high-risk for psychosis: Implications for suicide risk assessment and suicide prevention

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ABSTRACT

Background: Prior early psychosis studies have reported higher rates of suicidal ideation (SI) and parasuicidal behavior compared to healthy controls, but there is limited research examining rates and predictors of SI or protective factors in clinical high risk (CHR) youth. We investigated suicidality in CHR participants in the third sample of the North American Prodrome Longitudinal Study (NAPLS-3) and investigated associated demographic, life event, symptom, functional, treatment and outcome information.

Methods: The sample included 710 CHR (mean age 18.2, 45.8 % female) and 96 healthy control (HC) participants (mean age 18.6, 50.0 % female). Past SI, plans, self-harm and attempts were assessed via the clinician-administered Structured Assessment of Violence Risk in Youth (SAVRY) scale and the Calgary Depression Scale for Schizophrenia (CDSS).

Results: A significantly greater proportion of CHR participants compared to HC participants endorsed a history of SI or plan (30.7 % vs 0 %), a history of self-harm with no intent (25.6 % vs 4.2 %), serious suicide attempts (12 % vs 0 %) and suicide attempts designed to end in death (1 % vs 0 %). Within the CHR group, increasing levels of suicidality were significantly associated with worse symptoms; comorbid DSM diagnoses; decreased global and premorbid functioning; and stressful life events at baseline. Although parasuicidal behavior predicted future general symptoms including dysphoria and stress intolerance, it did not predict psychotic conversion at future timepoints.

Conclusion: Suicidality is prominent in CHR youth and an indicator of greater acuity, highlighting the importance of suicide risk assessments and suicide prevention interventions specifically targeted to CHR youth.

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1. Background

It has been widely reported that people with psychotic disorders have high rates of suicidal ideation, behavior, and attempts (Alvarez et al., 2022; Barbeito et al., 2021; Sher and Kahn, 2019). The lifetime risk of suicide attempts in psychotic patients ranges from 10 to 50 % and suicide is one of the leading causes of premature death in people with psychotic illness (Girgis, 2020). In fact, approximately 30 % of all deaths in first and early episode samples are due to suicide, with overall risk of death by suicide around 5.6 % (Girgis, 2020). Risk of suicide is greater in younger patients, in the early stages of illness, and prior to patient contact with the healthcare system (Nordentoft et al., 2015). Parasuicidal behavior, or deliberate self-harm with or without suicide intent, is also prevalent in individuals with psychosis (Challis et al., 2013; Harvey et al., 2018).

In the literature, less is known regarding suicidality and self-harm in individuals at clinical high-risk (CHR) for psychosis. The CHR state is characterized by not only the recent onset or worsening of attenuated psychotic symptoms (perceptual changes, suspiciousness, referential thoughts) but also more general symptoms including depression, anxiety, irritability, withdrawal, insomnia, and a decline in functioning (Fusar-Poli et al., 2013; Knittel et al., 2008). Retrospective accounts of psychotic patients report higher rates of suicidal ideation (25.5 %) and suicide attempts (7.5 %) during the prodromal phase of their illness when compared to controls (Andriopoulos et al., 2011). Pelizza et al. (Pelizza et al., 2020) found that a higher percentage of CHR participants had a history of suicidal ideation or attempts (60 %, 14.5 %) compared to participants with first-episode psychosis (36.9 %, 5.7 %). Furthermore, individuals at CHR for psychosis have high rates of depression, anxiety, trauma, and other comorbid disorders that are associated with suicidality (Kline et al., 2018; Loewy et al., 2019). It has been proposed that suicidal behavior could be an early predictor for the development of a psychotic disorder in that there are retrospective reports of a fourfold increase in the risk of developing schizophrenia after hospitalizations for parasuicidal behavior (Nordentoft et al., 2015). At the very least, suicidality appears to be a key component of the CHR syndrome.

Studies of predictive factors for suicidality in young people with early psychotic illness have demonstrated associations between SI or parasuicidal behavior and severity of psychotic and depressive symptoms, comorbid psychiatric disorders, trauma, substance use, and impaired social functioning (Barbeito et al., 2021; Toll et al., 2023; Ventriglio et al., 2016). There are fewer studies that examine predictors of suicidality in the CHR population. In general, predictors of SI or suicidal behavior in CHR youth mirror those in the early psychosis population: trauma history (Grivel et al., 2018; Zuschlag et al., 2018); comorbid mental health conditions (Haining et al., 2021) (Zuschlag et al., 2018); more severe depressive, affective, and obsessive-compulsive symptoms (Andriopoulos et al., 2011; DeVylder et al., 2012; Palmier-Claus et al., 2012; Pelizza et al., 2020); impaired social and role functioning (Andriopoulos et al., 2011; Gill et al., 2015; Haining et al., 2021); substance use (Preti et al., 2009); and sleep disturbance (Cohen et al., 2024). Prior research shows an inconsistent relationship between suicidal ideation and/or behavior and both positive and negative attenuated symptoms of psychosis in CHR individuals (Andriopoulos et al., 2011; Bang et al., 2019; Gill et al., 2015; Ventriglio et al., 2016).

In terms of protective factors, studies in patients with schizophrenia have identified social support, positive coping skills, life satisfaction, and resiliency as protective factors that may mitigate suicide (Montross et al., 2005). Pelizza et al. (Pelizza et al., 2020) found that CHR individuals who reported a better quality of life were less likely to have suicidal ideation.

A deeper understanding of predictive and protective factors of suicide and parasuicidal behavior in CHR youth is necessary to develop more targeted suicide risk assessments and treatments, consistent with Assertive Community Treatment (ACT) frameworks established in first episode psychosis (Stein and Santos, 1998).

The aims of the current project were to:

1) Investigate rates of suicidality and parasuicidal behavior at baseline assessment in CHR participants in the third sample of the North American Prodrome Longitudinal Study (NAPLS-3).

2) Determine which demographic, life event, symptom, functional and treatment information is associated with SI and parasuicidal behavior at baseline, addressing both risk and protective factors.

3) Investigate whether SI and parasuicidal behavior predicts psychotic conversion, symptoms and functioning at follow-up timepoints over a 24 month period.

We hypothesized that CHR participants would report high rates of historical suicidal ideation, behavior, and self-harm compared to the general population and that suicidality and self-harm would be associated with attenuated psychotic symptoms, comorbid diagnoses, functioning, substance use, trauma, and premorbid functioning, while it would be negatively associated with protective factors at baseline assessment. We also hypothesized that suicidality and self-harm would predict conversion to psychosis, symptom severity, and functioning at follow-up time points.

2. Methods

2.1. Participants

Participants in this study were part of NAPLS3, a 9-site, 2-year longitudinal study that is detailed in Addington et al. (Addington et al., 2022). The sample included 710 CHR and 96 healthy control (HC) participants between the ages of 12 and 35 years old at baseline assessment. Follow-up clinical assessments were also performed at 2-, 4-, 6-, 8-, 12-, 18- and 24-month time points. The CHR samples at each follow-up time point included $N = 503$, $N = 464$, $N = 433$, $N = 446$, $N = 422$, $N = 346$ and $N = 315$ respectively. A total of 71 CHR participants converted to psychosis by 24 months. The cumulative conversion number included $N = 19$ by month 2, $N = 29$ by month 4, $N = 38$ by month 6, $N = 47$ by month 8, $N = 54$ by month 12, $N = 58$ by month 18, and $N = 71$ by month 24.

2.2. Clinical measures

Via interview by trained clinicians, CHR participants met the Criteria of Psychosis-Risk Syndromes (COPS) through the Structured Interview for Psychosis-Risk Syndromes (SIPS) (McGlashan et al., 2010). Past SI, plans, self-harm, and attempts were assessed via the clinician-administered Structured Assessment of Violence Risk in Youth (SAVRY) (Borum et al., 2010) scale and the Calgary Depression Scale for Schizophrenia (CDSS)(Addington et al., 1993) at the baseline time point. The items on these scales assessing suicidality are shown in Table 1. Additional clinical data was obtained via the following clinician-

Table 1
NAPLS-3 Suicide Measures.

Calgary Depression Scale for Schizophrenia (CDSS)	Structured Assessment of Violence Risk in Youth (SAVRY)
8. SUICIDE: Have you felt that life wasn't worth living? Did you ever feel like ending it all? What did you think you might do? Did you actually try?	*5. History of Self-Harm or Suicide Attempts*
Absent	
Mild: Frequent thoughts of being better off dead, or occasional thoughts of suicide.	Low: No history of self-harm or suicide attempts.
Moderate: Deliberately considered suicide with a plan, but made no attempt.	Moderate: History of self-harm or suicidal gestures w/ no clear suicidal intent.
Severe: Suicidal attempt apparently designed to end in death (i.e.: accidental discovery or inefficient means).	High: History of serious self-harm or suicide attempts.

administered assessments: the Scale of Prodromal Symptoms (SOPS) (McGlashan et al., 2010), the Structured Clinical Interview for DSM-5 Disorders (SCID-5) (First et al., 2015), the Global Assessment of Functioning (GAF) (Hall, 1995), the Global Functioning Social and Role Scales (GF:R, GF:S) (Cornblatt et al., 2007), the Social and Occupational Functioning Scale (SOFAS) (Morosini et al., 2000), and the Premorbid Adjustment Scale (PAS) (Brantley and Jones, 1989; Cannon-Spoor et al., 1982). The Daily Stress Inventory (DSI) (Brantley and Jones, 1989) and the Life Events (Dohrenwend and Egri, 1981) questionnaire scales were also used. Substance use was examined both via DSM diagnosis with the SCID-V as well as via the Alcohol/Drug Use Scale (AUS/DUS) (Drake et al., 1996) and the Cannabis Scale (Arseneault et al., 2002).

2.3. Analyses

Analyses were conducted utilizing SPSS Statistics. One-way multivariate analyses of variance and chi-square tests were run to determine the relationship between suicidality as measured by both the CDSS and SAVRY and other clinical measures. Analyses were conducted using sex as a covariate in multivariate analyses given significant sex differences on both the CDSS and SAVRY suicide indices. Exploratory analyses were done to determine the relationship between history of suicidality and self-harm at baseline and outcome measures of psychotic conversion, symptom severity, and functioning at each follow-up time point. To reduce the number of analyses and risk of type 1 error, multivariate analyses were used in each domain and analyses were initially restricted to broad domains (e.g. positive, negative, disorganized, general symptoms and number of traumas) prior to follow-up analyses of individual items in each domain if indicated by meeting the significance threshold of <0.01.

3. Results

3.1. Sample characteristics CHR and HC

Of the 697 and 684 CHR participants with SAVRY and CDSS data respectively, a significantly greater proportion endorsed a history of SI or plan compared to the 96 HC participants on the CDSS (30.7 % vs 0 %), a history of self-harm with no intent on the SAVRY (25.6 % vs 4.2 %), serious self-harm or suicide attempts on the SAVRY (12 % vs 0 %) and suicide attempts designed to end in death on the CDSS (1 % vs 0 %) (Table 2). Because so few research participants (1 %) endorsed a past serious suicide attempt on the CDSS (rated Severe), for subsequent analyses the Moderate and Severe ratings on the CDSS were combined into one category (Moderate/Severe).

3.2. Demographics

Among the CHR participants, there were significant sex differences in suicidal ideation, whereby female participants were more likely to have a history of any suicidal ideation or self-harm and males were more likely to have moderate or severe SI with plan or past serious suicide attempt (p's < 0.02; 0.001). (Table 3). Therefore, sex was included as a covariate in multivariate analyses. There were no other demographic differences between those with and without a history of suicidal thoughts or self-harm behaviors.

3.3. Symptoms

In analyzing associations between CDSS scores and SOPS symptoms ratings, all sub-scale total scores were significant and associated with increasing levels of suicidality including positive, negative, disorganized, and general symptoms total scores (p's < 0.02; 0.001; 0.01; 0.001); therefore, we followed up with individual item scores to determine which individual symptom items accounted for total score differences (Table 4). Notably, symptoms with the greatest effect on these associations were suspiciousness/persecutory ideas ($p < 0.01$); perceptual abnormalities/hallucinations ($p < 0.005$); avolition ($p < 0.001$); decreased experience of emotions and self ($p < 0.001$); bizarre thinking ($p < 0.004$); trouble with focus and attention ($p < 0.03$); sleep disturbance ($p < 0.001$); dysphoric mood ($p < 0.001$); and impaired tolerance to normal stress ($p < 0.001$). A history of self-harm rated with the SAVRY was significantly associated with general symptoms ($p < 0.001$), which was accounted for by dysphoric mood and impaired stress tolerance (p's < 0.001; 0.03) (Table 5).

3.4. DSM Diagnoses

Multiple co-morbid diagnoses were significantly associated with both suicidal ideation and behavior on the CDSS and self-harm on the SAVRY (Tables 4 and 5): major depressive disorder (p's < 0.001), panic disorder (p's < 0.02; 0.001), and borderline personality disorder (p's < 0.01; 0.002). Obsessive compulsive disorder ($p < 0.03$), social phobia ($p < 0.01$), and avoidant personality disorder ($p < 0.001$) were also associated with suicidal ideation on the CDSS and post-traumatic stress disorder ($p < 0.005$) and agoraphobia ($p < 0.002$) were associated with self-harm on the SAVRY.

3.5. Functioning

Poor premorbid and global functioning, measured by the Premorbid Adjustment Scale and the GAF, were significantly associated with CDSS suicidal ideation and behavior (p's < 0.001; 0.005) as well as self-harm on the SAVRY (p's < 0.001; 0.003), while social and occupational functioning on the SOFAS and the Global Functioning: Social Scale were also associated with suicidal ideation on the CDSS (p's < 0.001; 0.04) (Tables 4 and 5).

3.6. Stress and life events

Total daily stress as measured by the Daily Stress Inventory (DSI) and negative life events were significantly associated with a history of suicidal ideation on the CDSS (p's < 0.003; 0.002) and self-harm on the SAVRY (p's < 0.003; 0.001) (Tables 4 and 5). Follow-up tests on individual items demonstrated that certain stressful events were significantly associated with history of suicidality and/or self-harm in Chi

Table 2
Rates of Suicidal Ideation and Parasuicidal Behavior in CHR vs HC.

	CDSS Suicide					
	Absent	Mild: Suicidal Ideation	Moderate: Suicidal Ideation with Plan	Severe: Past Serious Suicide Attempt	χ^2	*P*-value
CHR ($N = 684$)	68.3 %	24.5 %	6.2 %	1 %	42.20	<0.001
HC ($N = 96$)	100 %	0 %	0 %	0 %		
	SAVRY Self-Harm and Suicide Attempts					
	Low: None	**Moderate: Self-Harm No Intent**	**High: Serious Self-Harm or Attempt**			
CHR ($N = 697$)	62.4 %	25.6 %	12 %		42.46	<0.001
HC (N = 96)	95.8 %	4.2 %	0 %			

Table 3
Demographic Data of CHR participants with CDSS and SAVRY Data.

	CDSS Suicide				
	Absent	Mild: Suicidal Ideation	Mod/Severe: Suicidal Ideation with Plan or Past Serious Suicide Attempt	χ^2/F	P-value
Race Number (%)	261 (67.8)	94 (24.4)	30 (7.8)	16.27	NS
White (European)	11 (78.6)	3 (21.4)	0 (0.0)		
First Nations	23 (54.8)	16 (38.1)	3 (7.1)		
East Asian	4 (40.0)	4 (40.0)	2 (20.0)		
Southeast Asian	11 (50.0)	7 (31.8)	4 (18.2)		
South Asian	5 (71.4)	13 (16.3)	0 (0.0)		
West/ Central Asian & Middle Eastern	62 (77.5)	10 (24.4)	5 (6.3)		
Black	29 (70.7)	21 (22.6)	4 (4.3)		
Central/ South American	1 (50.0)	2 (4.9)			
Native Hawaiian or Pacific Islander	68 (73.1)				
Interracial					
Ethnicity Number (%)	101 (70.6)	37 (25.9)	5 (3.5)	4.17	NS
Hispanic	375 (67.7)	134 (24.2)	45 (8.2)		
Non-Hispanic					
Sex Number (%)	273 (72.2)	75 (19.8)	30 (8.0)	9.98	<0.02
Male	203 (63.6)	96 (30.1)	20 (6.2)		
Female					
Age Years (SD)	18.1 (4.0)	18.6 (4.2)	17.8 (4.3)	1.02	NS
Education Years (SD)	11. 4 (3.1)	11.6 (3.0)	11.1 (3.1)	0.48	NS
	SAVRY Self-Harm Low: None	**Moderate: No Intent**	**High: Serious or Suicide Attempt**	**χ^2/t**	**P-value**
Race Number (%)	230 (60.7)	97(25.6)	52 (13.7)	16.27	NS
White (European)	10 (71.4)	4 (2.3)	0 (0.0)		
First Nations	23 (57.5)	10 (25.0)	7 (17.5)		
East Asian	8 (80.0)	2 (20.0)	0 (0.0)		
Southeast Asian	15 (68.2)	6 (27.3)	1 (4.5)		
South Asian	6 (85.7)	14 (17.5)	10 (12.5)		
West/ Central Asian & Middle Eastern	56 (70.0)	14 (34.1)	3 (7.3)		
Black	24 (58.5)	0 (0.0)	0 (0.0)		
Central/South American	2 (100.0)	27 (30.7)	9 (10.2)		
Native Hawaiian or Pacific Islander	52 (59.1)				
Interracial					
Ethnicity Number (%)	82 (59.4)	44 (31.9)	12 (8.7)	4.50	NS
Hispanic	131 (24.0)	70 (12.8)			
Non-Hispanic	345 (63.2)				
Sex Number (%)	262 (70.4)	73 (19.6)	37 (9.9)	22.53	<0.001
Male	102 (32.7)	45 (14.4)			
Female	165 (52.9)				
Age Years (SD)	18.33 (4.20)	17.74 (3.89)	18.56 (3.73)	1.68	NS
Education Years (SD)	11.55 (3.08)	11.17 (3.24)	11.45 (2.45)	0.95	NS

Square analyses including the following (with *p* values listed for both the CDSS and SAVRY): being misunderstood (p's < 0.001; NS); being embarrassed (p's NS; <0.05); thinking about the future (p's < 0.01); having a confrontation with an authority figure (p's < 0.05; 0.01); being concerned over personal appearance (p's NS; <0.001); being bullied or getting in a fight (p's NS; <0.05); being the subject of a cruel rumor (p's < 0.05; 0.001); being excluded from a peer group (p's NS; <0.001); being assaulted (p's NS; <0.001); and a close friend attempting suicide (p's < 0.01; 0.001).

3.7. Personal risk and protective factors

A history of trauma including bullying (p's < 0.01), emotional neglect (p's < 0.001), and abuse (p's < 0.005) were also significantly more prevalent in the group with a history of suicidal thoughts or behavior on the CDSS as well as self-harm on the SAVRY (Tables 4 and 5). Better protective factors including better coping (p's < 0.001); resilient personality traits (p's < 0.004); strong commitment to school (p's < 0.02); strong social support (p's < 0.02; NS); and strong attachment and bonds (p's < 0.03; NS) were associated with less past SI or behavior and/or self-harm (Tables 4 and 5).

3.8. Substance use

Alcohol (p's < 0.005), tobacco (p's < 0.02), cannabis (p's < 0.01), and cocaine (p's < 0.02; NS) use were all significantly associated with history of suicidality and self-harm. SCID-V diagnosis of alcohol use disorder was significantly associated with history of SI on the CDSS ($p < 0.02$) and diagnosis of cannabis use disorder was significantly associated with history of self-harm or parasuicidal behavior on the SAVRY ($p < 0.04$). However, amount of cannabis used over the past 6 months at baseline was not significantly associated with history of SI or self-harm. Analyses of use of other substances were limited by the small number of participants reporting use of these substances; therefore, this data was not reported.

3.9. Treatment

Treatment at baseline with any psychotropic was significantly associated with suicidal ideation and behavior as well as self-harm (p's < 0.01) (Tables 4 and 5). Individuals with a history of self-harm on the SAVRY were more likely to have received psychotherapy (p < 0.04), while this association was not observed in those with a history of SI or behavior.

Table 4
Suicidality and Associated Clinical Features in CHR Participants.

	CDSS				
	Absent	Mild: Suicidal Ideation	Mod/ Severe: Suicidal Ideation with Plan or Serious Attempt	χ^2/ F	P-value
SOPS Estimated					
Marginal Means	12.74	13.24	14.10	4.50	<0.02*
(SEM)	(0.15)	(0.26)	(0.47)	3.46	<0.04
Positive Symptoms	3.70	3.74	4.12	4.64	<0.01
Total Score	(0.05)	(0.08)	(0.15)	0.09	NS
P1: Unusual	2.98	3.28	3.46	5.31	<0.005
Thought Content/	(0.07)	(0.11)0	(0.20)0	1.13	NS
Delusional Ideas	0	.91	.84 (0.19)	7.92	<0.001*
P2:	.92	(0.10)	3.56	4.55	<0.02
Suspiciousness/	(0.06)	3.30	(0.20)	8.82	<0.001
Persecutory Ideas	3.01	(0.11)	2.12	2.32	NS
P3: Grandiose	(0.06)	1.90	(0.21)	7.54	<0.001
Ideas	2.09	(0.11)	13.72	0.04	NS
P4: Perceptual	(0.07)	13.39	(0.88)	2.88	NS
Abnormalities/	11.44	(0.48)	2.42	4.62	<0.01*
Hallucinations	(0.29)	2.67	(0.24)	0.27	NS
P5: Disorganized	2.22	(0.13)	3.00	5.59	<0.004
Communication	(0.08)	2.94	(0.23)	3.76	<0.03
Negative	2.40	(0.12)	1.50	1.56	NS
Symptoms Total	(0.07)	1.58	(0.20)	43.51	<0.001*
Score	1.31	(0.11)	2.50	12.43	<0.001
N1: Social	(0.07)	2.30	(0.23)	61.01	<0.001
Anhedonia	1.85	(0.12)	1.24	2.73	NS
N2: Avolition	(0.07)	1.19	(0.19)	21.91	<0.001
N3: Decreased	1.21	(0.10)	3.06		
Expression of	(0.06)	2.72	(0.28)		
Emotion	2.46	(0.15)	6.20		
N4: Decreased	(0.09)	5.51	(0.45)0		
Experience of	4.96	(0.24)0	.90 (0.17)		
Emotions and Self	(0.15)	.76	1.50		
N5: Decreased	0	(0.09)	(0.18)		
Ideational	.81	1.04	2.84		
Richness	(0.06)	(0.10)	(0.19)0		
N6:	0	2.77	.96 (0.17)		
Occupational	.89	(0.10)0	11.96		
Functioning	(0.06)	.94	(0.57)		
Disorganized	2.49	(0.09)	2.82		
Symptoms Total	(0.06)	11.37	(0.20)		
Score	0	(0.31)	4.54		
D1: Odd	.77	2.71	(0.21)0		
Behavior or	(0.06)	(0.11)	.94 (0.15)		
Appearance	8.44	4.02	3.66		
D2: Bizarre	(0.19)	(0.11)	(0.26)		
Thinking	2.16	1.04			
D3: Trouble with	(0.07)	(0.08)			
Focus and	2.86	3.60			
Attention	(0.07)	(0.14)			
D4: Impairment	0				
in Personal	.82				
Hygiene	(0.05)				
General Symptoms	2.60				
Total Score	(0.09)				
G1: Sleep					
Disturbance					
G2: Dysphoric					
Mood					
G3: Motor					
Disturbances					
G4: Impaired					
Tolerance to					
Normal Stress					
SCID-V Comorbid					
Diagnoses	176	117	40 (81.6)	72.46	<0.001
Number (%)	(37.3)	(68.4)	6 (12.2)	4.06	NS
Major	26	14 (8.2)	5 (10.2)	4.37	NS
Depressive	(5.5)	19	11 (22.4)	7.64	<0.03
Disorder	30	(11.1)	12 (24.5)	8.11	<0.02
Bipolar Disorder	(6.4)	17 (9.9)	4 (8.2)	2.41	NS
Posttraumatic	46	44	15 (30.6)	9.95	<0.01
Stress Disorder	(9.7)	(25.7)	14 (28.6)	0.39	NS
Obsessive	77	17 (9.9)	11 (22.4)	1.93	NS
Compulsive	(16.3)	50	8 (16.3)	4.21	NS
Disorder	30	(29.2)	4 (8.2)	11.51	<0.01
Panic Disorder	(6.4)	55	8 (16.3)	15.18	<0.001
Agoraphobia	89	(32.2)	1 (2.0)	8.21	<0.02
Social Phobia	(18.9)	26	1 (2.0)	2.64	NS
Generalized	141	(15.2)			
Anxiety Disorder	(29.9)	25			
Attention-	91	(14.6)			
Deficit/	(19.3)	14 (8.2)			
Hyperactivity	46	14 (8.2)			
Disorder	(9.7)	10 (5.8)			
Schizotypal	12	15 (8.8)			
Personality	(2.5)				
Disorder	18				
Borderline	(3.8)				
Personality	8 (1.7)				
Disorder	33				
Avoidant	(7.0)				
Personality					
Disorder					
Alcohol Use					
Disorder					
Cannabis Use					
Disorder					
Substance Use					
Mean (SEM)	1.17	1.32	1.29	6.21	<0.003***
Tobacco	(0.02)	(0.04)	(0.07)	5.70	<0.005***
Alcohol	1.35	1.52	1.38	5.35	<0.006
Marijuana	(0.03)	(0.04)	(0.08)	4.48	<0.02***
Cocaine	1.29	1.44	1.16		
	(0.03)	(0.05)	(0.09)		
	1.00	1.04	1.00		
	(0.01)	(0.01)	(0.02)		
Functioning Mean					
(SEM)	52.59	48.24	44.33	16.54	<0.001***
GAF Score	(0.55)	(0.91)	(1.7)	8.32	<0.001*
SOFAS Score	58.39	55.46	50.85	5.44	<0.005*
Premorbid	(0.63)	(1.1)	(2.0)	1.16	NS
Functioning	0.27	0.31	0.32	3.41	<0.04**
Global	(0.01)	(0.01)	(0.02)		
Functioning: Role	6.32	6.02	6.10		
Global	(0.10)	(0.17)	(0.32)		
Functioning: Social	6.53	6.19	6.31		
	(0.07)	(0.12)	(0.22)		
Daily Stress					
Inventory Mean	64.92	77.98	84.87	5.73	<0.003*
(SEM)	(2.5)	(4.2)	(7.7)		
Total Score					
Life Events Mean					
(SEM)	8.99	10.46	10.23	6.20	<0.002***
Total Undesirable	(0.23)	(0.38)	(0.70)		
Events					
Trauma Number					
(%)	1.65	2.22	2.55	12.24	<0.001
Total # of traumas	(0.08)	(0.13)	(0.24)	5.09	NS
Mean (SEM)	271	109	34 (70.8)	10.74	<0.005
Psychological	(57.4)	(64.5)	19 (39.6)	21.94	<0.001
bullying	119	62	25 (52.1)	10.42	<0.005
Physical	(25.2)	(36.7)	22 (45.8)	13.96	<0.001
bullying	138	78	14 (29.2)	3.94	NS
Emotional	(29.4)	(46.2)	7 (14.6)		
neglect	120	55			
Psychological	(25.5)	(32.5)			
abuse	75	47			

(*continued on next page*)

Table 4 (*continued*)

	CDSS				
	Absent	Mild: Suicidal Ideation	Mod/ Severe: Suicidal Ideation with Plan or Serious Attempt	χ^2/ F	P-value
Physical abuse	(15.9)	(27.8)			
Sexual abuse	53	29			
	(11.3)	(17.2)			
SAVRY Risk/					
Protective	1.77	1.99	2.18	12.22	<0.001*
Factors Mean	(0.03)	(0.05)	(0.10)	4.42	<0.02***
(SEM)	1.36	1.48	1.56	2.00	NS
Stress and Poor	(0.03)	(0.05)	(0.08)	3.64	<0.03*
Coping	1.12	1.16	1.06	7.24	<0.001*
Risk Taking/	(0.02)	(0.03)	(0.05)		
Impulsivity	1.30	1.44	1.44	3.08	NS
Negative	(0.03)	(0.05)	(0.09)	7.90	<0.02
Attitudes	4.86	4.50	4.09	7.15	<0.03
Lack of	(0.08)	(0.13)	(0.23)	3.05	NS
Personal/Social				10.45	<0.01
Support	333	114	30 (60.0)	13.66	<0.002
Protective	(71.5)	(68.3)	32 (64.0)		
Factor Index	367	119	44 (88.0)		
Protective	(78.8)	(71.3)	48 (96.0)		
Factors Number	402	130	26 (52.0)		
(%)	(86.3)	(77.8)	31 (62.0)		
Prosocial	418	146			
Involvement	(89.7)	(87.4)			
Strong Social	333	105			
Support	(71.5)	(62.9)			
Strong	376	118			
Attachment and	(80.7)	(70.7)			
Bonds					
Positive Attitude					
Toward					
Intervention/					
Authority					
Strong					
Commitment to					
School					
Resilient					
Personality Traits					
Treatment Number					
(%)	232	95	35 (83.3)	9.57	<0.01
Any	(60.1)	(66.4)	21 (50.0)	9.31	<0.01
pharmacotherapy	106	45	30 (71.4)	12.85	<0.002
Antipsychotic	(27.5)	(31.5)	40 (95.2)	4.35	NS
treatment	165	69			
Antidepressant	(42.7)	(48.3)			
treatment	333	130			
Any	(86.3)	(90.9)			
psychotherapy					

* Moderate/Severe and Mild > None.
** Mild < None.
*** Mild > None.

3.10. Prediction of psychotic conversion, symptoms and functioning at follow-up

Baseline measures of suicidality and self-harm were not associated with future conversion to psychosis at any follow-up time point in cross-sectional Chi Square analyses. Similarly, a history of suicidality and self-harm were not associated with positive, negative, or disorganized attenuated symptoms of psychosis at follow-up time periods. There were significant associations between history of SI and self-harm and total general symptom score on the SOPS at multiple follow-up time points (see Supplemental Table 1), with subsequent analyses demonstrating that dysphoric mood and impaired tolerance to normal stress were the specific symptoms contributing to these significant correlations (p's < 0.05—0.001). In terms of functioning at follow-up, there was a

Table 5
Suicidality and Associated Clinical Features in CHR Participants.

	SAVRY				
	Low: None	Moderate: Self-Harm No Intent	High: Serious Self-Harm or Attempt	χ^2/F	P-value
SOPS Estimated					
Marginal Means	12.77	13.22	13.14	1.300	NS
(SEM)	(0.16)	(0.25)	(0.38)	.248	NS
Positive Symptoms	11.98	12.29	12.41	1.38	NS
Total Score	(0.31)	(0.48)	(0.71)	11.15	<0.001
Negative	5.02	5.21	5.65	3.12	<0.05
Symptoms Total	(0.15)	(0.24)	(0.35)	21.26	<0.001
Score	8.84	10.47	10.29	1.49	NS
Disorganized	(0.20)	(0.32)	(0.47)	2.74	<0.03
Symptoms Total	2.26	2.59	2.30		
Score	(0.07)	(0.11)	(0.16)		
General Symptoms	2.98	3.71	3.88		
Total Score	(0.07)	(0.12)0	(0.17)0		
G1: Sleep	0	.971	.962		
Disturbance	.822	(0.08)	(0.12)		
G2: Dysphoric	(0.05)	3.21	3.15		
Mood	2.78	(0.14)	(0.21)		
G3: Motor	(0.09)				
Disturbances					
G4: Impaired					
Tolerance to					
Normal Stress					
Functioning Mean					
(SEM)	52.25	49.76	46.86	8.16	<0.001*
GAF Score	(0.58)	(0.91)	(1.3)	1.39	NS
SOFAS Score	57.90	56.42	55.56	5.260	<0.005*
Premorbid	(0.68)	(1.1)0	(1.5)0	.8310	NS
Functioning	0	.286	.334	.143	NS
Global	.278	(0.01)	(0.02)		
Functioning: Role	(0.01)	6.41	6.04		
Global	6.24	(0.17)	(0.24)		
Functioning:	(0.11)	6.44	6.35		
Social	6.44	(0.12)	(0.17)		
	(0.07)				
SCID-V Comorbid					
Diagnoses	179	94 (54.0)	57	24.57	<0.001
Number (%)	(42.1)	15 (8.6)	(70.4)	2.60	NS
Major	22	15 (8.6)	6 (7.4)	10.74	<0.005
Depressive	(5.2)	17 (9.8)	13	4.36	NS
Disorder	24	51 (29.3)	(16.0)	15.31	<0.001
Bipolar Disorder	(5.6)	23 (13.2)	14	12.190	<0.002
Posttraumatic	41	42 (24.1)	(17.3)	.9140	NS
Stress Disorder	(9.6)	53 (30.5)	14	.126	NS
Obsessive	66	29 (16.7)	(17.3)	1.71	NS
Compulsive	(15.5)	17 (9.8)	3 (3.7)	2.45	NS
Disorder	24	9 (5.2)	20	12.58	<0.002
Panic Disorder	(5.6)	13 (7.5)	(24.7)	1.19	NS
Agoraphobia	90	8 (4.6)	26	5.51	NS
Social Phobia	(21.2)	8 (4.6)	(32.1)	6.71	<0.04
Generalized	128		19		
Anxiety Disorder	(30.1)		(23.5)		
Attention-	78		13		
Deficit/	(18.4)		(16.0)		
Hyperactivity	45		9 (11.1)		
Disorder	(10.6)		5 (6.2)		
Schizotypal	11		4 (4.9)		
Personality	(2.6)		11		
Disorder	22		(13.6)		
Borderline	(5.2)				
Personality	7 (1.6)				
Disorder	30				
Avoidant	(7.1)				
Personality					
Disorder					
Alcohol Use					
Disorder					
Cannabis Use					
Disorder					

(*continued on next page*)

Table 5 (*continued*)

	SAVRY				
	Low: None	Moderate: Self-Harm No Intent	High: Serious Self-Harm or Attempt	χ^2/F	P-value
Substance Use					
Mean (SEM)	1.18	1.27	1.33	4.57	<0.02
Tobacco	(0.02)	(0.04)	(0.06)	8.29	<0.001*
Alcohol	1.33	1.47	1.57	4.82	<0.01****
Marijuana	(0.03)	(0.04)	(0.06)	1.19	NS
Cocaine	1.28	1.31	1.51		
	(0.03)	(0.05)	(0.07)		
	1.01	1.02	1.00		
	(0.01)	(0.01)	(0.01)		
Functioning Mean					
(SEM)	52.44	49.19	46.48	8.47	<0.001
GAF Score	(0.64)	(1.02)	(1.51)	2.35	NS
SOFAS Score	58.13	56.01	55.26	4.97	<0.003
Premorbid	(0.67)	(1.05)	(1.52)	0.40	NS
Functioning	0.28	0.29	0.34	0.13	NS
Global	(0.01)	(0.01)	(0.02)		
Functioning: Role	6.36	6.26	6.11		
Global	(0.11)	(0.18)	(0.27)		
Functioning:	6.48	6.43	6.38		
Social	(0.08)	(0.13)	(0.19)		
Daily Stress					
Inventory Mean	64.97	72.00	86.48	5.90	<0.003**
(SEM)	(2.6)	(4.1)	(5.9)		
Total Score					
Life Events					
Total Undesirable	8.93	9.82	11.46	9.56	<0.001***
Events	(0.24)	(0.38)	(0.55)		
Trauma Number					
(%)	1.58	2.15	2.67	19.25	<0.001
Total # of traumas	(0.08)	(0.13)	(0.18)	10.77	<0.005
Mean (SEM)	236	112 (65.1)	59	9.68	<0.008
Psychological	(55.7)	54 (31.4)	(72.8)	21.86	<0.001
bullying	108	70 (40.9)	34	20.44	<0.001
Physical	(25.5)	60 (35.1)	(42.0)	15.36	<0.001
bullying	124	43 (25.1)	44	18.56	<0.001
Emotional	(29.3)	32 (18.7)	(54.3)		
neglect	99		37		
Psychological	(23.4)		(45.7)		
abuse	64		25		
Physical abuse	(15.1)		(30.9)		
Sexual abuse	38		19		
	(9.0)		(23.5)		
SAVRY Risk/					
Protective	1.73	1.97	2.25	23.43	<0.001
Factors Mean	(0.03)	(0.05)	(0.08)	19.10	<0.001*
(SEM)	1.30	1.53	1.66	3.85	<0.03
Stress and Poor	(0.03)	(0.04)	(0.06)	6.94	<0.002*
Coping	1.10	1.14	1.21	5.01	<0.01****
Risk Taking/	(0.02)	(0.03)	(0.04)		
Impulsivity	1.28	1.41	1.53	3.39	NS
Negative	(0.03)	(0.05)	(1.40)	1.96	NS
Attitudes	4.82	4.69	4.18	3.71	NS
Lack of	(0.08)	(0.13)	(0.19)	4.26	NS
Personal/Social				9.15	<0.02
Support	303	124 (70.9)	50	11.51	<0.004
Protective	(71.0)	134 (76.6)	(61.0)		
Factor Index Mean	327	141 (80.6)	57		
Protective	(76.6)	164 (93.7)	(69.5)		
Factors Number	369	175 (72.0)	67		
(%)	(86.4)	140 (80.0)	(81.7)		
Prosocial	377		72		
Involvement	(88.3)		(87.8)		
Strong Social	294		82		
Support	(68.9)		(53.7)		
Strong	335		51		
Attachment and	(78.5)		(62.2)		
Bonds					
Positive Attitude					
Toward					
Intervention/					
Authority					
Strong					
Commitment to					
School					
Resilient					
Personality Traits					
Treatment Number					
(%)	206	98 (69.0)	54	20.78	<0.001
Any	(57.5)	58 (40.8)	(85.7)	18.43	<0.001
pharmacotherapy	85	76 (53.5)	26	29.10	<0.001
Antipsychotic	(23.7)	132 (93.0)	(41.3)	6.92	<0.04
treatment	139		46		
Antidepressant	(38.8)		(73.0)		
treatment	305		58		
Any	(85.2)		(92.1)		
psychotherapy					

* Moderate and High > Low.
** High > Moderate.
*** Moderate > Low.
**** High > Low and Moderate.

significant relationship between history of self-harm and SI on the SAVRY and worse global functioning on the GAF at 2- and 6-month follow-up (p's < 0.003; 0.02). There are no significant associations between history of suicidality on the CDSS and functioning at follow-up time points.

4. Discussion

In total, between 30 and 40 % of the NAPLS-3 CHR sample report a history of suicidality including thoughts, plans, self-harm, or attempts. Twelve percent of this group report a history of serious self-harm or suicide attempts. These rates are consistent with prior CHR reports (Andriopoulos et al., 2011; Defayette et al., 2024; Gill et al., 2015; Haining et al., 2021) and, to our knowledge, this represents the largest CHR sample with information regarding parasuicidal behavior.

Although there is very little data reported on the rate of deaths by suicide in the CHR population, suicide is one of the leading causes of death in people with psychotic disorders (Coentre et al., 2021; Pompili et al., 2007). It is also well-documented that in the time course of a psychotic illness, risk of suicide is highest around the first-episode period (Nordentoft et al., 2015; Toll et al., 2023). Our data did not demonstrate a significant relationship between a history of SI or self-harm and psychotic conversion or worsening attenuated psychotic symptoms at follow-up time points, but a history of SI was associated with future dysphoria and stress intolerance as well as shorter term global functioning. However, conversion to psychosis likely increases the risk of suicide, underscoring the importance of early identification and intervention in the CHR group to prevent conversion and thereby decrease risk of suicide. One of the greatest predictors of suicidality is prior suicidal behavior (Haining et al., 2021; Horwitz et al., 2017; Pigoni et al., 2024) and SI in the prodromal phase has been strongly associated with lifetime suicidality after conversion to psychosis (Andriopoulos et al., 2011).

Suicidal ideation and parasuicidal behavior are evidently important components of CHR pathology. The CHR group is very heterogenous (Rintell et al., 2024), with a history of comorbid non-psychotic diagnoses, stressful life events, and adverse childhood experiences that are associated with not only CHR but an increased risk of suicidality (Haining et al., 2021; Kline et al., 2018; Loewy et al., 2019). Past trauma has been linked to both CHR symptoms and suicidality (Cui et al., 2020;

Grivel et al., 2018; Loewy et al., 2019). Prior studies have demonstrated that trauma exposure in this population often occurs early in life and before the onset of the CHR syndrome (Loewy et al., 2019). Negative schema has been found to be a moderator between childhood trauma and suicidality in patients with first-episode psychosis (Cui et al., 2020) and may also play a role in the CHR population given the associations of suicidality with themes of conflict, judgment, harassment, and bullying in the current study.

However, there appear to be factors unique to the CHR syndrome that confer additional increased risk of suicidal thoughts and self-harm. In a retrospective case study of a young person with suspected prodromal psychosis who died by suicide, Knittel et al. (Knittel et al., 2008) propose potential reasons for prodromal psychosis as a specific etiology of suicide including impairment in reality testing, suspiciousness, loss of connections with others, and difficulty with communication that may interfere with seeking help. Our findings support this theory as there is a positive relationship between suicidality and attenuated positive, negative, disorganized and general symptoms as well as functional impairment while better coping skills and more protective factors are associated with less parasuicidal behavior.

Our findings have implications for the assessment and treatment of individuals meeting CHR criteria. The importance of suicide risk assessments and the development of suicide prevention interventions specifically targeted to CHR youth is evident. A better understanding of associated risk and protective factors in the CHR population will help in the further development of targeted treatments in this high-risk population. Importantly, individuals with a history of parasuicidal behavior in this sample were more likely to have been in psychotherapy and/or receive pharmacologic treatment suggesting that this population is help-seeking. Targeting comorbid depression and anxiety disorders is likely to mitigate suicide risk. Given the trauma and stressor data, trauma-based interventions may be particularly important for preventing suicide in the CHR population. The fact that better premorbid and global functioning are strongly inversely correlated with suicidality indicates that interventions that bolster psychosocial support, educational and work rehabilitation, and family dynamics will make a difference in a young person's future trajectory.

4.1. Limitations

A limitation of this study is the limited nature of the suicide data collected in the NAPLS-3 dataset. Suicide data was not collected in a comprehensive fashion with a dedicated questionnaire such as the Columbia-Suicide Severity Rating Scale (C-SSRS). The suicide data collected as part of the CDSS and SAVRY questionnaires represents only historical suicidality and not current. This measurement limitation highlights how recent it is that SI and parasuicidal behavior have been recognized as important components of the CHR syndrome to study and focus prevention and treatment efforts on. Future studies would benefit from including more thorough suicide screens such as the Columbia-Suicide Severity Rating Scale (C-SSRS) to get more accurate data.

4.2. Conclusions and future directions

Suicidal ideation and self-harm are common in the CHR population and likely linked to not only attenuated psychotic symptoms but comorbid non-psychotic diagnoses, a history of stressful life events and poor functioning. There is clearly a need for more thorough suicide risk assessments in this vulnerable population and interventions that target the comorbid conditions and the effects of childhood trauma. Future directions will include examining long-term clinical outcomes (5-20 years) in CHR participants to determine how parasuicidal behavior is associated with future clinical and functional outcomes including early death and suicide in this population.

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CRediT authorship contribution statement

Tara Trujillo: Writing – review & editing, Writing – original draft, Formal analysis. **Heline Mirzakhanian:** Writing – original draft. **Jean Addington:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **Carrie E. Bearden:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **Tyrone D. Cannon:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **Barbara A. Cornblatt:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **Matcheri Keshavan:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **Daniel H. Mathalon:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **Diana O. Perkins:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **William Stone:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **Elaine F. Walker:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **Scott W. Woods:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **Kristin S. Cadenhead:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization.

Contributions

All NAPLS PIs (Addington, Bearden, Cadenhead, Cornblatt, Keshavan, Mathalon, Perkins, Stone, Walker, Woods) contributed to the design of the study, obtaining funding, review and editing of the manuscript. Dr. Trujillo contributed to data analysis and writing of the manuscript along with Dr. Mirzakhanian.

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Declaration of competing interest

Authors declare they have no conflict of interest with respect to this study.

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